PONDICHERRY UNIVERSITY

DEPARTMENT OF BANKING TECHNOLOGY

SCHOOL OF MANAGEMENT

MBA: BANKING TECHNOLOGY DEGREE PROGRAMME

CURRICULUM & COURSE STRUCTURE

[Academic Year 2024- 25 onwards]

SOFTCORES IT STREAM

MBABX31: DESIGN PATTERNS

Soft Core: 3 Credit

Prerequisites: *Knowledge in OO Concepts*

Learning Objectives

1. *To introduce the concept of Design Patterns*
2. *To introduce the various values of patterns*

Learning Outcomes

1. *Gain knowledge on principles and strategies of Design Pattern*
2. *Acquire the practical knowledge to develop software patterns*

Methodology:

Lecture, Discussion, Case studies, Exercise, Case studies, Assignments and mini projects

Unit I: Introduction to Design Patterns:

Design Patterns Arose from Architecture and Anthropology – Architectural to Software Design Patterns – Advantages of Design Patterns – Adapter Pattern – Strategy Pattern – Bridge Pattern – Abstract Factory Pattern

Unit II: New Paradigm of Design:

Principles and Strategies of Design Patterns -Open-Closed Principle – Designing from Context - Encapsulating Variation. Commonality and Variability Analysis - Analysis Matrix - Decorator Pattern - Open Closed Principle – The Principle of encapsulating variation – Abstract Classes vs Interfaces

Unit III: Values of Patterns:

Observer Pattern - Categories of Patterns - Template Method Pattern – Applying the Template Method to the Case Study - Using Template Method Pattern to Reduce Redundancy

Unit IV: Applying Design Patterns:

Design Patterns - Factories - Singleton Pattern and the Double- Checked Locking Pattern - Applying Singleton Pattern to Case Study. Object Pool Pattern - Management of Objects - Factory Method Pattern - Object Oriented Pool Pattern

Unit V: Case Studies

What to Expect from Design Patterns - The Pattern Community an Invitation – A Parting Thought – Banking Case Study

Text and Reference Books:

1. **Smith, J. M, Elemental design patterns. Addison-Wesley.**
2. Shalloway, A., & Trott, J. R, Design patterns explained: A new perspective on object-oriented design, 2/E. Pearson Education India.
3. Gamma, E., Helm, R, Johnson, R., Vlissides, J, Design patterns: elements of reusable object-oriented software, Pearson India.
4. Freeman, E., Robson, E., Bates, B., & Sierra, K, Design Patterns: A Brain-Friendly Guide," O'Reilly Media, Inc.".
5. Freeman, E., Robson, E, Design Patterns: Building Extensible and Maintainable Object-Oriented Software," O'Reilly Media, Inc.".

SOFTCORES IT STREAM
MBAB X32: SMART BANKING TECHNOLOGIES

Soft Core: 3 Credit

Prerequisites: *Knowledge in Banking Technology*

Learning Objectives:

1. *To introduce the concepts on Smart Banking & IoT*
2. *To introduce the various applications on Smart Banking Technology & IoT.*

Learning Outcomes:

1. *Gain knowledge on context aware computing and IoT*
2. *Acquire practical knowledge to apply internet of things in Banking Applications*

Methodology:

Lecture, Discussion, Case studies, Exercise, Case studies, Assignments and mini projects

Unit I: Smart Banking and Software Agents

Introduction – Characteristics of Smart Banking environment – Components and Technologies of Smart Banking environments – Issues in Smart Banking - Software Agents – Introduction – Fundamentals - Agents as Tools of the Information Society - Fundamental Concepts of Intelligent Software Agents - Base Modules of Agent Systems - Development Methods and Tools – Applications - Application Areas for Intelligent Software Agents.

Unit II: RFID – Introduction – RFID system components

Operating frequency – Close coupling smart cards – Proximity-coupling smart cards, working of slotted Aloha – OSI layers and RFID, vicinity coupling smart cards, RFID security considerations – RFID Applications – Short range RFID applications, Long range RFID applications.

Unit III: Context Aware Computing

Introduction – Structure and Elements of Context Aware Pervasive Systems – Context Aware Mobile Services – Context-Aware Artifacts – Context Aware Mobile Software Agents for Interaction with Web Services in Mobile Environment – Context Aware Addressing and Communication for People, Things and Software Agents – Context-Aware Sensor Networks – Context Aware Security.

Unit IV: Internet of Things

Introduction to IoT Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs- Design challenges, Development challenges, Security challenges, other challenges - Home automation, Banking and Other Industry applications, Surveillance applications, Other IoT applications

Unit V: Case Studies

In Software Agents, RFID, Context Aware Computing and Internet of Things - Contemporary Banking using Robots, Drones etc.

Text and Reference Books:

1. **Brenner, W., Zarnekow, R., & Wittig, H, Intelligent software agents: foundations and applications. Springer Science & Business Media.**
2. Shepard, S, RFID: radio frequency identification. McGraw Hill Professional.
3. Loke, S, Context-aware pervasive systems: architectures for a new breed of applications. Routledge.
4. Hanes, D., Salgueiro, G., Grossetete, P., Barton, R., & Henry.J, IoT fundamentals: Networking technologies, protocols, and use cases for the internet of things. Cisco Press.
5. Chorafas, D. N, Enterprise architecture and new generation information systems. CRC Press.

SOFTCORES IT STREAM
MBAB X33: SOFTWARE PROJECT MANAGEMENT

Softcore: 3 Credit

Prerequisites: *Basic knowledge of Software Design principles*

Learning objectives:

1. *To introduce the various concepts on project management.*
2. *To introduce the project management tools and techniques*

Learning outcome:

1. *Gain knowledge on Software project management principles and practices.*
2. *Acquire practical knowledge on Project Management tools and techniques*

Methodology:

Lecture, Discussion, Case studies, Exercise, Case studies, Assignments and mini projects

Unit I: Product, Process and Project

Definition: Product Life Cycle: Project Life cycle Models. Process Models-IS0-9001 Model, Capability Maturity Model, Six Sigma. Metrics - Metrics strategy, Setting Targets and Tracking, Metrics implementation checklists and Tools.

Unit II: Software Quality assurance

Quality control and Quality assurance, cost and benefits of quality, Software quality assurance tools, Software Quality analyst's functions. Software Configuration Management - Processes and activities. Risk Management - Processes and activities.

Unit III : Project Schedule

Planning and tracking- Top down and bottom up planning - initial and final project schedule plans - milestones - Project tracking - Overview of project progress - project outlook - occurrence of tracking - tracking meetings - Project estimation.

Unit IV: Project Management in Testing phase

Testing, Activities of Testing, Test scheduling and types of tests. Management structures for Testing in Global teams. Project Management in Maintenance Phase - Processes, activities, management issues – Framework for Project management and control – Virtual team management - Contract management.

Unit V: Emerging trends in Project Management:

Globalization issues in Project Management, Impact of Internet on Project Management, People focused Process Models, Project Management tools.

Text and Reference Books

1. **Ramesh, Gopalaswamy, Managing Global Software Projects, Tata McGraw Hill.**
2. Neal Whitten, Managing Software Development Projects, Formula for Success, John Wiley and sons.
3. Humphrey, Watts, Managing the software process,Addison Wesley.
4. Robert K. Wysocki, Effective Software Project Management, Wiley Publication.
5. Walker Royce, Software Project Management, Addison-Wesley.

SOFTCORES IT STREAM
MBAB X34: SERVICE ORIENTED ARCHITECTURE

Softcore: 3 Credit

Prerequisites:

Basics of application development

Learning Objectives:

1. *To correlate business processes with of SOA and design services based implementation*
2. *To introduce microservices and analyse applications as microservices*

Learning Outcome:

1. *Design and develop real work applications using the concepts of SOA and Web services*
2. *Identify and implement microservices for business applications*

Methodology:

Lecture, Discussion, Case studies, Assignments and Hands-on practice

Unit I: SOA and MSA Basics:
Service Orientation in Daily Life, Evolution of SOA and MSA. Service Oriented Architecture and Microservices architecture – Drivers for SOA, Dimensions of SOA, Conceptual Model of SOA, Standards and Guidelines for SOA, Emergence of MSA. Enterprise-Wide SOA: Considerations for Enterprise-wide SOA, Strawman Architecture for Enterprise-wide SOA, Enterprise SOA Reference Architecture, Object-oriented Analysis and Design (OOAD) Process. Service-oriented Analysis and Design (SOAD) Process, SOA Methodology for Enterprise.

Unit: II: Service-Oriented Applications:
Considerations for Service-oriented Applications, Patterns for SOA, Pattern-based Architecture for Service-oriented Applications, Composite Applications, Composite Application Programming Model. Service-Oriented Analysis and Design: Need for Models, Principles of Service Design, Nonfunctional Properties for Services, Design of Activity Services (or Business Services), Design of Data Services, Design of Client Services, Design of Business Process Services

Unit III: Microservices:
Microservices: Understanding Microservices, Adopting Microservices, The Microservices Way. Microservices Value Proposition: Deriving Business Value, defining a Goal-Oriented, Layered Approach, Applying the Goal Oriented, Layered Approach. Designing Microservice Systems: The Systems Approach to Microservices, A Microservices Design Process, Establishing a Foundation: Goals and Principles, Platforms, Culture.

Unit IV: Business Process Design: WS-BPEL language basics; WS Coordination overview; Service oriented business process design; WS addressing language basics; WS Reliable Messaging language basics. SOA Platforms: SOA platform basics; SOA support in J2EE /.NET, Business Case studies.

Unit V: Service Design:
Microservice Boundaries, API design for Microservices, Data and Microservices, Distributed Transactions and Sagas, Asynchronous Message-Passing and Microservices, dealing with Dependencies, System Design and Operations: Independent Deployability, More Servers, Docker and Microservices, Role of Service Discovery, Need for an API Gateway, Monitoring and Alerting. Adopting Microservices in Practice: Solution Architecture Guidance, Organizational Guidance, Culture Guidance, Tools and Process Guidance, Services Guidance

Text and Reference Books

1. **Shankar Kambhampaty, Service-oriented Architecture and Microservice Architecture: For Enterprise, Cloud, Big Data and Mobile, Wiley**.
2. Irakli Nadareishvili, Ronnie Mitra, Matt McLarty & Mike Amundsen, Microservice Architecture - Aligning Principles, Practices, and Culture, Oreilly.
3. Sam Newman, Building Microservices - Designing Fine-Grained Systems, O'reilly.
4. Thomas Erl, Service Oriented Architecture: Concepts, Technology, and Design, Pearson Education.
5. Icon Group International; The 2018-2023 World Outlook for Service-Oriented Architecture (SOA) Software and Services; ICON Group International.

SOFTCORES IT STREAM
MBAB X35: DATA SCIENCE USING R

Softcore: 3 Credit

Prerequisite*: Basics of programming.*

Learning Objectives:

1. To understand the data science fundamentals and process.

2. To understand the data description and data relationship for data science process.

Learning Outcomes:

1. Define the data science process

2. Understand different types of data description and relationships between data for data science process.

Methodology:

Lecture, Discussion, Programming examples, Presentation of projects, flipped classroom.

UNIT 1: Introducing to Data Science

Data science – Importance of data science – Data science vs Business Intelligence – Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory Data analysis – build the model– presenting findings and building applications – Data Mining – Data Warehousing – Basic Statistical descriptions of Data- Data science use cases (banking and financial domain) – data science tools.

Unit II Describing data and its relationship

Types of Data – Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages – Describing Variability – Normal Distributions and Standard (z) Scores. Data analytics - Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error estimate —interpretation - multiple regression equations –regression towards the mean.

Unit 3- Data definition, Control structures and Functions in R

R fundamentals – basic function and operations -R Data types – Control structures, R Data Structures – Declarations - Vector –- Characters- Strings- Factors- Identifying Categories- Defining and Ordering Levels- Introduction to Functions – built-in functions –user defined functions - functions scoping rules, dates and times, Recursions. Defining a Matrix- Subsetting- Matrix Operations - Multidimensional Arrays- Subsets, Extractions, and Replacements.

UNIT 4: Data Manipulation in R

Lists of Objects-Component Access-Naming-Nesting-Data Frames-Adding Data Columns and Combining Data Frames-Logical Record Subsets-Some Special Values-Infinity-NaN-NA-NULL. Attributes-Object-Class-Is-Dot Object-Checking Functions-As-Dot Coercion Functions. Reading And Writing Files- R-Ready Data Sets- Contributed Data Sets- Reading in External Data Files- Writing Out Data Files and Plots- Ad Hoc Object Read/Write Operations. Usage of Tidyr, Tidyverse, dplyr, carret, Tidyquant package, digest, e1071.

UNIT 5: Data Visualization and Statistical Modelling in R

Using plot with Coordinate Vectors-Graphical Parameters-Automatic Plot Types-Title and Axis Labels Color-Line and Point Appearances -ggplot2 Package-Quick Plot with qplot-Setting Appearance Constants with Geoms. Statistical functions for central tendency, variation, skewness and kurtosis, handling of bivariate data through graphics, correlations, regression, programming and illustrative examples in banking domain.

TEXT and REFERENCE BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, Introducing Data Science, Manning Publications.

2. Robert S. Witte and John S. Witte, Statistics, Wiley Publications.

3. Hadley Wickham, R for data science: Import, Tidy, Transform, Visualize, And Model Data, O'Reilly.

4. Eric Pimpler, Data Visualization and Exploration with R A Practical Guide to Using R RStudio and Tidyverse for Data.

5. Hadley Wickham, "Advanced R", CRC Press.

SOFTCORES IT STREAM

MBAB X36: BIG DATA ANALYTICS

Softcore: 3 Credit

Prerequisites: *Statistics, Operating Systems, DBMS*

Learning Objectives:

1. *To provides practical foundation-level training and effective participation in big data*
2. *Basic and advanced analytic methods and an introduction to big data analytics and tools*
3. *To gain knowledge on web personalization and web visualization of social networks*

Learning outcome:

1. *On successful completion of the course, the students will be able to use current techniques, skills, and tools necessary for managing and doing analytics on big data.*
2. *Develop personalized websites and visualization for Social networks*

Methodology:

Lecture, Discussion, Case studies, Exercise, Case studies, Assignments, and mini projects

Unit I: Basics of Data Science and Analytics:

Data understanding-Data preparation- Data transformation- Mathematical foundations Algebraic view - vectors, matrices- Geometric view - vectors, distance, projections, eigenvalue decomposition -Statistics for decision making- Descriptive statistics, the notion of probability, distributions. Data analytics framework-General Software Tools for Data Analysis-Basic programming environment- -Data extraction- Data visualization- Big Data.

Unit II: Big Data Concepts and Platform:

Evolution of Big data – Types and Sources of Data – Characteristics - Analytics Cycle - Roles in Analytic Projects - Big Data Challenges and Applications in Industries - Different Types of Analytics. Hadoop - History, Terminologies, DFS, HDFS - Design, Read and Write in HDFS, Commands - Cluster Architecture-Eco System and Tools.

Unit III: Algorithms for Handling Big Data:

Random Forest Algorithm, Unstructured Data Analytics, Overkill Algorithm-Randomized Matrix Algorithms in Parallel and Distributed Environments, Mahout: Probabilistic Hashing for Efficient Search and Learning on Massive Data Dirichlet process clustering, Latent Dirichlet Allocation, Singular value decomposition, Parallel Frequent Pattern mining, Complementary Naive Bayes classifier, Random forest decision tree based classifier.

Unit IV - Advanced Analytics and Statistical Modeling for Big Data

Technology & Tools: Learning various tools to Perform Analytics on Unstructured data using the MapReduce Programming paradigm. Use Hadoop, HIVE, PIG, and other products in the Hadoop ecosystem for unstructured data analytics. Effectively use advanced SQL functions and Green plum extensions for in-database analytics. Use MAD lib to solve analytics problems in the database. Apache Spark

Unit V - Using R for Initial Analysis of the Data:

Introduction to Using R Initial Exploration and Analysis of the Data Using R Basic Data Visualization Using R. How to use the R package as a tool to perform basic data analytics, reporting, and apply basic data visualization techniques to sample data. Apply basic analytics methods such as distributions, statistical tests, and summary operations, and differentiate between statistically sound results vs. statistically significant ones. Identify a model for sample data and define the null and alternative hypothesis.

Text and Reference Books:

1. **João Moreira, Andre Carvalho, Tomás Horvathm, A General Introduction to Data Analytics, Wily.**
2. DT Editorial Services, Big Data (Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visulization) Black Book, Dreamtech Press.
3. Soumendra Mohanty. Analytics in Practice. Tata McGraw-Hill Education Private Limited.
4. Collier K, Agile analytics: A value-driven approach to business intelligence and data warehousing. Addison-Wesley
5. Miner D, Shook A, MapReduce design patterns: building effective algorithms and analytics for Hadoop and other systems. O'Reilly Media.

SOFTCORES IT STREAM
MBAB X37: NATURAL LANGUAGE UNDERSTANDING AND CHATBOTS

Softcore: 3 Credit

Prerequisites: *Data mining*

Learning Objectives:

1. *To introduce concepts and theories related to natural language processing*
2. *To facilitate the application of the concepts and theories into practice in the field of natural language processing.*

Learning Outcome:

1. *Understand and appreciate the concepts of natural language processing.*
2. *Acquire required knowledge and demonstrate skills sets required for natural language processing and chatbot application in business*

Methodology:

Lecture, Discussion, Case studies, observations, presentation.

Unit I: Words

Structure – spell check, morphology using FSTs - Semantics - Lexical Semantics, Word Net and Word Net based similarity measures, Distributional measures of similarity, Concept Mining - Word Sense Disambiguation - supervised, unsupervised and semi-supervised approaches) - Parts of Speech.

Unit II: Sentences

Basic ideas in compositional semantics, Classical Parsing – different types of parsing - Bottom up, top down, Dynamic Programming - Parsing using Probabilistic Context Free Grammars and Expectation-Maximization based approaches for learning PCFG parameters. Language Modelling.

Unit III: Machine Translation

Machine Translation - rule-based techniques, Statistical Machine Translation, parameter learning using Expectation- Maximization - Information Extraction - Introduction to Named Entity Recognition and Relation Extraction - Natural Language Generation - the potential of using ML - Advanced Language Modelling – Applications - summarization, question answering.

Unit IV: Chatbot

Design of a Chatbot - Introduction to Conversational Interface - Preliminaries, developing a speech based Conversational Interface, Conversational Interface and devices - Technology of Conversation: Introduction - Conversation as Action- The structure of Conversation - The language of Conversation.

Unit V: Text to Speech

Developing a Speech-Based Conversational Interface - Implementing Text to Speech - Text Analysis - Wave Synthesis - Implementing Speech Recognition - Language Model, Acoustic Model -Decoding - Speech Synthesis Mark-up Language - Advanced voice user interface design – Advanced Chatbots.

Text and Reference Books

1. **James Allen, Natural Language Understanding, Addision-Wesley**
2. Srini Janarthanam, Hands-On Chatbots and Conversational UI Development: Build chatbots, Packt Publishing Ltd.
3. Jurafsky, Dan and Martin, James, Speech and Language Processing, Prentice Hall.
4. Cathy Pearl, Designing Voice User Interfaces: Principles of Conversational Experiences, O'Reilly.
5. Michael McTear, Zoraida Callejas, David Griol, The Conversational Interface: Talking to Smart Devices, Springer.

SOFTCORES IT STREAM
MBAB X38: BLOCKCHAIN TECHNOLOGY

Softcore: 3 Credit

Prerequisites: *Computer Networks and security systems*

Learning Objectives:

1. *To introduce about Block Chain and its usages in projects*
2. *To introduce about Crypto currencies and implementation*

Learning Outcomes:

1. *Gain knowledge relating various block chain and cryptographic concepts*
2. *Acquire practical knowledge to develop a secure system using Block chain.*

Methodology:

Lecture, Discussion, Case studies, Exercise, Case studies, Assignments and mini projects

Unit I: Blockchain overview:
Introduction to crypto economics - History and Origin of Blockchain - Technical Concepts of Blockchain Systems - Decentralized - Mining - Distributed Consensus Byzantine agreement - Extensions of BFT - Incentives - Proof of Work and other models - Cryptosystems - Distributed Networks - Attacks - Blockchain types - Public and private blockchains - - Ripple, Stellar networks - Hard and soft forks - Sharding Side chain.

Unit II: Cryptography and Other Technologies:
Public key, Private key Cryptography - Classical Encryption Techniques, Data Encryption Standard - Advanced Encryption Standard, RSA algorithm, Elliptic Curve Cryptography, Hash - MD5, SHA - Digital Signatures, Application of Cryptography to Blockchain - Using hash functions to chain blocks - Digital Signatures to sign transactions - Using hash functions for Proof-of-Work.

Unit III: Smart Contracts
The Ethereum 'Ecosystem' - Smart Contract Languages (Solidity & Others) - Layer 2 and Payment Channel Networks (Lightning) - Distributed Virtual Machines - Oracles - Basics of contract law - Smartcontracts and their potential Trust in Algorithms, - Integration with existing legal systems - OpenZeplin, OpenLaw-Writing smart contracts.

Unit IV: Implementation:
Supply Chain and Identity on Blockchain - Blockchain interaction with existing infrastructure – Trust in blockchain data - Scaling Blockchain – reading and writing data. Differentiate nodes, sparse data and Merkle trees. NFTs and ERC-721 Tokens - Stablecoins and other ERC-20 Tokens - Decentralized Finance (DeFi) - Distributed Storage IPFS and SWARM - Ethereum Virtual Machine.

Unit V: Cryptocurrencies:
The big picture of the industry – size, growth, structure, players - Bitcoin versus Cryptocurrencies Blockchain - Distributed Ledger Technology (DLT) - VAJRA - Strategic analysis of the space –Major players: Blockchain platforms, regulators, application providers, etc. - Bitcoin, Hyper Ledger, Ethereum, Litecoin, Zcash, CBDC.

Text and Reference Books:

1. **Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies Is Changing the World, Don Tapscott and Alex Tapscott, Portfolio.**
2. Paul Vigna and Michael J. Casey, The Age of Cryptocurrency: How Bitcoin and the Blockchain Are Challenging the Global Economic Order, Picador.
3. Blockchain Technology Explained: The Ultimate Beginner's Guide About Blockchain Wallet, Mining,
4. Alan T. Norman, Bitcoin, Ethereum, Litecoin, Zcash, Monero, Ripple, Dash, IOTA And Smart Contracts, CreateSpace Independent Publishing Platform.

SOFTCORES IT STREAM
MBAB X39: INFORMATION SYSTEMS CONTROL AND AUDIT

Softcore: 3 Credit

Prerequisites: *Basics of Information System*

Learning Objectives:

1. *This course focuses on the audit and control aspects of information systems.*
2. *This course emphasizes on the management control framework, data resource management controls, application control framework and processing controls.*

Learning outcome:

1. *Understand the concepts of Audit and Control in information system.*
2. *Gain practical knowledge for carrying out projects in information system audit and control.*

Methodology:

Lecture, Discussion, Case studies, Exercise, Case studies, Assignments and mini projects

Unit I: Introduction

Overview of Information Systems Auditing– Need for Control and Audit of Computers–Effects of Computers on Internal Controls–Effects of Computers on Auditing –Foundations of Information Systems Auditing-Conducting Information Systems Audit–Audit risks–Types of Audit Procedures–Auditing around or through the computer.

Unit II: Management Control

Management Control Framework – Top Management Controls – Systems Development Management Controls–Programming Management Controls

Unit III: Data Resource Management

Data Resource Management Controls–Security Management Controls–Operations Management Controls–Quality Assurance Management Controls

Unit IV: Application Control

The Application Control Framework– Boundary Controls– Input Controls- Communication Controls

Unit V: Process Control

Processing Controls– Database Controls– Output Controls

Text and Reference Books:

1. **RonWeber, "Information System Control and Audit", Prentice Hall.**
2. Dube, D.P. and Gulati V.P., Information System Audit and Assurance (Including Case Studies and Check lists from the Bank), Tata McGraw-Hill.
3. Frederick Gallegos, DanielP. Manson, Sandra Sen ft,and Carol Gonzales Gallegos, Information Technology Control and Audit, Auerbach Publications
4. Alexander, Michael, Microsoft Access 2007 Data Analysis. Wiley.
5. Mayer-Schönberger,V. and K. Cukier, Big Data, First Mariner Books

SOFTCORES IT STREAM
MBAB X40: DATA VISUALIZATION AND REPORTING

Softcore: 3 Credit

Prerequisites:

Data warehousing and Data Mining

Learning Objectives:

1. *To introduce visual perception and core skills for visual analysis*
2. *To understand issues and best practices in information dashboard design*

Learning outcome:

1. *Gain knowledge in visual perception and core skills for visual analysis*
2. *Gain practical knowledge in use of current techniques, skills, and tools necessary for visualizing data output and preparing business intelligence reports.*

Methodology:

Lecture, Discussion, Case studies, observations, presentation.

Unit I :Core skills for visual analysis

Information visualization-effective data analysis - traits of meaningful data- visual perception - making abstract data visible - building blocks of information visualization - analytical interaction - analytical navigation - optimal quantitative scales - reference lines and regions - trellises and crosstabs - multiple concurrent views- focus and context- details on demand- over-plotting reduction - analytical patterns-pattern examples.

Unit II :Time-series, ranking, and deviation analysis

Time-series analysis - time-series patterns - time-series displays - time-series best practices - part to whole and ranking patterns - part-to-whole and ranking displays - best practices - deviation analysis-deviation analysis displays- deviation analysis best practices

Unit III :Distribution, correlation, and multivariate analysis

Distribution analysis - describing distributions - distribution patterns - distribution displays - distribution analysis best practices - correlation analysis - describing correlations - correlation patterns - correlation displays - correlation analysis techniques and best practices - multivariate analysis - multivariate patterns - multivariate displays - multivariate analysis techniques and best practices.

Unit IV : Information dashboard design

Information dashboard - categorizing dashboards - typical dashboard data - dashboard design issues and best practices - visual perception - limits of short-term memory - visually encoding data - Gestalt principles -principles of visual perception for dashboard design

Unit V : Information dashboard design II:

Characteristics of dashboards - key goals in visual design process - dashboard display media - designing dashboards for usability- meaningful organization - maintaining consistency- aesthetics of dashboards - testing for usability - case studies: sales dashboard, CIO dashboard, Telesales dashboard, marketing analysis dashboard.

Text and Reference Books:

1. **Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", Analytics**
2. Stephen Few, "Information dashboard design: The effective visual communication of data", O'Reilly,
3. Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press,
4. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.
5. Ben Fry, "Visualizing data: Exploring and explaining data with the processing Environment"O' Reilly,

SOFTCORES IT STREAM
MBAB X41: ROBOTIC PROCESS AUTOMATION

Softcore: 3 Credit

Prerequisites:

Basic Knowledge about Robotics and Automation

Learning Objectives:

1. *To understand the role of the Artificial Intelligence in Automation*
2. *To learn Blue Prism process and Automation Anywhere and automate any business process with intelligent, scalable software robots.*

Learning Outcomes:

1. *Apply basic principles of AI in solutions that require problem solving, knowledge and automation*
2. *Identify processes suitable for RPA and recognize how RPA is transforming businesses*

Methodology:

Lecture, Discussion, Case studies, observations, presentation.

UNIT I: AI and Automation

AI Foundations- AI Data, AI Capabilities framework- Associated Technologies of AI - AI Prototyping- Industrializing AI - Cognitive Automation tools- Natural language processing- AI Resources -Future of AI.

UNIT II: Introduction to RPA

RPA Foundations- History of RPA-Difference between RPA and AI- Benefits of RPA-Components of RPA-RPA Architecture- RPA Skills- Process Methodologies in RPA- Planning for RPA-RPA Platforms- Types of Bots- Deployment platforms- Future of RPA.

UNIT III: UI path

Introduction to UI Path: UIPath Studio-UI Path Robot-UI path Orchestrator-Task Recorder-Sequence,
Flowchart, and Control Flow- Sequencing the workflow- Data Manipulation- Application with Plug-ins and Extensions Terminal Plug-in- Handling User Events and Assistant Bots- Deploying and Maintaining the Bot.

UNIT IV: Blue Prism

Introduction-Process Studio- Pages, Actions, Decisions, Choices and collections-Implementing business objects-Spying Elements-Working with excel –Sending and receiving email, Control room and work queues- Exception Handling

UNIT V: Automation anywhere

Introduction of Automation Anywhere-Tasks-Tasks Editors-Integration and collaboration with Automation Anywhere- working with web pages and JSON Data- Citrix Automation- E-mail Automation- PDF integration- Web Recorder-Creating IQ bots -Deploying and Maintaining the Bot.

Text Books and References:

1. **Alok Mani Tripathi ,"Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool – UiPath", Packt Publishing.**
2. Tom Taulli,"Artificial Intelligence Basics: A Non-Technical Introduction ",Latest Edition,Apress
3. Lim Mei Ying,"Robotic Process Automation with Blue Prism Quick Start Guide ", Packt Publishing
4. Tom Taulli ,"The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress.

SOFTCORES IT STREAM

MBAB X42: UX DESIGN

Softcore: 3 Credit

Prerequisites:

Basic Knowledge about Designing.

Learning objectives:

1. *To provide a sound knowledge in UI & UX*
2. *To understand the need for various Research Methods used in UI and UX Design*

Learning outcomes:

1. *Build UI for user Applications*
2. *Evaluate UX design of any product or application*

Methodology:

Lecture, Discussion, Case studies, observations, presentation.

UNIT I Foundations of Design

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT II: Foundations of UI Design

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT III Foundations of UX Design

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals - Principles of accessibility of Web and Mobile Design.

UNIT IV Wireframing, Prototyping and Testing

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

UNIT V Research, Designing, Ideating, & Information Architecture

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

Text and Reference Books:

1. Joel Marsh, "UX for Beginners", O'Reilly
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly.
3. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" , O'Reilly.
4. Steve Schoger, Adam Wathan "Refactoring UI".
5. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition.

SOFTCORES FINANCE AND MANAGEMENT STREAM

MBAB X43: RETAIL BANKING

Softcore: 3 Credit

Prerequisites: Basics of Banking Concepts and practices.

Course Objective

1. *To introduce and expose the key issues in rural banking*
2. *To introduce various Government initiatives for inclusive financial system*

Learning Outcomes:

1. *To gain knowledge on rural financing and development policy*
2. *To acquire practical knowledge on problems and prospects in rural banking.*

Methodology:

Lecture, Discussion, Case studies, observations and presentation

Unit- I: Introduction to Retail Banking:

Meaning and definition, Retail Vs. Corporate/ Wholesale Banking – Commercial banks - Regulatory Framework – RBI guidelines – Emerging trends - Business Intelligence and analytics – New product development – Product customization - Role of technology in retail banking.

Unit- II: Retail Products and Services

Customer requirement and products development process –Approval process for retail loans - credit scoring - Asset Products - Home Loans, Vehicle Loans, Personal Loans, Educational Loan, Credit Card, Debit card, - Eligibility, Purpose, Amounts, Margin, Security, Disbursement, Moratorium, Repayment, Prepayment - Credit Vs Debit Cards - Eligibility, Purpose, Amounts, Margin, Security, Billing Cycle, Credit Points - Other Products – Remittances, Funds Transfer etc. – Record keeping and documentation procedures.

Unit- III: Marketing of Retail Products

Retail Strategies - Tie-ups with Institutions, OEMs, Builders etc. - Delivery Channels - Branch, ATMs, POS, Internet Banking, M-Banking etc. Selling Process - Direct Selling Agents - Customer Relationship Management.

Unit – IV: Regulations and Compliance

Account opening – AML and KYC norms – NPA Norms – Recovery of Retail Loans - defaults, rescheduling, recovery process - SARFAESI Act, DRT Act, Lok Adalat forum - Recovery Agents - Outsourcing - RBI guidelines - CIBIL Procedures.

Unit-V: Retail Banking Developments

Securitization, Mortgage based securities, New products -Insurance, Demat services, online / Phone Banking, Property services, Investment advisory/ Wealth management, Reverse Mortgage - Cross selling opportunities.

Text and Reference Books:

1. **O.P.Agarwal, Fundamentals of Retail Banking, Himalaya Publishing House.**
2. IIBF, Retail Banking, MacMillan Education.
3. IIBF, Retail Banking & wealth management, MacMillan Education.
4. Keith Pond, Retail Banking, Gosbrook Professional Publishing.
5. Suresh Samudrala, Retail Banking Technology, Jaico Publishing House.

SOFTCORES FINANCE AND MANAGEMENT STREAM
MBAB X44: CENTRAL BANKING & POLICY DEVELOPMENT

Softcore: 3 Credit

Prerequisites: *Basics of Economics & Banking*

Learning Objective

1. *To introduce the concepts on central banking and monetary policy*
2. *To introduce various functions of the monetary Policy and the role of Central Banks in the Economy.*

Learning Outcomes:

1. *To gain knowledge in central banking and its importance in floating economy*
2. *To acquire knowledge and understanding of central banking operations*

Methodology:

Lecture, Discussion, Case studies, observations, presentation, role plays, problem and games

UNIT I: Introduction to RBI and Conventional Central Banking:

Establishment of RBI and RBI Act, 1934 - RBI as the Apex Bank in the Indian Banking System – Conventional central banking functions of RBI: Issue of Currency – Lender of Last Resort – Regulator and Supervisor of Banks – Payment and Settlement System - Government Debt Management – Management of Forex and Foreign Exchange Rate – Conduct of Monetary Policy

UNIT II: RBI as Regulator and Supervisor of the Banks in India

Rational for Banking Regulation – Various forms of Banking Regulations in India: bank licensing – LOLR - deposit insurance – Capital adequacy requirements under Basel norms – Prudential regulations on asset quality, income recognition and provisioning – Rationale for Banking Supervision – Onsite inspection and off-site surveillance by RBI – CAMELS

UNIT III: Conduct of Monetary Policy

Overview of Theories of Money Demand and Money Supply – Role of Commercial Banks in Money Creation under Partial Reserve System – RBI's Control on Money Supply and Determination of Interest Rates – Monetary Policy framework: Objectives, Instruments and Targets – Channels of Monetary Transmission – RBI's Monetary Policy Operating Procedure – RBI's Inflation Targeting framework

UNIT IV: RBI Functions and Debt Management

Rbi as banker to the government - Public Debt Management - Government Securities market - fiscal and money coordination.

UNIT V: External Sector Management and RBI

Overview of Open-economy Macroeconomics – Economic Reforms in India and liberalization of international capital flows – Market oriented exchange rate management – Challenges for conduct of monetary policy under *Impossible Trinity* – RBI's balancing act

Text and Reference Books:

1. **Blinder, Alan S., Central banking in theory and practice, Mit press**
2. Mishkin, Frederic S.,Economics of Money, Banking and Financial Markets, Pearson Education, 11th Edition.
3. Gans, Joshua, Robin Stone cash, Martin Byford, Gregory Mankiw, Stephen King, and Jan Libich, Principles of economics, Cengage AU.
4. Samantaraya, Amaresh (2024): Functions, Regulations and Management of Banks in India, Cambridge University Press (Forthcoming).

SOFTCORES FINANCE AND MANAGEMENT STREAM

MBAB X45: CORPORATE RESTRUCTURING

Softcore: 3 Credits

Prerequisites: Basic knowledge on Business Management and Strategic Management

Learning Objectives:

1. To create awareness on understanding concepts and principles

2. To provide expert knowledge of legal, procedural and practical aspects of Corporate Restructuring

Learning Outcome:

1. To understand practical aspects and intent of law relating to Corporate Restructuring

2. To acquire knowledge of the legal, procedural and practical aspects of Corporate Restructuring

Methodology:

Lecture, Discussion, Case studies, observations, presentation, and mini projects

UNIT-I Concepts

Meaning of corporate restructuring, need, scope and modes of restructuring - Historical background - National scenario and Global scenario. Planning, formulation and execution of various corporate restructuring strategies – Concepts of Mergers, Acquisitions, Takeovers, Disinvestments, Strategic alliances, Demergers, & Hiving off. Revival, Rehabilitation and Restructuring of Sick Companies - Sick companies and their revival with special reference to the law and procedure relating to sick companies.

UNIT – II Mergers and Acquisitions

Concept; legal, procedural, economic, accounting, taxation and financial aspects of mergers and amalgamations including stamp duty and allied matters; interest of small investors; merger aspects under competition law; jurisdiction of courts; filing of various forms; Amalgamation of banking companies and procedure related to Government companies; Cross border mergers – Latest Merger and Acquisition cases and status.

UNIT-III Takeovers

Meaning, concept & types of takeovers - legal aspects - SEBI takeover regulations; procedural, economic, financial, accounting and taxation aspects; stamp duty and allied matters; payment of consideration; bail out takeovers and takeover of sick units; takeover defences; cross border takeovers – Examples of Recent Takeovers and the status.

UNIT-IV Corporate Demergers And Reverse Mergers

Concept of demerger; modes of demerger - by agreement, under scheme of arrangement; demerger and voluntary winding up; legal and procedural aspects; tax aspects and reliefs; reverse mergers – procedural aspects and tax implications. Revival, Rehabilitation and Restructuring of Sick Companies - Sick companies and their revival with special reference to the law and procedure relating to sick companies - Examples of recent demergers and the status

UNIT – V Changing World and Its Effect on Restructuring

Globalisation: Dominance of Services economy; technological and communication advancement; Expansion of Financing opportunities and Financial Innovations; expanding role of professionals. Corporate Restructuring in Challenging Times: Financial Mis-governance; Liquidity Crunch, Sub Prime Crises; Global Recession; Solutions for Business Failures.

Text and Reference Books

1. Rabi Narayan & Kar,Minakshi, Mergers Acquisitions & Corporate Restructuring | Strategies & Practices , Taxmann publications

2. K.R. Sampath, Mergers, Amalgamations, Takeovers, Joint Ventures, LLPs and Corporate Restructure, Snow White Publications

3. Ray.J, Mergers and Acquisitions Strategy, Valuation and Integration, PHI publications

4. K.R. Chandratre (Dr.), Corporate Restructuring, Bharat Law House Pvt. Ltd

5. ICSI's Handbook on Mergers Amalgamations and Takeovers

SOFTCORES FINANCE AND MANAGEMENT STREAM
MBAB X46: HUMAN RESOURCE MANAGEMENT

Softcore: 3 Credit

Prerequisites: *Basics of Business*

Learning Objectives:

1. *To familiarize the students with methods and techniques of HRM*
2. *To equip the students with the application of the HRM tools in real world business situations.*

Learning Outcome:

1. *Understand and appreciate the concepts of Human Resources Management*
2. *Understand the recent trends in Human Resources Management*

Methodology:

Lecture, Discussion, Case studies, observations, presentation, role plays, and games

UNIT-I: Introduction

Human Resources Management - Definition - Objectives - Functions - Scope - Importance - HRM in India- Organisation and Functions of the HR and Personnel Department – HR Structure and Strategy; Evolution of HRM - Computer Application in Human Resource Management

UNIT – II: Staffing

Recruitment and Selection - Manpower Planning - Job Analysis - Job Description and Job Specification Factors - Governing Recruitment, Recruitment Sources and Techniques. = Selection – Induction & Orientation - Performance and Potential Appraisal

UNIT-III: Human Resources Development

Human Resources Development –Training and Development Methods - Design & Evaluation of T&D Programmes - Career Development - Promotions and Transfers - Personnel Empowerment including Delegation - Retirement and Other Separation Processes.

UNIT-IV: Talent Management

Talent Acquisition - selecting recruitment source - preparing recruitment budget - employer branding - Talent Retention: Comprehensive approach to Retaining employees - Managing Voluntary Turnover - Strategic Compensation plan for Talent Engagement - leadership and traits - Leadership behavior and styles.

UNIT – V: Trends in HRM

Learning Organization - Business Process Reengineering and Role of HRM - Work-life balance - Competency mapping - Cross cultural management - Moonlighting- Human Resource Information System - Human Resource Audit and Human Resource Accounting - Employee Empowerment.

Text and Reference Books

1. **P. Subba Rao, Personnel & Human Resource Management, Himalaya Publishing House.**
2. K. Aswathappa, Human Resource and Personnel Management, Tata Mc Graw Hill Publishing Co.
3. Flippo, Edwin B., Personnel Management, Tata McGraw Hill Publishing Co.
4. Venkata Ratnam C. S. & Srivatsava B. K., Personnel Management and Human Resources, Tata Mc-Graw Hill.
5. Aswathappa, Human Resource Management, Tata McGraw Hill

SOFTCORES FINANCE AND MANAGEMENT STREAM
MBAB X47: MERCHANT BANKING AND FINANCIAL SERVICES

Softcore: 3 Credit

Prerequisites: *Basics of Treasury and Debt instruments*

Learning Objectives

1. *To introduce the basics of debt markets and treasury operations.*
2. *To provide the skills required to calculate yields, bond values etc.*

Learning Outcomes:

1. *To acquire the knowledge related to Treasury and Debt instruments*
2. *To gain the practical knowledge to work in the treasury divisions of the banks.*

Methodology:

Exercise, Case studies, Assignments and mini projects

Unit I: Debt Instruments:
Fundamental Features–Indian Debt Markets–Market segments– Participants -Secondary Market for Debt instruments – Bond Market – SEBI (Disclosure and Investor Protection) guidelines 2008

Unit II: Analysis and Valuation of Bonds:
Pricing of bonds – Measuring yields – Bond price volatility – Factors affecting bond yields and the term structure of interest rates.

Unit III: Bond Portfolio Management Strategies:
Passive management strategies–Active management strategies – Global fixed income investment strategy – Core-plus bond portfolio management – Matched-funding Techniques

Unit IV: Central Govt. Securities:
G - Secs–Tenor and Yields–Primary Issuance Process, Participants–SGL accounts – Dealers – Secondary Market – Negotiated Dealing system – T bills – Cut off Yields – State Govt. Bonds – Money market instruments -Call Money Markets– Participants

Unit V: Fixed Income Derivatives:
Meaning–Types–Mechanics for forward rate agreements–Guidelines for exchange traded interest rate derivatives.

Text and Reference Books:

1. Frank J. Fabozzi, Bond Markets, Analysis and Strategies, Pearson
2. Reilly, Brown, Investment Analysis and Portfolio Management, CengageLearning
3. Fixed-Income Securities. L. Martellini, P. Priaulet and S. Priaulet. John Wiley & Sons
4. Website of National Stock Exchange.
5. Steven M Braggs ―Treasury Management: The Practical Guide, Wiley.

SOFTCORES FINANCE AND MANAGEMENT STREAM
MBAB X48: ENTREPRENEURSHIP AND START-UPS

Hard Core: 3 Credits

Prerequisite: *Basic Knowledge in Business*

Learning Objective:

1. To create a learning experience to enable the students to face the challenges of starting new ventures.
2. To prepare the students for starting a new business and the skills for managing an existing family business.

Learning Outcomes:

1. To gain knowledge in business plan preparation by using various sources of finance
2. To acquire knowledge to become Entrepreneurs in different fields.

Methodology:

Lecture, Discussion, Case studies, observations, presentation, Proposals

Unit I: Introduction to Entrepreneurship:

The Entrepreneurial mindset- Types of Entrepreneurship and startups-Evaluating Entrepreneurial Career Options and Startup Opportunities Overview of Entrepreneurship - understanding of the role of innovation and creativity - successful Entrepreneurs

Unit II: Identifying and Evaluating Opportunities:

Market research and analysis- Idea generation and screening- Opportunity evaluation and selection-Role of Government: Government push for startups-facilities-training- approaching government-innovative ideas-different departments

Unit III: Creating a Business Plan and Financing a Startup:

Elements of a business plan- Pitching and presenting a business plan- Financial projections and analysis-Understanding Startup Finances and Capital Requirements- Sources of funding for startups- Bootstrapping and self-funding- Venture capital and angel investing

Unit IV: Legal and Regulatory Issues:

Firm Registration and Formalities- Regulatory Compliance- Intellectual property protection- Contract negotiation and drafting- Developing and Presenting Startup Business Plan- Patent Registration- Reporting - Managing risk and uncertainty

Unit V: Launching and Managing the Startup Enterprise:

Maintaining Competitive Advantage The Changing Role of the Entrepreneur: Mid-Career Dilemmas What to Expect During the “Launch Stage” The Imperatives of the Launch Stage Legal Issues Facing Entrepreneurs Building Your Team

Text and Reference Books:

1. Hisrich, Robert D. Effective entrepreneurial management. Springer international publishing.
2. Harvard Review, Steve Blank, Marc Andreessen, Reid Hoffman, and William Sahlman. HBR, 10 Must Reads on Entrepreneurship and Startups. Ascent Audio.
3. by Krishiv Agarwal & Nikhil Agarwal, The StartUp Masterplan: How to Build a Successful Business from Scratch.
4. Lassala, Carlos, and Samuel Ribeiro-Navarrete. Financing Startups. Springer International Publishing.
5. Drucker, Peter. Innovation and entrepreneurship. Routledge.

SOFTCORES FINANCE AND MANAGEMENT STREAM

MBAB X49: CYBER CRIMES AND IT LAWS

Softcore: 3 Credit

Prerequisites: *Basics of IT Laws*

Learning Objective:

1. *To understand the importance of cyber security in banks*
2. *To understand the basics of cyber forensics, investigation and cyber security*

Learning Outcomes:

1. *To understand the practices of Forensic Science*
2. *To acquire required knowledge and demonstrate skills sets required for cyber security in electronic business*

Methodology:

Lecture, Discussion, Case studies, observations, presentation, role plays, problem and games

Unit I: Fundamentals of Criminal Behaviour and cyber crime

Nature and fundamental principles of crime – Theories of Criminal Behaviour - Cyber crimes – definition, scope and growing dimensions – Cyber Criminals and characteristic- Nature and Types of cyber crimes - Cyber Crime Techniques; Computer insecurity and computer attacks; Internet Crimes and Internet Frauds; Computer Hacking and Hackers; Social Engineering; Digital signatures and forgery.

Unit II: Emerging Banking Environment and Vulnerability

Development in Banking Industry and Banking operations – Payment and Settlement; E-commerce, Online Banking and Crimes; Banking Software crimes, Computer Hacking – browsing, password cracking, session hijacking, man in the middle attack, Website hacking, DOS, DDoS, Source code theft - On-line banking crimes and Frauds - Spamming – Phishing - identity theft, cyber money laundering, intercepting electronic communication, Accounting frauds, forgery and counterfeiting; Vulnerability in Banks - Bank Failure and its impact on the system.

Unit III: Cyber Forensics and Investigation

Introduction to Cyber Forensic Investigation, Investigation Tools, e-Discovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Encryption and Decryption methods, Search and Seizure of Computers, Recovering deleted evidences, Password Cracking.

Unit IV: Cyber Security in Banks

Introduction to Cyber Security, Implementing Hardware Based Security, Software Based Firewalls, Security Standards and Best Practices, Assessing Threat Levels, Penetration Testing Security Controls – Preventive, Detective and Corrective controls; Forming an Incident Response Team, Reporting Cyber crime, Operating System Attacks, Application Attacks, Cryptanalytic Attacks; Reverse Engineering & Cracking Techniques - Cryptography- Encryption- Public Key Infrastructure (PKI), Key Management - IS Security and IS Audit - Global initiatives and development.

Unit V: Cyber Crimes and Legislative Framework

Salient features of IT Act, 2000 and latest amendments – offenses and penalties – Amendments to Indian EvidenceAct, 1872 - Amendments to Indian Penal Code, 1860 - Amendments to Bankers Book of Evidence Act, 1891 - Amendments to RBI Act, 1934 - Civil and criminal liability of cyber crime - Challenges of legislative, law enforcement and justice system – Indian and International Initiatives.

Text and Reference books:

1. **VermaAmita, Cyber Crimes and Law, Central Law Publications, Allahabad.**
2. Dasgupta .M. , Cyber Crimes in India – A Comparative Study, Eastern Law House, Kolkata.
3. Barkha and Mohan Rama.U., Cyber Law and Crimes – IT Act 2000 and Computer Crime Analysis, Asia Law House, Hyderabad.
4. Eoghan Casey, Digital Evidence & Computer Crime, Forensic Digital Science, Computers and Internet, Latest Edition.

SOFTCORES FINANCE AND MANAGEMENT STREAM
MBAB X50: RISK MANAGEMENT IN BANKS

Softcore: 3 Credit

Prerequisites: *Basics of Banking principles and practices.*

Learning Objectives:

1. *To understand the basic concept of risk management in banks*
2. *To expose the various types of risk faced by banks*

Learning Outcomes:

1. *To understand and appreciate the concepts of Risk/ Return Tradeoffs.*
2. *To acquire required knowledge and demonstrate skills sets required for Credit Risk Management.*

Methodology:

Exercise, Case studies, Assignments and mini projects

Unit I: Introduction and Overview:
Risk definition – Basel Committee Norms – Risk Process- Risk Organization and policy – Important risks in commercial banks – Regulatory Framework and RBI guidelines - Liquidity Risk Management and Asset Liability Management.

Unit II: Credit Risk:
Credit risk framework - RBI guidelines - Risk rating and risk pricing - Credit risk assessment - Standardized approach and Advanced approach - Credit rating /scoring - Credit Bureaus - Stress test and sensitivity analysis - Internal Capital Adequacy Assessment Process (ICAAP) - Structured products.

Unit III: Operational Risk:
Operational risk framework - Types of operational risk - Causes for operational risk - Sound Principles of Operational Risk Management (SPOR) - Identification, measurement, control / mitigation of operational risks- Organizational set up and Policy requirements- Strategic approach and key responsibilities of ORM - Capital allocation for operational risk, methodology and qualifying criteria for banks for the adoption of the methods; Computation of capital charge for operational risk.

Unit IV: Market risk:
Interest rate risk - Price risk (Equity) - Commodity risk - Currency risk – Managing Market risk - Measuring Market risk under Basel- Standardized duration method- Internal measurement approach – Value at Risk (VaR) – Equity Risk Premium (ERP)

Unit V: Risk Measurement, Control and Management:
Risk Calculation - Risk exposure analysis - Prudential norms – Income Recognition and Asset Classification (IRAC) norms -Capital adequacy norms - Hedging – Forwards – Futures – Options Arbitrage opportunities -Regulatory prescriptions of risk management - Systems Audit - Risk Organization and Policy.

Text and Reference Books:

1. **Moorad Choudhry, Bank Asset and Liability Management: Strategy, Trading, Analysis, Wiley Publishing.**
2. John C. Hull, Risk Management and Financial Institutions , Pearson.
3. Indian Institute of Banking and Finance(IIBF), Risk Management , Macmillan Publishers India.
4. IIBF., Risk Measurement Models to Capital Allocation Policies, Wiley.
5. Foundations of Banking Risk: An Overview of Banking, Banking Risks and Risk-Based Banking Regulation by GARP (Global Association of Risk Professionals).

SOFTCORES FINANCE AND MANAGEMENT STREAM

MBAB X51: FINANCIAL MODELING

Softcore: 3 Credit

Prerequisites: *Basics of derivatives*
Learning Objectives:
1. To learn the various Financial Analysis
2. To understand the methods of various Financial Analysis
Learning outcome:
1. To gain the knowledge to analyze and build Financial Models
2. To acquire the practical knowledge to build models for assess the financial positions of firms
Methodology*:*
Exercise, Case studies, Assignments and mini projects

Unit I: Introduction to Financial Modeling:
Introduction to a spreadsheet, database functions in a spreadsheet, finance function in a spreadsheet- Basic Excel functions and shortcuts- Basic Financial Calculations – Modelling best practices- Essential Tools and Formulas- Formatting & Color Coding

Unit II: Building Financial Models in Excel:
Building a basic financial model- Formatting and presenting financial models- Date Functions for Finance- Lookup Functions-Formatting of Basic Model- Developing a good model – Multipage calculations-

Unit III: Financial Analysis and Decision Making:
Overview of the income statement, balance sheet, and cash flow statement-Forecasting financial statements using historical data- Sensitivity analysis and scenario analysis- Goals Seeking- One-way and Two-Way table- Break Even- Calculating-

Unit IV: Financial Modeling in Corporate Finance:
Financial modeling in capital budgeting- Financial modeling in mergers and acquisitions- NVA-NPV

Unit V: Advanced Financial Modeling Techniques:
Monte Carlo simulation- Optimization modeling- Forecasting using time series analysis-Application of Statistical tools for financial calculations and Model Building through Excel Add on.

Text and Reference Books:
1. Benninga, Simon. Financial modeling. MIT press.
2. Proctor, K. Scott., Building financial models with Excel: A guide for professionals.
3. Day, Alastair. Mastering cash flow and valuation modelling. Pearson UK.
4. Sengupta, Chandan. Financial analysis and modeling using Excel and VBA. Vol. 456. John Wiley Sons.
5. Yeo, Julian, Financial statement analysis.

SOFTCORES FINANCE AND MANAGEMENT STREAM
MBAB X52: FOREX AND CURRENCY DERIVATIVES

Softcore: 3 Credits

Prerequisites: *Basic Knowledge on Financial Market Operations*

Learning Objectives:

1. *To introduce concepts and theories related to Forex and Currency Derivatives*
2. *To facilitate the application of the concepts and theories into practice in the field of Forex Trading*

Learning Outcome:

1. *To understand and appreciate the concepts of Forex and Currency Management*
2. *To acquire required knowledge and demonstrate skills sets required for Forex Trading*

Methodology:

Lecture, Discussion, Case studies, observations, presentation, problem solving, Market Watch and currency trading games

Unit I: Foreign Exchange Market: Organisation – Spot Vs Forward Markets – Bid and Ask rates – Interbank Quotations – International Market Quotations – Cross Rates – Merchant Rates – FEDAI Regulations – Role of RBI.

Unit II: Exchange Rates - Exchange rate systems – Gold Standard – Bretton Woods – Fixed Vs Floating Exchange Rate systems – Determinants of Exchange Rates – Exchange Controls.

Unit III: Foreign Exchange Transactions – Purchase and Sale transactions – Spot Vs Forward transactions – Forward Margins – Interbank Deals – Cover deals – Trading – Swap deals – Arbitrage Operations – Factors determining Forward margins.

Unit IV: Ready and Forward Exchange Rates – Principle types of Ready Merchant rates – Ready rates based on cross rates – Forward exchange contracts – Execution of Forward contracts – cancellation and Extensions - Dealing position – Exchange position – Cash position.

Unit V: Currency Derivatives – Currency Forwards – Currency Futures – Currency Options – Exchange traded transactions – Financial Swaps – Forward Rate agreements – Interest Rate Options.

Text and Reference Books

1. **Alan C Shapiro: Multinational Financial Management, Prentice Hall, New Delhi**
2. Francis Cherunilam : International Economics, Tata Mc Graw Hill Pub Ltd, New Delhi
3. Ian H Giddy: Global Financial Markets, AITBS Publishers and Distributors, New Delhi
4. C Jeevanandam, Foreign Exchange: Practice, Concepts, Sultan Chand & Sons, New . Delhi
5. Vijayabhaskar P and Mahapatra B., Derivatives Simplified, Respose Books, Sage Publications, New Delhi

SOFTCORES FINANCE AND MANAGEMENT STREAM
MBAB X53: PRUDENTIAL NORMS FOR INDIAN BANKS

Soft Core 3 Credit

Prerequisites: *Basics of understanding of Banking principles and practices in India.*
Learning Objectives:

1. *To understand the basic concept of prudential management in banks*
2. *To expose the various regulatory framework and guidelines for banks in India*

Learning Outcomes:

1. *To understand and appreciate the various prudential banking practices in India*
2. *To acquire required knowledge and demonstrate skill sets to apply the prudential norms.*

Methodology:

Exercise, Case studies, Assignments and mini projects

Unit- I: Introduction:
Basel Committee - RBI Good Governance Policies and Practices - Risk Management Process in Banks - Risk Organization and policy – Important risks in commercial banks – Regulatory Framework and RBI guidelines – Bank risk management policy – Risk Management Committee – Role of Board of Directors.

Unit- II: Asset Liability Management in Banks:
Bank balance sheet – Financial margin – Liquidity and Interest rate risk – Interest rate sensitivity - ALM Information System – ALM organization and ALM process**,** risk parameter, identification, measurement, management and tolerance levels.

Unit- III: Asset Quality:
Credit Appraisal and Loan Pricing - Income Recognition and Asset Classification and Provisioning norms – RBI guidelines – Role of Board of Directors and RBI guidelines – NPA Management – Recovery policies and strategies of Banks – Modes of Recovery - Role of Asset Reconstruction Companies.

Unit- IV: Capital Adequacy:
Basel Committee Norms for Capital Adequacy - RBI norms for capital adequacy – Regulatory capital – Capital charge for credit risk and market risk – Calculation of total risk weighted assets to capital ratio – Risk weights for credit risk – Off balance sheet items - Reporting requirements and actions.

Unit- V: Exposure Norms:
Exposure Norms for Credit – Single and group borrowers – exposure for various products – consortium arrangements – types of exposure and prudential limits – Emerging trends in prudential norms – Case studies

Text and Reference Books:

1. **Sant, R.K., Managing Non Performing Assets by Public Sector Banks.**
2. Ramachandra Reddy B., Management Of Non-Performing Assets In Banks And Financial Institutions.
3. Srivastava Ashish, Effectiveness of Prudential Regulations for Banks: Global Perspective and Indian Context, Eliva Press.
4. Mathias Dewatripont, The Prudential Regulation of Banks, The MIT Press.
5. IFSCA, The IFSCA Banking Handbook: Prudential Directions.

SOFTCORES FINANCE AND MANAGEMENT STREAM

MBAB X54: SUSTAINABLE FINANCE

Soft Core 3 Credit

Prerequisites: *Basic understanding on Financial system*

Learning Objectives:

1. *To provide basic principles for managing Sustainable Finance*
2. *To create a forum of shared learning for managers to understand both the challenges and opportunities around sustainable finance and gain exposure to this emerging and exciting field.*

Learning Outcome:

1. *Do investment in Green Finance products*
2. *Choose the career in the field of Sustainable Finance*

Methodology:

Lectures, case study design and analysis, group discussions, seminar presentation, writing assignments and tests

Unit I: Introduction

Introduction to Climate Change - Sustainable Development - Sustainability and Finance - Introduction to sustainable finance - Economics of transitioning to a lower carbon future – costs, past trends, emerging opportunities stranded assets - Opportunities and challenges in financing green assets – the role of markets, regulations, and technology - Pricing carbon, using carbon finance and carbon markets - Emerging emissions trading schemes across the world

Unit II: Risk Assessment

Risk assessment due to climate change – sub-regionally and sectorally - Climate risk disclosure for mitigation and adaptation - Risk mitigation in financing green projects and companies, including examples of how risks were mitigated

Unit III: Green Investment

Green bonds – an introduction and updates on latest developments - The involvement of stock exchanges – how stock exchanges can grow green finance and the development of "green finance hubs" - Understanding Thematic Bonds

Unit IV: Green Assets Management

Development Finance Institutions and Blended Finance - Banking and sustainable asset management - Insurance and climate vulnerability – climate risks mitigation through the insurance sector

Unit V: ESG & International Developments

Concept of ESG - International Governance for Climate Change - Climate Finance Opportunity for Financial Institutions (Global) - International developments in UNFCCC negotiations on climate finance and other international developments

Text & Reference Books:

1. Dirk Schoenmaker, Willem Schramade, "Principles of Sustainable Finance", OUP Oxford publishers 2. Handbook of Environmental and Sustainable Finance, Science Direct
2. Simon Thompson, Green and Sustainable Finance: Principles and Practice, Kogan Page publisher

MANAGEMENT PROCESSES

COURSE CODE: MBAH011

OBJECTIVES:

- Providing conceptual understanding of management concepts
- Familiarizing the students with the contemporary issues in management
- Enable them to apply the concepts in the management organization

METHODOLOGY:

Lectures, Case studies, Application exercises, Group or Class learning activities, Experiential Exercises

UNIT I

Natre of Management – Tasks of a Professional Manager - Social Responsibilities of Business – Manager and Environment – Systems Approach to Management – Levels in Management – Managerial Skills.

UNIT II

Planning – Steps in Planning Process – Scope and Limitations – Short Range and Long-Range Planning – Flexibility in Planning – Characteristics of a Sound Plan – Management by Objective (MBO) – Policies and Strategies – Scope and formulation – Decision Making - Techniques and processes.

UNIT III

Organizing – Organisation Structure and Design - Authority Relationships – Delegation of Authority and Decentralisation – Interdepartmental Coordinator – emerging Trends in corporate Structure, Strategy and Culture – Impact of Technology on Organisational design - Mechanistic vs. Adoptive Structures – Formal and Informal Organisation.

UNIT IV

An Overview of Staffing and Directing functions – Controlling – Prerequisites' of Control Systems – Control Process – Methods, Tools and Techniques of Control – Design of techniques – Choices in Control.

UNIT V

Comparative Management Styles and approaches – Japanese Management Practices – Organisational Creativity and Innovation – Management of Innovation – Entrepreneurial Management – Benchmarking – Best Management Practices across the world – Select cases of Domestic & International Corporations – Management of Diversity.

Course Outcomes:

CO1: Define and classify the concepts, approaches, and managerial skills

CO2: Recall the planning and decision-making process.

CO3: Outline the concepts of organization.

CO4: Summarize the concepts of controlling and equip the knowledge with the staffing process

CO5: Explain the management styles and approaches and interpret the best

CO-PO Mapping

CO - PO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	2	3	3	2	2	3
CO2	3	2	0	2	3	3	2
CO3	3	0	2	2	0	3	2
CO4	3	3	0	0	2	3	2
CO5	3	3	2	2	0	2	3
	3	**2**	**1.4**	**1.8**	**1.4**	**2.6**	**2.4**

TEXT BOOKS:

1. Koontz & Weirich, "Essentials of Management: An International perspective", 8th Edn. Tata McGraw-Hill, New Delhi, 2009.
2. Koontz H. "Essentials of Management 5E, Tata McGraw-Hill, New Delhi, 1994.
3. Stephen P. Robbins & David A. Decenzo, "Fundamentals of Management", Pearson Education, New Delhi, 3rd Edn. 2001.
4. Peter F. Drucker, "The Practice of Management", Harper Business; Reissue edition, 2006.
5. Mason Carpenter & Talya Bauer, "Principles of Management", Flat World Knowledge, Inc. 2009.

REFERENCES:

1. Sarah cook, Practical Bench Marking: A manager's guide to creating competitive advantage, London, Kogan Page 1995
2. Heracleous.L and Devoge, S., "Bridging the gap the of relevance: strategic management and organizational development, Long Range planning 31(5), 1998
3. Bateman Snell, "Management: Competing in the new era", McGraw Hill Irwin, 2002.
4. Peter Eichhorn & Ian Towers, Principles of Management: Efficiency and Effectiveness in the Private and Public Sector, Springer International Publishing. 2018.

WEB RESOURCES:

1. www.shrm.org www.shrmindia.org www.ipma-hr.org www.ahrd.org

ILLUSTRATIVE EXERCISE:

- The Internal mark is awarded based on the components

ORGANISATIONAL BEHAVIOUR

COURSE CODE: MBAH012

The success of a manager to contribute to the achievement of organizational goals is through the others. That depends on how effective the manager-person is able to understand and work on social-entity reality of an organization. In order to be successful, managers need to understand why people behave the way they do in organizations both as individuals and in groups, and also be able to apply their understanding in the dynamics of the workplace.

OBJECTIVE:

To understand and appreciate the fact that why & how of human behaviour in organizations is critical for its success and to orient the managers-to-be to develop people skills to make and run the work-place effective, innovative and stake-holder centric

METHODOLOGY:

The subject coverage goes with, among others, lectures, interactive discussion sessions, case-studies, experiential inputs of practitioners, observations, role-play and presentations; the students will have the assessment – element wise;

UNIT I: INTRODUCTION

Organizational Behaviour: Definition, need and importance - Human Behaviour in Organisations: Behaviour in Times of Change - Diversity of Organizations - Diverse Workforce, Attitude Formation – Personal Values, Attitudes, Emotions, Beliefs and Moods at Work - Ethical Behaviour - Factors that Affect Ethical Behaviour, Challenges for Managers: Competing in the Global Economy.

Case discussion, Web exercises, Field based activities-visiting organisation for studying attitude formation and ethical issues in Pandemic Period

UNIT II: INDIVIDUAL PROCESSES AND BEHAVIOR

Personality, Perception and Attribution: Individual Differences and Organizational Behaviour - Application of Personality Theory in Organisations, Motivation at Work: Motivation and Work Behaviour – Theories of Motivation, Learning: Models of Learning - Social and Cognitive Theories of Learning - Goal Setting at Work, Stress and Well-Being at Work: Approaches to Stress - Stressors - Sources of Work Stress - Consequences of Stress - Preventive Stress Management.

Video case discussion, Web exercises, OB application-based activities, Self-Awareness Exercises – Studying personality of managers and consequences of Stress in Pandemic Period

UNIT III: INTERPERSONAL PROCESSES AND BEHAVIOR

Communication: Interpersonal Communication - Communication Skills for Effective Managers - Barriers and Gateways to Communication - Communicating through New Technologies and Social Media, Work Teams and Groups: Group Decision Simulation – Team Orientation, Formation and Development - Decision Making: Process - Models and Limits - Individual Influences on Decision Making - Group Decision-Making Process.

Video case discussion, Web exercises, Self-Awareness Exercises & Group Activities-Team formulation

UNIT IV: POWER, LEADERSHIP, CONFLICT AND NEGOTIATION

Power and Political Behaviour: Concept of Power - Forms and Sources of Power in Organizations - Managing Political Behaviour in Organisations, Leadership: Types, Importance, Theories and Models - Organisational Climate and Culture - Creating a culture for Innovation & Creativity - Conflict and Negotiation: Causes of Conflict in Organizations – Types- Conflict Management Strategies and Techniques, Organisational Change and Development.

Case discussion, Web exercises, Field based activities-visiting organisation for studying Political Behaviour and Leadership Styles.

UNIT V: ORGANIZATIONAL PROCESSES AND STRUCTURE

Organizational Design and Structure: Basic Design Dimensions - Five Structural Configurations - Forces Reshaping Organizations - Emerging Organizational Structures, Trends in Organisational Behaviour - Research Issues in Organisational Behaviour, Organizational Socialization - Challenges to Developing a Positive, Cohesive Culture, Managing Change: Forces for Change in Organizations - Scope of Change - Gender Sensitivity - Need for Organization Development Interventions - Techniques for OD Intervention.

Video case discussion, Web exercises, Self-Awareness Exercises – Developing Research Proposal and Studying Consequences of Gender Sensitivity

Course Outcomes:

CO1: Define the concepts, models, and importance of Organization Behaviour.
CO2: Outline the components of individual behavior
CO3: Classify the formation of group and outline the types of leadership along with concepts of power and politics.
CO4: Explain the various structure and dimensions of the organization.
CO5: Formulate the recent trends in OB.

CO-PO Mapping

CO - PO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	0	2	1	0	2	3
CO2	3	3	2	0	3	3	3
CO3	3	3	3	2	3	3	2
CO4	3	0	2	3	0	3	3
CO5	3	2	2	3	2	2	3
	3	**1.6**	**2.2**	**1.8**	**1.6**	**2.6**	**2.8**

TEXT BOOK:

1. Fred Luthans (2020), Organisational Behaviour, Tata McGraw Hill, New Delhi.
2. Christopher Grey, A Very Short Fairly Interesting and Reasonably Cheap Book About Studying Organizations, University of Warwick

REFERENCES

1. Rego, A., Clegg, S., Cunha, M. P. e., Simpson, A. (2020). Positive Organizational Behaviour: A Reflective Approach. (n.p.): Taylor & Francis.
2. McKenna, E. (2020). Business Psychology and Organizational Behaviour. UNIT ed Kingdom: Taylor & Francis. ISBN: 9781317294634, 1317294637
3. Organizational Behaviour and the Physical Environment. (2019). UNIT ed Kingdom: Taylor & Francis.
4. Bratton, J. (2020). Work and Organizational Behaviour. UNIT ed Kingdom: Macmillan Education UK.
5. McLachlan, C. J., Smith, P. E., Yellowley, W. (2020). Organizational Behaviour: Managing People in Dynamic Organizations. UNIT ed Kingdom: Taylor & Francis Group.
6. Organisational Behaviour. (2020). UNIT ed States: SBPD Publishing House.
7. Robbins, Stephen P (2020) Organisational Behaviour: Concepts Controversies and Applications, Prentice Hall, New Delhi.

WEB RESOURCES:

1. www.obweb.org
2. http://www.indianchild.com/organizational_behavior.htm
   www.obmnetwork.com
3. www.humanmetrics.com
4. www.quickmba.com
5. www.thinkingmanagers.com
6. www.mindtools.com
7. www.studygs.net

ILLUSTRATIVE EXERCISE:

- The Internal mark is awarded based on the components.

MANAGERIAL ECONOMICS

COURSE CODE: MBAH013

COURSE OBJECTIVES

- To provide a basic foundation on concepts and principles of Macro Economics, Micro Economics and managerial economics.
- To demonstrate the application of economic theory to business decision- making.

METHODOLOGY

- Class sessions comprise a mixture of lectures, interactive discussions, case presentations, and problem solving.
- In addition to the in-class exams and homework assignments, each student will undertake a short econometric project.

SYLLABUS

UNIT I: INTRODUCTION

Introduction to Managerial Economics: Definition, Nature, Scope, Importance and General Foundation of Managerial Economics. Circular flow of activities. Nature of firm; Objectives of firm; Theory of firm Forms of Organizations-Sole Proprietorship; Partnership; Joint Stock Company; Cooperatives; Public Enterprises.

Relevance of demand analysis in Business Decision-making: Law of Demand; Elasticity of Demand; Determinants of Demand; Individual, firm and Market demand; Demand Curve and its nature; Demand Forecasting Techniques.

UNIT II: MARKETS AND PRICING

Product Markets and Recourse Markets. Market Structure: Differently Competitive Markets; Pricing under different Market structures. Methods of Pricing new and existing products; Pricing strategies. Cost-Oriented and Market-Oriented Pricing. Cost concepts: Types of cost; Relationship between Average and Marginal Cost in Short run and long run; Economics and Accountant View on Cost; Preparation of Cost sheet and Computation of UNIT and Total Cost; Using Marginal costing in business decision- making. Production functions in short and long run. Wages and wage differentials.

UNIT III: ECONOMIC DECISION-MAKING

Concept of Required Rate of Return and Internal Rate of Return; Annual-cost and Annual-worth Comparisons; Present-worth analysis; Computation of Cost of Capital and its relevance to decision-making; Economic Life; Replacement Economy; Analysis of risk and uncertainty in capital expenditure decisions.

Budgetary Control: Preparation of Cash Budgets, Purchase Budgets, Production Budgets and Flexible Budgets; Concept of Zero-Based Budgeting.

UNIT IV MACRO ECONOMIC ISSUES (I)

The Great Depression of 1920s and lessons learnt. Global recession of 2008 and its impact on Indian business. The Euro crisis. WTO and its impact on Indian Agriculture and Textiles industry. Concepts of SEZs, EPZs, FTZs and EPCs.

UNIT V: MACRO ECONOMIC ISSUES (II)

Introduction to National Income and Methods of Estimating National Income. Inter-Sectoral Linkages Macro Aggregates and Policy Interrelationships- Fiscal and Monetary Policies. Business and Government. Economic Indicators Technology, Employment and Poverty-Issues and Challenges Industrial Finance – Money Market and Capital market.

Course Outcomes:

CO1: Aware with the fundamental concepts and principles of Managerial Economics – the definition, nature, scope, importance, Firms – nature, objectives, theory, Forms of organizations and Demand concepts- forecasting techniques.

CO2: Familiar about different Product and Resource Markets and Pricing in those markets, Cost and Production Functions.

CO3: Thorough with various concepts of economic decision making, economic life, replacement economy, budgetary control, and types of budgets

CO4: Learnt about the past recessions, depressions and crisis happened worldwide; WTO and its impact on Indian Industry; and the concepts of economic zones.

CO5: Aware about the Macro economic issues; national income; sectoral linkages &economic policy interrelationships and economic indicators

CO-PO Mapping

CO-PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	2	3	3
CO3	3	3	3	3	1	3	3
CO4	2	2	2	3	2	2	3
CO5	3	3	3	3	2	3	3
	2.8	**2.8**	**2.8**	**3**	**2**	**2.75**	**3**

TEXT BOOKS

1. Gupta G.S., MANAGERIAL ECONOMICS, Tata McGraw-Hill, New Delhi.
2. Varshnavy and Maheashwary, MANAGERIAL ECONOMICS, Sultan and Chand, New Delhi.
3. Managerial Economics by R. Panneerselvam, P. Sivasankaran and P. Senthilkumar (2018); Cenage Learning India Pvt. Ltd.
4. Managerial Economics and Business Strategy by Michael R Baye and Jeff Prince (2017); McGraw Hill Education, Eighth Edition

5. Managerial Economics: Principles and Worldwide Applications by Dominick Salvatore and Siddartha k rastogi (2016); Oxford Higher Education
6. Managerial Economics by D N Dwivedi (2015); Vikas Publishing House
7. Principles of Macroeconomics (7th Edition) by Karl E. Case, Ray C. Fair, Publisher: Prentice Hall
8. Macroeconomics: Principles and Tools (3rd Edition) by Arthur O'Sullivan, Steven M. Sheffrin, Publisher: Prentice Hall

REFERENCES

1. Peterson, HC and W.C.Lewis, MANAGERIAL ECONOMICS, Prentice-Hall of India, New Delhi.
2. Riggs, J.L. MANAGERIAL ECONOMICS, McGraw-Hill, New Delhi.
3. Stiglitz J., PRINCIPLES OF MICROECONOMICS, Norton Publishers 2nd Edition.
4. Joel Dean, Managerial Economics, Himalaya Publishing house, New Delhi.
5. Macroeconomics and Active Graphs, Third Edition by Olivier Blanchard, Publisher: Prentice Hall
6. Macroeconomics: Theories, Policies, and International Applications by Roger LeRoy Miller, David D. VanHoose, Publisher: South-Western College
7. Macroeconomics with Macro Tools by Roger Farmer, Publisher: South-Western College
8. Intermediate Macroeconomics by Dennis W. Jansen, Charles D. Delorme, Robert B. Ekelund, Publisher: Thomson Learning

WEB RESOURCES

1. ww.wareseeker.com/free-managerial-economics-tutorials
2. www.managementstudyguide.com
3. www.managementparadise.com
4. www.referenceforbusiness.com
5. www.debunkingeconomics.com
6. www.economywatch.com

ILLUSTRATIVE EXERCISE:

- Problems on Preparation of Cost sheet, Forecasting demand using Regression Analysis, Calculation of Cost of Capital, Preparation of various budgets such as Production Budgets, Purchase Budgets, Cash Budgets and Flexible Budgets, and Cost of Acquiring and Replacing Machines using Capital Budgeting shall be worked out.

- Students shall be required to deliberate on various macro and micro economic problems at global and national level, and on issues having an impact on the functioning of any business.

ACCOUNTING FOR MANAGERS

COURSE CODE: MBAH014

OBJECTIVES

- To acquaint the students with the fundamental's principles of financial, cost and management accounting.
- To enable the students to prepare, analyse and interpret financial statements.
- To enable the students to take decisions using management accounting tools.

METHODOLOGY FOR COVERING SYLLABUS

- Class Room teaching of each of the UNIT s followed by regular exercises and surprise tests.
- One practical assignment on 'Accounting for SBEs" and its presentation by students.
- Case Study - Analysis of Company Annual Report & application of marginal costing
- Training on Tally Package

UNIT I

Book-keeping and Accounting – Meaning – Definition – Objectives of Financial Accounting – Branches of Accounting: Financial, Cost and Management Accounting – Accounting Concepts and conventions – journal – Ledger – Trial Balance – Preparation of Final Accounts: Trading, Profit and Loss Account and Balance Sheet (problems) – Accounting Standards – Groups interested in Accounting Information – An Introduction to Tally Package – salient features – types of vouchers – reports generated by Tally.

UNIT II

Capital and Revenue Expenditure – Deferred Revenue Expenditure – Capital and Revenue Receipts – Depreciation – Definition – Causes – Necessity of providing for depreciation – Methods of Calculating Depreciation: Straight Line Method and Written Down Value Method – Problems.

UNIT III

Financial Statements – Meaning – Types of financial Analysis – Techniques of Financial Analysis – Ratio Analysis – Profitability Ratios – Coverage Ratios – Turnover Ratios – Financial Ratios – Ratios to Financial Statement (problems) – uses and limitations of Ratio Analysis – Funds Flow Analysis (simple problems) – uses and limitations – Cash Flow Analysis (simple problems) – uses and limitations – Difference between funds flow and cash flow analysis.

UNIT IV

Marginal costing – assumptions – Cost Volume Profit Analysis – Breakeven Analysis – Key Factor – Profit Planning (problem) – Decisions involving Alternative Choices: Determination of sales mix, exploring new markets and Make or Buy decisions (Problem for case study)

UNIT V

Concept of cost – Elements of Cost – Cost Accounting – Objectives – Cost Sheet (Problems) – classification of cost – Cost UNIT and Cost Centre – Methods of Costing – Techniques of Costing.

Course Outcomes:

CO1: Recall the accounting principles and prepare and interpret Final accounts of a Business Concern.

CO2: Classify various categories of expenditure and analyze problems concerning different methods of Depreciation.

CO3: Describe the various Techniques of Financial Analysis, classify different types of ratios and distinguish Fund Flow Analysis from Cash Flow.

CO4: Analyze the problems related to Marginal Costing and Break-Even Analysis and choose the decisions from alternative choices pertaining to determination of sales mix, exploring new markets and analyze the cases related to make or buy decisions

CO5: Classify in detail about the various elements of cost and define different methods and techniques of Costing and analyze the Cost Sheet of any firm

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	3	0	1	0	3	3
CO2	3	2	0	0	0	2	2
CO3	3	3	0	0	0	2	2
CO4	3	3	0	3	0	2	2
CO5	3	3	0	3	0	2	2
	3	**2.8**	**0**	**1.4**	**0**	**2.2**	**2.2**

TEXT BOOKS:

1. N. Vinayakam & B. Charumathi: Financial Accounting, S. Chand
2. S.N. Maheswari: Management Accounting, Sultan Chand

REFERENCES

1. Hingorani, Ramanathan & Grewal: Management Accounting, Sultan Chand
2. R.N. Anthony: Management Accounting – Text and cases, Irwin
3. B.K. Bhar: Cost Accounting, Academic Publishers
4. H.G. Guthman: Analysis of Financial Statements, Prentice Hall

WEB RESOURCES

1. www.accountingformanagement.com
2. http://www.business.com/directory/accounting/software/
3. www.icai.org
4. www.icsi.edu
5. www.icwai.org

ILLUSTRATED EXERCISES

1. Tally practical record and examination – 15 marks
2. Practical assignment on Accounting by Small Business Enterprises and presentation of the same in the class – 5 marks
3. Submission of assignment on IFRS and accounting standards – 5 marks 4. Brain storming session on Emerging Trends in Accounting – 5 marks

BUSINESS LAW

COURSE CODE: MBAH015

OBJECTIVES:

- To introduce the statutory provisions that affects the business decisions.
- To give an exposure to important commercial laws, the knowledge, that is essential for an understanding of the legal implications of the general activities of a modern business organisation.
- To understand the legal frame work related to contract
- To familiarise about the legal aspects regarding negotiable instruments
- To understand the legal regulations about the company

METHODOLOGY:

- Lectures, Case studies, Assignments, Presentation of legal reports

UNIT I (11 SESSIONS)

The Indian Contract Act, 1872

Definition of a Contract and its essentials, Formation of a valid Contract - Offer and Acceptance,

Consideration, Capacity to Contract, Free consent, Legality of object, Discharge of a Contract by performance, Impossibility and Frustration, Breach, Damages for breach of a contract, Quasi contracts, Contract of Agency.

UNIT II (08 SESSIONS)

The Indian Partnership Act, 1932

Definition of Partnership and its essentials, Rights and Duties of Partners: Types of Partners, Minor as a partner, Doctrine of Implied Authority, Registration of Firms, Dissolution of firms.

Limited Liability Partnership Act, 2008

Incorporation by registration, Relationship of members, members as agents, ex- members, designated members, Cessation of trade by Limited liability partnership, Insolvency and winding up

UNIT III (08 SESSIONS)

The Sale of Goods Act, 1930

Definition of a Contract of Sale, Conditions and Warranties, Passing of Property, Right of Unpaid Seller against the Goods, Remedies for Breach.

The Negotiable Instrument Act, 1881

Definition and characteristics, Kinds of negotiable instruments, Promissory Note, Bill of Exchange and Cheques, Holder and Holder in due course, Negotiation, Presentment, Discharge from Liability, Noting and Protest, Presumption, Crossing of Cheques, Bouncing of Cheques.

UNIT IV (10 SESSIONS)

The Companies Act, 2013

Nature and Definition of a Company, Registration and Incorporation, Memorandum of Association, Articles of Association, Prospectus, Kinds of Companies, Directors: Their powers and duties, Meetings, Winding up.

UNIT V (08 SESSIONS)

The Consumer Protection Act, 2019

Aims and Objects of the Act, Redressal Machinery under the Act, Procedure for complaints under the Act, Remedies, Appeals, Enforcement of orders and Penalties.

Competition Act 2002

Objective, Anti-Competitive Agreements, Abuse of Dominant Position, Regulation of Combinations, Competition Commission of India –Composition, Powers and Functions.

Goods and Service Tax (GST)

Introduction, Overview and Evolution of GST, Registration under GST, Supply under GST and Valuation of Supply, Input Tax Credit under GST & Returns, Custom Duty and Indirect Taxation.

Course Outcomes:

CO1: Identify and demonstrate the essentials of Law of Contract and its elements
CO2: Recalls the legal provisions relating to partnership, sale of good and insurance
CO3: Identify and check the procedural stipulation on negotiable instruments and contract of agency
CO4: Analyze the legal provisions on company law
CO5: Apply Company Administration & Management

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	3	0	2	0	1	1
CO2	3	3	0	3	0	0	0
CO3	0	1	0	3	0	0	1
CO4	3	1	0	3	0	1	0
CO5	3	2	0	3	0	0	1
	2.4	**2**	**0**	**2.8**	**0**	**0.4**	**0.6**

Books.

1. Kapoor, N.D. “Elements of mercantile law”, Sultan Chand & Sons, New Delhi, 2014
2. Sen & Mitra, “Commercial Law” The World Press Pvt. Ltd., Calcutta, 2018
3. Systematic Approach to Indirect Tax- Kumar, Sanjeev
4. Text Book of Indirect Tax – Sinha P.K
5. Dr. Vinod Singhania, Taxman Publication, New Delhi

Reference.

1. Indirect Taxes: V. S. Datey – Taxman Publication
2. M Vat Subramanian Snow White Publication.
3. Kuchhal M.C. - Business Law (Vikas Publication, 4 th Edition)
4. Gulshan S.S. - Business Law Including Company Law (Excel Books)
5. Avtar Singh - Principles of Mercantile Law (Eastern Book Company, 7th Edition).
6. N.D Kapoor & Rajni Abbi-General Laws & Procedures (Sultan Chand & Sons)

WEB RESOURCES

1. www.legalindia.in
2. www.legalserviceindia.com
3. www.supremecourtofindia.nic.in
4. www.mca.gov.in
5. www.netlawman.co.in
6. www.legalhelpindia.com

ILLUSTRATIVE EXERCISE:

- The Internal mark is awarded based on the components.

BUSINESS ENVIRONMENT

COURSE CODE: MBAH016

Course Objectives:

- To enable students, understand the opportunities and challenges of prevailing and desirable global business environment in which business has to operate.
- Provide an understanding of the role of business in society.
- To enable students read, research and discuss the issues through written papers, presentations, industrial visits and role plays in class seminars.

Methodology:

- Teaching and Learning involves multiple and varied pedagogical tools with an emphasis on interactivity, which include the following:
- Classroom Lectures, Group Discussion on selective Articles taken from Newspapers, Magazines, Journals, Online Sources, and Various Reports.
- Case Studies, Seminar Presentations, Written Assignments, Role Plays and Field Visits

UNIT I: Economic Environment

- External and Internal Environment
- PEST / PESTEL Analysis
- Environmental Analysis – Scanning, Monitoring, Forecasting and Assessing the Current and Future Environmental Changes.
- Liberalization, Privatization and Globalization of Economy.
- Social, Political and Economic Consequences of globalization.
- Structure of the Economy, Inflation and GDP

UNIT II: Political and Legal Environment

- Democracy, Political Diversity, Politics and Markets
- Bureaucracy, Corruption Level, Societal Outlook and Orientation
- Roles of Government:
  a) Regulatory Role – Fiscal, Monetary and Industrial Policies, Tax Policies, Education and Employment Laws
  b) Promotional Role
  c) Entrepreneurial Role
  d) Planning Role

UNIT III: Socio-Cultural Environment

- Population & its Growth Rate, Education Levels, Age Distribution and Life Expectancy Rates
- Family Size and Structures, Gender Distribution, Religion, Nationality and Beliefs and Minorities
- Social Classes and Lifestyle, Average Disposable Income
- Attitude towards Product Quality and Customer Service, Buying Habits,

Environmental Consciousness, Work and Leisure, Health Consciousness, Risk Taking Ability.

UNIT IV: Technological Environment

- Basic Infrastructure Level - Energy, Transport, Communication, Science and Technology.
- Research and Development, Product and Process Innovation, Rate of Technological Change and Penetration Levels, Protection of Intellectual Property Rights
- Technological Leadership and Followers, Technology and Competitive Advantage, Time Lags in Technology Introduction, Adaptation, Transfer of Technology
- Internet Infrastructure

UNIT V: Global Environment

- International Relations - MNCs
- World Trade Organization, Competition
- FDI, FPI, Special Economic Zone
- Environmental Issues
- Outsourcing and Collaboration
- Sustainable Development

Course Outcomes:

CO1: Understand the external and internal environment of business with LPG, GDP and national income concepts

CO2: Enrich themselves with political and legal environment prevailing around the business and learn about the different roles of Government in Business

CO3: Analyze the social and cultural factors of business with attitude of customers towards quality and service provided by business organizations.

CO4: Recognize the basic infrastructure of our country and know about the research and development process innovation and technology growth of business

CO5: Clarify in detail to know about WTO, FDI, FPI and SEZ and outsourcing with Global Environment

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**
CO1	3	1	0	2	0	1	0
CO2	3	2	3	2	0	1	3
CO3	2	1	2	3	1	2	2
CO4	1	2	3	2	1	3	1
CO5	3	3	3	2	2	3	2
	2.4	**1.8**	**2.2**	**2.2**	**0.8**	**2**	**1.6**

References:

Text Books:

1. Francis Cherunilam: Business Environment – Text and Cases, Himalaya Publishing House, New Delhi.
2. A.C. Fernando, Business Environment, Pearson.
3. Ian Worthington and Chris Britton: The Business Environment, Prentice Hall
4. Shaikh Saleem, Business Environment, Pearson

References-Books:

1. Rudder Dutt and Sundharam, K.P.M.: Indian Economy, S. Chand & Company Limited, New Delhi.
2. Misra, S.K. and Puri, V.K.: Economic Environment of Business, Himalaya Publishing House, New Delhi.
3. Misra, S.K. and Puri, V.K.: Indian Economy, Himalaya Publishing House, New Delhi.

Magazines & Other References:

1. Survey of Indian Industry – published every year
2. Magazines & Journals – The Economist, The Week, Harvard Business Review, Indian Management, Economic and Political Weekly, India Today, Business Today, Business World, Outlook, Computers Today, Daily Business and General News Papers, Etc.
3. TV Programs on Business and Environment
4. Others: Various publications such as reports, surveys, studies on business and management.

Web Resources

1. http://www.wikipedia.org
2. http://www.allbusiness.com
3. http://www.ehow.com
4. http://www.quickmba.com
5. http://www.businessballs.com
6. http://www.earth.columbia.edu
7. http://www.sustdev.org
8. http://data.worldbank.org
9. http://www.rbi.org.in
10. http://www.goidirectory.gov.in
11. http://www.businessdictionary.com
12. http://www.business-definition.info

Illustrative Exercises:

1. Study and analysis of prevailing business environment in the industry chosen/or given and recommendations for creating more enabling environment to promote

business activity.

2. Visit to an Industrial Estate / Other organization and assess the infrastructural facilities such as appropriate roads, street lights, industrial waste treatment plants and other amenities, and submit a Written Report small team project.

BUSINESS ANALYTICS LAB -I

[2-Credit Paper- Workshop Mode]

COURSE CODE: MBAH017

OBJECTIVES

- To enable the students to know about the information needs of Management
- To introduce the concepts of data analysis methods
- To have hands-on training of Statistical Data Analysis through MS-EXCEL

METHODOLOGY

- The methodology is predominantly by Problem Solving [using MS-EXCEL], supplemented by lecture mode and case discussion. The students have to undertake a project work in a topic of their interest and product, whereby apply the concepts studied in the course as their course evaluation submission.

UNIT I

BASICS OF STATISTICS AND EXCEL

Basic Statistical Terms - Population and Sample (Theory), Understanding Data- Qualitative Vs Quantitative Data / Continuous vs Discrete (Theory) -Measurement Scales - Nominal, Ordinal, Interval & Ratio

Types of Data in Excel - Text, Numbers, Date/Time, Logical (Excel) -Understanding Formulas and Functions (Excel) - Relative vs Absolute Reference (Excel), Basic Formulas, Functions and Named Ranges (Excel)

DESCRIPTIVE STATISTICS

Descriptive Statistics – Summary statistics [Mean/Median/Mode/Quartiles, Percentiles / Standard Deviation / Coefficient of Variation/Measures of Skew ness & Kurtosis

Installing Data Analysis Pack and Calculating Descriptive Statistics (Excel)

DATA VISUALIZATION

Importance of data visualization- types of charts

Bar/Pie Charts -Histogram -Box and Whisker Chart -Scatter Diagram (Excel)

UNIT II

BASIC PROBABILITY CONCEPTS AND PROBABILITY DISTRIBUTIONS

Basic Probability Concepts – Types - Rules - Concept of Bayes' theorem

Probability Distribution - Types (Discrete, continuous) -Random variable -Use of expected value in Decisions making - Binomial Distribution - Poison Distribution - Normal Distribution

Theory of Sampling-Types probability sampling, non-probability sampling - Introduction to Sampling Distribution (Concept of SE) - Sample Size Estimation

Theory of Estimation- Types - Interval Estimates and Confidence Interval - Calculation Interval Estimates (C.I) for small & large samples

HYPOTHESIS TESTING

Tests for Mean and Proportions –One Sample test)

[One Sample z Test - One Sample t Test- One Sample p Test]
Testing of Hypothesis (two sample test) - Test for differences between means (large, small samples) - Test for proportions (small, large samples)

UNIT III

Chi Square Analysis - Test of Independence - Test of Goodness of fit Analysis of Variance - One-Way Classification - Two-way Classification
Theory of Correlation - scattered diagram, Karl-Pearson & Spearman Rank Correlation - Introduction to partial Correlation - Regression Analysis- Introduction to Time series and forecasting

Course Outcomes:

CO1: To Study about basics of statistics and excel, Descriptive statistics and Data Visualization

CO2: To know about the basic probability concepts and probability distributions

CO3: To analyze chi square, correlation, and time series analysis

CO- PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	1	1	0	0	1	1	1
CO2	1	1	0	0	0	0	1
CO3	1	1	0	1	0	1	0
	1	**1**	**0**	**0**	**0**	**1**	**1**

TEXT BOOKS:

1. Panneerselvam, R., RESEARCH METHODOLOGY, PHI Learning Pvt. Ltd., New Delhi, 2004
2. Levin R., and Rubin D, Statistics for Managers, Prentice Hall of India, New Delhi, 2006 (7th Edition)

REFERENCES

1. Panneerselvam, R. (2012). Design and Analysis of Experiments, PHI, New Delhi
2. Wayne, Winston (2014). Microsoft Excel 2013: Data Analysis and Business Modelling, Micro soft Press, Washington
3. Christian Albright and Wayne L. Winston (2011). Business Analytics: Data Analysis and Decision Making, Cengage Learning, New Delhi [5th Edition]

MAGAZINES & OTHER REFERENCES

1. www.emeraldinsight.com (A renowned research journal database)
2. www.ficci.com **(Official web site of Federation of Indian chambers, Commerce and Industry)**
3. www.ibef.org**(Official web site of India Brand Equity foundation, a subsidy of**

CII)

4. www.ncaer.org **(National Council of Applied Economic Research – Govt. of India data resource)**

WEB RESOURCES:

1. www.stattutorials.com (**Statistics tutorials** including worked examples using softwares like SPSS)
2. www.analyzemath.com/statistics.html (**Statistics tutorials)**
3. www.burns-stat.com/pages/tutorials.html (**Statistics tutorials)**
4. www.search.ebscohost.com

Mode of Evaluation:

- Continuous Internal Assessments– based on lab exercises

COMMUNICATION SKILLS WORKSHOP

COURSE CODE: MBAH018

No. of Credits: 2

OBJECTIVES:

- To understand the communication process in an organization
- To sharpen the communication skills – both oral and written - of the learner
- To simulate real-world business communication contexts and communicate effectively
- To facilitate experiential learning through use of role plays, presentations and so on.

METHODOLOGY:

1. Entirely Experiential Learning based course. Briefings, case discussions, story-telling, role-plays, seminar presentations, position papers, mini-projects, social media content discussions

UNIT I: COMMUNICATION FOUNDATIONS

Communication model – relevance and types of managerial communication – communication barriers – ethical communication

Professionalism in communication – team communication, meetings, listening, nonverbal communication

UNIT II: ANALYSIS OF BUSINESS COMMUNICATIONS

Reading and understanding business related articles, company profiles, not-for-profit organizations, profiles of corporate leaders and styles of communication, using reference sources

Organizing and writing business messages – Patterns – Use of tools such as word cloud, mind maps – composing messages in various forms such a poster, videos, interviews and presentations

Crafting readable messages by using the principles of clarity and completeness, avoiding clutter and complexity

Writing business proposals and reports by doing a mini survey for a chosen problem or issue

UNIT III: WORKPLACE COMMUNICATION

Electronic messages and digital media – Analyzing the use of audio visuals and their reach

Positive messages - Negative messages – structure and patterns in communicating news

Persuasive messages – Changing mindsets through social cause communications

Presentation skills – preparation for good content, overcoming stage fright – gaining and retaining attention

Course Outcomes:

CO1: To understand the communication process in an organization

CO2: To sharpen the communication skills – both oral and written - of the learner

CO3: To simulate real-world business communication contexts and communicate effectively and to facilitate experiential learning through use of role plays, presentations and so on.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	3	2	2	3	3	2
CO2	2	3	2	1	3	3	2
CO3	3	3	2	1	3	3	2
	2.7	**3**	**2**	**1.3**	**3**	**3**	**2**

WEB RESOURCES:

1. http://gallocommunications.com/
2. http://www.businesscommunicationblog.com
3. http://www.networkedblogs.com/blog/journeys_in_communication/
4. www.globalindian.net.in

ILLUSTRATIVE EXERCISES:

- The continuous assessment is done based on components such as role play, presentation, active classroom participation, Web 2.0 based assignments related content

SPREADSHEET FOR MANAGERS

COURSE CODE: MBAH019

OBJECTIVES

- To familiarize students with the information needs of management.
- To introduce concepts and methods of data analysis
- To provide hands-on training in statistical data analysis using MS-Excel
- You will learn data analysis using MS Excel and gain proficiency in Excel's interface, data entry, formatting, data analysis, tables, data tools, and lookup functions.

METHODOLOGY

The course will primarily use problem-solving through MS Excel, supplemented by lectures and case discussions. Students will undertake a project on a topic of their choice and apply the course concepts to their project as their evaluation submission.

UNIT I: Introduction to MS-Excel

- MS-Excel Interface: Tabs and Ribbons, Document Windows, Navigation Tips, Office Button, and Save
- Multiple ways of Entering Data: Fonts, Fills, and Alignment, Cut, Copy, and Paste, Paste Special, Undo and Redo, Moving, Finding, and Replacing a Value, Cell Styles, Comments
- Formatting Numbers: Currency Format, Format Painter, Formatting Dates, Custom and Special Formats
- Managing Worksheets: Naming and Moving Worksheets, Copying Worksheets, Adding, Deleting, and Hiding Worksheets, Grouping Worksheets, Moving, Copying, Deleting, and Hiding Grouped Worksheets

UNIT II: Data Analysis Techniques in MS-Excel

- Modifying Rows and Columns: Inserting and Deleting Columns and Rows, Inserting and Deleting Cells, Inserting Multiple Columns and Rows, Modifying Cell Width and Height, Hiding and Unhiding Rows and Columns
- Understanding Formulas: Using Operations, Creating Formulas, AutoSum, Common Formulas, Searching for Formulas, Copying Formulas, Using Relative and Absolute References
- AutoFill and Custom Lists: AutoFill a Series, AutoFill Non-Adjacent Cells, AutoFill on Multiple Sheets, Creating Custom Lists, Series Formatting
- Conditional Formatting: Highlight Cell Rules, Top/Bottom Rules, Data Bars, Color Scales, Custom Formatting Rule

UNIT III: Advanced Data Analysis Techniques in MS-Excel

- Tables: Insert a Table and Style Options, Add Rows and Columns, Perform a Function in a Table, Summarize with Pivot Table
- Data Tools: Data Validation, Drop-Down Lists, Removing Duplicates, Text to

Columns, Goal Seek, Scenario Manager

- Referencing Formulas: Multiple Sheet References, Consolidating Data, With or Without Links, Trace the Precedents and Dependents, Using the Watch Window
- Ranges and Dates: Cell Names, Named Ranges, Formulas with Cell Names, Date Formulas
- Lookups: VLOOKUP, VLOOKUP Exact Match, HLOOKUP, HLOOKUP Exact Match

TEXTBOOKS

1. "Excel 2016 Bible", John Walkenbach
2. "Excel 2016 Power Programming with VBA", Dick Kusleika and Michael Alexander
3. "Advanced Excel Essentials", Jordan Goldmeier

WEB RESOURCES

1. https://www.myonlinetraininghub.com/microsoft-excel-online-training-syllabus
2. https://excelexposure.com/
3. https://corporatefinanceinstitute.com/resources/excel/study/basic-excel-formulas-beginners/

Mode of Evaluation:

- Continuous Internal Assessments through exercises

PERSONALITY DEVELOPMENT WORKSHOP

COURSE CODE: MBAH019A

Duration and Mode of Evaluation:

- Number Credits :2 Credit
- Number of Contact hours :30 Hours [30 Sessions]
- Maximum Marks :50
- Evaluation: Continuous Internal Assessment based on exercises

Learning Objectives:

- Developing Favorable and balanced personality
- Understand Self, Identify potentials and limitations
- Building Self-esteem and Attitude
- Set the goals and Manage Emotions
- Understanding importance of Positive thinking and decision making
- Cultivate Interpersonal skills and manage conflicts for successful life.

Methodology

- The methodology is predominantly by Activity based learning and incidental exercises that includes, Conceptual Discussion, Case study, Role play, Management Games, In-Basket exercise, Individual and Group presentation, Web-assisted instructions and tests and Guest lectures.

UNIT I: Self Development and Management

Understanding the Self: Anatomy of the self-the mind-the intellect, Personality, The sub-conscious mind-Consciousness- States of awareness-Innate. Self-Evaluation, SWOT Analysis, Recognition of one's own limits and deficiencies, managing self – emotions, ego, pride, Building Self-Esteem, Self-Confidence and Self-Efficacy, Locus of Control, Setting Goals, Attitude (Positive and Negative Attitude).

UNIT II: Emotional Intelligence, Mindfulness, Positive thinking

Emotional Intelligence: Meaning, components, developing EI. Mindfulness: Meaning, Principles of Mindfulness, Models and frameworks for mindfulness practices. Developing thought pattern: The power and effects of thoughts, Principles of positive thinking-Benefits of positive thinking, changing mind set- Steps to change cycle of thinking. Decision making: The key decisions, Group decision making, General aids and tips for improving decisions making.

UNIT III: Interpersonal Skill Development

Communication: Verbal, Non-Verbal, Para-Verbal, Listening-It's Importance, Good & Bad Listening, Body Language, Empathy, Mutuality, Trust, Emotional Bonding. Managing interferences- Perceptional Challenges, Interpersonal Transactions, Tips for

Improving interpersonal relationship, Assertiveness and negotiation skills, Conflict Management

Text Books:

1. Covey, S. R., & Covey, S. (2020). The 7 habits of highly effective people. Simon & Schuster.
2. Robbins, S. P., Judge, T. A., & Vohra, N. (2019). Organizational behaviour by Pearson 18e. Pearson Education India.
3. Jaikishan Roy. (2015). Improve your Personality by Mark publishers Jaipur.
4. R. N. Singh Yadav. (2016). The Dynamics of Successful personality by Mount Hill Publishing Company, New Delhi.

References:

1. Akpor-Robaro, M. O. (2018). Organizational Behaviour, Management Theory and Organizational Structure: An Overview of The Inter-Relationship.
2. Bradberry, T., & Greaves, J. (2006). The emotional intelligence quick book: Everything you need to know to put your EQ to work. Simon and Schuster.
3. Bradberry, T., & Greaves, J. (2009). Emotional Intelligence 2.0. TalentSmart.
4. Creswell JD (January 2017). "Mindfulness Interventions". Annual Review of Psychology. 68: 491–516. doi:10.1146/annurev-psych-042716-051139
5. Kabat-Zinn J (2013). Full Catastrophe Living: Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness. New York: Bantam Dell. ISBN 978-0345539724.
6. Murphy, J. (2019). The Power of Your Subconscious Mind: The Complete Original Edition: Also Includes the Bonus Book" You Can Change Your Whole Life". St. Martin's Essentials.
7. Fox, A., & Fox, B. (2018). Beyond Positive Thinking: Putting Your Thoughts into Action: Putting Your Thoughts into Action. Gildan Media LLC aka G&D Media.
8. Dobelli, R. (2015). The Art of Thinking Clearly-Edisi Bahasa Melayu. PTS Publications & Distributors Sdn Bhd.
9. R.M.Onkar. (2008). Personality Development and Career management – by S Chand Publications

Web resources:

1. https://www.managementstudyguide.com/importance-of-personality-development.htm
2. https://www.essentiallifeskills.net/improveyourpersonality.html
3. https://lesley.edu/article/personality-development
4. https://sourcesofinsight.com/change-your-mindset-change-your-results/
5. https://icrrd.com/media/01-11-2020-205951Mindset%20by%20Carol%20S.%20Dweck.pdf
6. https://www.mindtools.com/pages/article/newLDR_45.htm
7. https://www.verywellmind.com/what-is-emotional-intelligence-2795423
8. https://study.com/learn/lesson/interpersonal-relationships.html

MLSM 109: HUMAN RESOURCE MANAGEMENT

Objectives:

- To provide a thorough understanding of the H RM Practices from Indian Perspective

Learning Outcome:

- Towards the end of the course students should be able apply HRM models and come out with strategies to enhance efficiency.

Unit	Description	Hours
1	Introduction: Nature and Scope, Objectives and Functions of HRM. Role and responsibilities of Human Resource Manager, Concept of International HRM and Strategic HRM, Trends in HRM, Challenges faced by HRM.	09
2	Human Resource Planning: Meaning, Process of HRP- Job Analysis- Job Evaluation- Job Description- Job Specifications- Methods of Recruitment-Selection- Concept of Induction, Placement, Promotions and Succession Planning.	09
3	Human Resource Development: Meaning and Importance of HRD-Competency Mapping-Training: Need and Objectives, Methods of Training-Career Planning and Development-Performance Appraisal-Techniques of Performance Appraisal	09
4	Compensation and Welfare Measures: Wages and Salary Administration: P.F., ESI Schemes-Quality of Work Life Quality Circles- Health and Safety measures- Absenteeism- Employee Turnover, Employee Retention and Performance Management.	09
5	Management of Industrial Relations: Objectives and Importance of Industrial Relations- Prevention and Settlement of Industrial Disputes, Grievance Redressal - Trade Unions: Evolution and responsibilities, Collective Bargaining and Worker’ s Participation in Management.	09

Text Books:

1. Rajeesh Viswanathan, Strategic Human Resource Management, . (1st Ed). Himalaya Publishing House. Mumbai
2. Biju Verkey & Garry Dessler, Human Resource Management, Pearson Publishers

CENTRE FOR STUDY OF SOCIAL EXCLUSION AND INCLUSIVE POLICY

SCHOOL OF SOCIAL SCIENCES AND INTERNATIONAL STUDIES
PONDICHERRY UNIVERSITY
(A Central University)

M.A. Human Rights and Inclusive Policy

APPROVED BY

Special Board of Studies, CSSE&IP

On

02-04-2019

SYLLABUS

Framed: **2018-19**

Introduced: 2019-20

Course Code: **HRIP 411**

Course Title: **HUMAN RIGHTS: HISTORICAL AND PHILOSOPHICAL PERSPECTIVES**

Course Objectives:

The course aims at giving a foundation to the understanding of human rights with the historical roots and multiple perspectives pertaining to it. The course will also discuss the question of universality of rights in the context of cultural diversity.

Course Outcomes:

1. The students will understand the historical origin of human rights
2. They will know the evolution of different philosophical perspectives on human rights
3. The course will provide discussion on different theories on rights and classification of rights

Syllabus:

Unit I: Philosophical Foundations: Equality, freedom, Justice, Human Dignity, Self-Respect, Human Values, Individual and Collective, Power and Authority, Right to be human, moral and ethical base of human kind.

Unit II: Religious And Secular Traditions: Magna Carta (1215), Bills Of Rights 1689, American Declaration (1776), French Declaration (1789), Geneva Convention (1864), Dutch Declaration

Unit III: Universal Declaration of Human Rights, Cultural Relativism and the Universalization of Human Rights, ICCPR, ICSECR, Teharan Conference(1969), Vienna Convention (1993), Right to Development, Millennium Goals

Unit IV: Theoretical Perspectives: Natural Rights, Legal Rights, Liberal Perspectives, Marxist Perspective, Third World Perspective

Unit V: Indian Freedom Struggle: Aspiration for rights, Nehru Committee Report (1928), Tribal Struggles, Gandhian Perspective, Ambedkarite Perspective, Socialist Perspective (Lohia), Constitutional Debates on Rights.

Readings

Mandatory

Eriksen, T. H. (2008). Between Universalism and Relativism : A Critique of the UNESCO Concept of Culture. In M. Goodale, *Human Rights : An Anthropological Reader* (pp. 372-395). United Kingdom: Wiley-Blackwell.

Indian Journal of Human Rights. (1997). Special issue 1: Theoretical perspectives. Hyderabad: HCU.

Ishay, M. ed. (2007). *The Human Rights Read*er. United States of America: Routledge Taylor & Francis Group.

Rawls, J. (1971). *The Theory of Justice*. London: Harvard University Press.

Singh, M. P and Himanshu Roy. (2011). *Indian Political Thought: Themes and Thinkers*. Delhi: Pearson.

Suggestive

Amartya, Sen. (2009). *The Idea of Justice*. New Delhi: Penguin Books.

Baxi, Upendra. (2002). *The Future of Human Rights*. New Delhi: Oxford University Press.

Ishay, M. (2004). 'What are human rights? Six historical controversies'. *Journal_of Human_Rights*, 3(3), 359-371.

Nordahl R. (1992). A Marxian approach to human rights. In A. An Na'im, (Ed.), *Human Rights in Cross-Cultural Perspectives* (pp. 162-187). Philadelphia, PA: University of Pennsylvania Press.

Raphael D. D. (1966). The liberal Western tradition of human rights. *International Social Science Journal*, 18 (1):22-30

Course Code: **HRIP412**

Course Title: **SOCIAL EXCLUSION: HISTORY AND INCLUSIVITY OF THE CONCEPT**

Course Objectives:

The course provides an insight into the historical background of modes of social exclusion and its various theoretical dimensions. It lists different forms of social exclusion covering each with appropriate case studies focusing on the concept of social exclusion and analysis of poverty, discrimination, deprivation and inequality.

Course Outcomes:

1. The course provides an insight into the historical background of the concept social exclusion
2. The students will see how the concept is related to various theoretical concepts of inequality, poverty and discrimination
3. It discusses different modes of social exclusion with case studies from India and elsewhere
4. It discusses case studies relating to social exclusion with a specific focus on poverty, discrimination, deprivation and inequality

Syllabus:

Unit I: Historical Background of the Concept of Social Exclusion; humiliation, inequalities- social, economic and political, untouchability, stigmatization, discrimination, deprivation, marginalisation.

Unit II: Theories of Social Exclusion: Caste as Social Exclusion- Notions of purity and pollution and hierarchical gradation of people, inferior / superior occupations and remuneration; Property as economic exclusion- Unequal access to productive resources; Power as political exclusion, Rights as entitlements- educational opportunities, and unequal capabilities, competition, 'merit' based exclusion, and market based formal exclusions.

Unit III: Forms of Social Exclusion I: Religion, Race, Caste, Class, Gender, Indigenous/Adivasi, Disability

Unit IV: Forms of Social Exclusion II: Migrants and Refugees, Region, Language and Ethnicity, Illness.

Unit V: Social Exclusion, Human Rights and Inclusive Policy- the link: Reservation policies for the socially and educationally backward in India.

Readings

Mandatory

De Haan, Arjan.(1999). *Social Exclusion: Towards a Holistic Understanding of Deprivation.* London: Department for International Development.

Dréze, Jean and Amartya Sen. (1999). *Hunger and Public Action*. Delhi: Oxford University Press.

Guru, G. (ed.) (2009). Humiliation: Claims and Context. Delhi: OUP.

Indian Journal of Human Rights. (1997). Special issue on Dalits. Hyderabad: HCU.

Kothari, Rajni. (2003). Social Exclusion: Historical, Institutional and Ideological Dimensions. In A.K. Lal (ed.), *Social Exclusion: Essays in Honour of Dr. Bindeswar Pathak*, (pp. 11- 23). New Delhi: Concept Publishing Company.

Piketty, T. (2015). (Translated by Arthur Goldhammer). *The Economics of Inequality*. USA: Harvard College.

Sen, Amartya. (2007). *Social Exclusion: Concept, Application and Scrutiny*. New Delhi: Critical Quest.

Shah, G. et.al. 2006. Untouchability in Rural India. New Delhi: Sage Publications.

Teltumbde, A. (2010). *The persistence of caste: The Khairlanji murders and India's hidden apartheid*. Zed Books: London.

Thorat, Sukhadeo and Narender Kumar (2008). B.R. Ambedkar: Perspectives on Social Exclusion and Inclusive Policies, New Delhi: Oxford University Press.

Suggestive

Himanshu. (2018). *India Inequality Report: Widening Gaps*. London: Oxfam.

Kabeer, Naila. (2000). *Social exclusion, poverty and discrimination: towards an analytical framework.* IDS Bulletin, 31 (4), pp. 83-97.

Kurzhan, Robert and Mark. R. Leary. (2001). Evolutionary Origins of Stigmatization: The Functions of Social Exclusion. *Psychological Bulletin*, 127(2): 187 -208

Saith, R. (2001). 'Social Exclusion: The Concept and Application to Developing Countries', *Queen Elizabeth House Working Paper Series 72*. Oxford: Queen Elizabeth House.

Sheth, D. L. (2004). 'Caste, Ethnicity and Exclusion in South Asia: The Role of Affirmative Action Policies in Building Inclusive Societies', *Occasional Paper.* New York: UNDP, Human Development Report Office.

Thorat, Sukhadeo and Umakant. (Eds.). (2004). *Caste, Race and Discrimination – Discourses in International Context*. Jaipur and New Delhi: Rawat Publications.

Thorat, Sukhadeo (2009). Dalits in India: Search For Common Destiny, New Delhi: Sage Publications.

Course Code: **HRIP413**

Course Title: **INTERNATIONAL OBLIGATIONS TO PROTECT HUMAN RIGHTS**

Course Objectives:

The course discusses the history and development of International human rights laws and conventions.

Course Outcomes:

1. It will help to understand why human right is an obligation.
2. It highlights United Nation's contributions in protecting human rights.
3. It will help to trace out development of other International human rights obligations.
4. This course will help to examine various International instruments to protect human rights.

Syllabus:

Unit I: Concept of Obligations: Legal, moral, social; Establishing international obligations to protect human rights; Obligations accepted by International community through International law, Treaties and conventions

Unit II: The Anti-slave trade treaties, emergence of international humanitarian law, Bolshevik Revolution of 1917, minority treaties, Nazi and Fascist atrocities and totalitarianism, Second World War, League of Nations and colonies: the concept of "Sacred trust of civilization" (the Mandate System), ILO and labour welfare, refugees,

Unit III: Crimes against Humanity: Crimes against peace, war crimes, crimes against humanity, Nuremberg (London Charter of 1946) and Tokyo (General McArthur's Decree of 1946), International Military Tribunals for trial of major war criminals, evolution of international criminal law (UN General Assembly Resolution of 1946 on the Nuremberg Principles)

Unit IV: UN Charter provisions on human rights: Article 1(2) & (3), Article 13(1)(b), Articles 55, 56, 68, Chapters XI, XII, XIII; International Bill of Rights: The Universal Declaration of Human Rights 1948, International Covenant on Civil and Political Rights 1966, International Covenant on Economic, Social and Cultural Rights 1966

Unit V: International conventions and treaties on human rights: Human rights as *jus cogens*, Obligation to protect human rights as an international obligation *erga omnes* (owed to the entire international community); Issues of international accountability for breach of International Human rights obligations; The role of the UN Security Council, International Humanitarian Law.

Readings

Mandatory

Addo, M. K. (2010). Practice of United Nations and Human Rights Treaty Bodies in the Reconciliation of Cultural Diversity with Universal Respect for Human Rights. *Human Rights Quarterly, 32* (601).

Alston, P. & Crawford J. (Eds.). (2000). *The future of UN human rights treaty monitoring*. Cambridge: Cambridge University Press.

Alves, J. A. L. (2000). The declaration of human rights in postmodernity. *Human Rights Quarterly, 22* (478).

Ishay, M. (Ed.). (2007). *The Human Rights Read*er. United States of America: Routledge Taylor & Francis Group.

Keith, L. C. (1999). The United Nations International Covenant on Civil and Political Rights: Does it make a difference in human rights behavior?. *Journal of Peace Research*, 36(1) 95-118.

Suggestive

Frederking, B. (2007). *The United States and the Security Council: Collective security since the cold war*. Routledge.

Gaer, F. D. (2003). Implementing international human rights norms: UN human rights treaty bodies and NGOs. *Journal of Human Rights*, 2(3), 339-357.

Gutter, J. (2007). Special procedures and the Human Rights Council: achievements and challenges ahead.

Heyns, C. H. & Viljoen F. (Eds.). (2002). *The impact of the United Nations human rights treaties on the domestic level*. Martinus Nijhoff Publishers.

Hunt, L. A. (2007). *Inventing human rights: A history*. WW Norton & Company.

Saul, B. Kinley, D. & Mowbray, J. (2014). *The international covenant on economic social and cultural rights: commentary cases and materials*. Oxford: OUP.

Course Code: **HRIP 414**

Course Title: **INDIAN SOCIAL THINKERS ON HUMAN RIGHTS**

Course Objectives:

The course discusses major social thinkers and their contributions in social reform of India.

Course Outcomes:

1. The course will provide a perspective on different social issues of Indian society.
2. It highlights various social and religious movements against inequalities of Indian society
3. Contributions of thinkers on political structures and statehood is discussed
4. The course offers students an understanding of society from different points of entry as in caste, justice and evolution

Syllabus:

Unit I: Early beginnings- Issues of social and economic inequality in Indian society; The Brahmo Samaj and the Arya Samaj; Anne Beasant-Theosophical Society and Ramakrishna Mission; Aligarh Movement and Tablig Movement; Parsi Movements, Iqbal Singh and Guru Gobind Singh-Sikh Reform Movements

Unit II: Socio-Religious reformers: Raja Rammohan Roy and the Reinterpretation of Religions; Jyotiba Phule; Narayana Guru, Iyothee Thass, Periyar, Golwalkar, Shyam Prasad Mukherji

Unit III: Aurobindo Ghosh: Theory of Evolution; Revivalist view of Reconstruction of Nationalism- Tagore's Critique of Nationalism

Unit IV: Philosophy of Gandhi-Non-violence, and Truth; Tolerance, Harmony and Forgiveness; Sarvodaya, Duties, Swaraj, Swadeshi, Religion, Human Nature; Critique of Modern Civilisation, Lohia- seven revolutions.

Unit IV: B R. Ambedkar: Constitutionalism and Critique of Casteism; Amartya Sen- idea of freedom and justice, Upendra Baxi- future of Human Rights

Unit V: Women Pioneers: - Savitri Bai Phule, Tarabai Shinde, Chandraprova Saikiani, Pandita Ramabai, Irom Sharmila

Readings

Mandatory

Ambedkar, B. R. (2017). *The untouchables: Who were they and why they became untouchables?*. Delhi : Kalpaz, New Delhi. Distributed by Gyan Books Pvt. Ltd

Chakravarti, U. (2014). *Rewriting history: The life and times of Pandita Ramabai*. Zubaan.

Jaffrelot, C. (2009). *Hindu nationalism: A reader*. Princeton, NJ: Princeton University Press.

Kītā, V., & Rājaturai, E. V. (1998). *Towards a Non-Brahmin Millennium: From Iyothee Thass to Periyar*. Stree Distributed by Bhatkal Books International.

O'hanlon, R. (2002). *Caste, conflict and ideology: Mahatma Jotirao Phule and low caste protest in nineteenth-century western India* (No. 30). Cambridge: Cambridge University Press.

O'Hanlon, R., & Śiṅde, T. (1994). *A comparison between women and men: Tarabai Shinde and the critique of gender relations in colonial India*. USA: Oxford University Press.

Singh, M. P., & Roy, H. (Eds.). (2011). *Indian Political Thought: Themes and Thinkers*. Pearson Education India.

Viswanathan, E. S. (1983). *The Political Career of EV Ramasamy Naicker: A study in the Politics of Tamil Nadu, 1929-1949*. Madras: Ravi and Vasanth Publishers.

Yengde, S., & Teltumbde, A. (2018). *The radical in Ambedkar: Critical reflections*. Gurgaon, Haryana, India : Allen Lane, an imprint of Penguin Random House

Suggestive

Ambedkar, B. R. (2016). *Castes in India: Their mechanism, genesis and development* (Vol. 1). Soft Group, INDIA.

Ambedkar, B. R. (1979). *Dr. Babasaheb Ambedkar, Writings and Speeches*. Education Department, Government of Maharashtra.

Chakravarti, U. (2002). From exclusion to marginalisation? Hegemonic agendas and women's writing. *Thinking social science in India: Essays in honour of Alice Thorner*, 115-132.

Course Code: **HRIP 421**
Course Title: **INDIAN CONSTITUTION AND HUMAN RIGHTS**

Course Objectives:

The course aims at understanding Indian Constitution in relation with human rights. Various provisions in promoting human rights are discussed in context of India and the extent of its practice and violation.

Course Outcomes:

1. The students will have a comprehensive understanding of Indian constitution in relation with Human Rights
2. The students will understand how the plurality of Indian society is reflected and accommodated in the constitution
3. Indian constitution in relation to provisions of International human rights will be discussed
4. The students understand through the case studies the issue of violation of human rights.

Syllabus:

Unit I: Constituent Assembly debates on the Fundamental Rights and Directive Principles. Ideals enshrined in the Preamble to the Constitution (Justice: Social, Economic and Political; Liberty: Of thought, Expression, Belief, Faith and Worship: Equality of Status and of opportunity, Fraternity: Assuring the Dignity of the Individual and Unity of the Nation).

Unit II: International Human Rights and the Indian Constitution. Enforcement of human rights: Judiciary; National Specialized Agencies: Law Commission, SC/ST Commission, Minorities Commission, Women's Commission; Human Rights Commission; Professional Councils: Press, Medical, Bar Council; Consumer Court and Corporations; Criminal Justice System; Legal Aid; NGOs.

Unit III: The state, civil society in India and human rights violations: Plurality on Indian society: social structure, social inequality, caste hierarchy; human rights violations- in religious groups; by State, landlords, employers; Riots and violence in connection with inter-community tensions

Unit IV: Special laws for protection of specific categories/ vulnerable sections of the people; Reservations and the right to equality

Unit V: Human rights violations and Indian politics: Impact of colonial institutions on Indian society and polity; Impact of neo-colonialism; Political parties and Parliament; Media and corporate control; Social Movements and NGOs

Readings

Mandatory

Banerjee, D.N. (1960). *Our Fundamental Rights: Their Nature and Extent as Judicially Determined*. Calcutta: The World Press.

Basu, D.D. (1994). *Human Rights in Constitutional Law*. New Delhi: Prentice Hall.

Chandra Shailja, Justice V.R. Krishna Iyer. (1998). *On Fundamental Rights and Directive Principles*. New Delhi: Deep and Deep.

Dobhal, H., & Human Rights Law Network (New Delhi, I. (2011). *Writings on Human Rights, Law, and Society in India: A Combat Law Anthology : Selections from Combat Law, 2002-2010*. Human Rights Law Network.

Kannabiran, K. G. (2004). *The wages of impunity: Power, justice, and human rights*. New Delhi: Orient Longman.

Mehta, P. L. and Neena, Verma. (1995). *Human Rights under the Indian Constitution*. New Delhi: Deep and Deep Publications.

Pannikar, K. M. (1960). *The State and the Citizen*. London: Asia Publishing House.

Suggestive

Borgohain, Bani. (1999). *Human Rights: Social Justice and Political Change*. New Delhi: Kanishka Publishers.

Desai A. R. (Ed.). 1986. *Violations of Democratic Rights in India*. Bombay: Popular Prakashan

Dhavan, Rajeev. (Ed.), (1983). *Judges and Judicial Power: Essays in Honour of Justice V.R. Krishna Iyer*. London: Sweet & Maxwell Ltd.

Falk, Richard. (1981). *Human Rights and the State Sovereignty*. New York: Halmes and Meiser Publishers.

Gupta, Uma. (1998). *Supreme Court and Civil Liberties*. New Delhi: Mittal Publications.

Hansaria, B. L. (1993). *Right to Life and Liberty under the Constitution: A Critical Analysis of Article 21*. Bombay: N.M. Tripathi.

Hart, H.L.A. (1969). *Law Liberty and Morality*. Oxford: OUP.

Kashyap, Subhash. C. (1978). *Human Rights and Parliament*. Delhi: Metropolitan.

Course Code: **HRIP422**
Course Title: **SOCIOPOLITICAL CONTEXT OF HUMAN RIGHTS**

Course Objectives:

The course aims at providing the trajectory of political structures and its implications to social exclusion and human rights.

Course Outcomes:

1. The students will understand the colonial and post-colonial political structure in India through national uprisings.
2. The students will understand the federalism in India and the formations of various platforms for human rights
3. The students will get exposed to various International frameworks working against discrimination and good governance
4. Discuss policies adopted at National and Global levels for inclusion.

Syllabus:

Unit I: Colonialism to Nationalism in India: The age of colonial empires and scramble for colonies; League of Nations and the concept of 'sacred trust of civilization'; National uprisings during colonial rule and 1857 quest for independence; Nationalism and statehood; Emergence of the Indian National Congress and demands for self-determination

Unit II: Federalism in India: Government of India Act, 1935; Quit India Resolution, 1942; Resolution of the Constituent Assembly (22 January 1947); Issues of legitimacy of State and forms of governance; The structure of federalism under the Constitution of India: The constitutional framework of Union-State relations; Problems relating to formation of States, Panchayat Raj institutions, reservation for political representation. Changing Role of Indian State-Internationalist State to minimalist State.

Unit III: Right of the Peoples and Nations to Self-Determination: Meaning of self-determination, autonomy, democracy, governance, sovereignty; Enforcement of Rights: State Institutions, Special Courts, Derogation of Rights: War or National Emergency, Processing Justice, Sovereign states and peoples' rights: issues of economic sovereignty; Repressive Laws- Preventive Detention Act, Sedition Act, Unlawful Activities Prevention Act.

Unit IV: Freedom from Discrimination: Convention on Elimination of All Forms of Racial Discrimination 1965, UN Declaration on Elimination of all Forms of Intolerance and Discrimination based on Religion or Belief 1987, UNESCO Declaration on Race and Racial Prejudice 1978, UNESCO Declaration of Principles on Tolerance 1995

Unit V: Right to Democracy and Good Governance: United Nations Millennium Declaration, 2000, Paris Integrated Framework on Action on Education for Peace, Human Rights and Democracy, 1995, Pune Declaration on Education for Human Rights in Asia and the Pacific, 1999; UN General Assembly resolution 54/128 on Action against Corruption 2000, Declaration on Crime and Public Security 1996, UN General Assembly Declaration on the Right of Peoples to Peace 1984.

Readings

Mandatory

Agamben, Giorgio. (1998). *Homo Sacer: Sovereign Power and Bare Life*. Stanford, CA: Stanford University Press.

Akhavan, P. (2009). 'Are International Criminal Tribunals a Disincentive to Peace?: Reconciling Judicial Romanticism with Political Realism', *Human Rights Quarterly*,. 31 (1), 624-654

Alston, P. (ed.) (1992). *The United Nations and Human Rights: A Critical Appraisal*. Oxford: Oxford University Press.

Alston, P. and J. Crawford. (Eds). (2000). *The Future of UN Human Rights Treaty Monitoring.* Cambridge: Cambridge University Press.

Arendt, H. (2008). The Decline of the Nation-State and the End of the Rights of Man. In M. Goodale, *Human Rights : An Anthropological Reader* (pp. 32-57). United Kingdom: Wiley-Blackwell.

Bipan, Chandra. (Eds). (1988). *India's struggle for independence, 1857-1947*. New Delhi: Viking.

World Bank. 1997. *World Development Report 1997: The State in a Changing World.* New York: Oxford University Press. © World Bank.

Suggestive

Bailey, S. D. (1994). *The United Nations Security Council and Human Rights.* New York: St Martin's Press.

Camp Keith, L. (1999). 'The United Nations International Covenant on Civil and Political Rights: Does It Make a Difference in Human Rights Behavior?', *Journal of Peace Research*, 36 (1), 95-118

Fletcher, L. E. and Weinstein, H. (2002). 'Violence and Social Repair: Rethinking the Contribution of Justice to Reconciliation', *Human Rights Quarterly*, 24 (3), 573-639.

Gaer F. (1995). 'Reality Check: Human Rights Non-governmental Organisations Confront Governments at the United Nations', *Third World Quarterly*, 16 (3), 389–404.

Goldstone, R. (1996). 'Justice as A Tool For Peace-Making: Truth Commissions and International Criminal Tribunals', *New York University Journal of International Law and Politics*, 28 (3), 485-503.

Course Code: **HRIP 423**
Course Title: **INDIAN SOCIAL INSTITUTIONS AND THE MARGINALISED**

Course Objectives:

The course discusses Indian social institutions and the creation of marginalisation.

Course Outcomes:

1. Students will be exposed to Indian social institutions
2. Students will understand spaces in Indian social institutions that create marginalisation
3. Students will learn who the marginalised are and why
4. Students will learn of rights and legal protection for the marginalsied

Unit I: Village as a Productive Unit- Economic Geography, Productive Resources – land and water, nature of its availability, People, Spatial organisation of village, hierarchy of resources, Resources and allocation, production organization, structures and Processes.

Unit II: Caste as a Productive Organisation- People, caste as a System of Human and Natural Resource Administration**,** structure and functions of different social groups, Hereditary nature of Rights and Access to Productive Resources, System of privileges and denials and its socio-economic implications.

Unit III: Conceptual Foundations of Exclusion- Notions of purity, pollution, ritual merit and discard, notions relating to morality, family, legal heir, occupation as a religious / spiritual duty, the idea of work and its value, and remuneration. Rights of SC, ST, Women, Transgender and children. Legal Protections.

Unit IV: Family as a Fundamental Economic Unit- Caste and vitality of family, notions of rights, kinship network, joint and nuclear families, marriage, gender, sexuality, engendering labour, politics of hereditary occupation.

Unit V: Indian Development Experiences-Development of transport, education and employment opportunities, urbanisation and its impact on traditional social structure, Productive resources and hierarchies of access and reconfiguration of caste into socio-economic inequalities

Readings:
Mandatory

Ambedar, B.R., "Book I—Untouchables or The Children of India's Ghetto, in V. Moon edited *Dr.BabasahebAmbedkarWritings and Speeches, Vol.* 5. http://drambedkarwritings.gov.in/content/writings-and-speeches/

Ambedar, B.R., “Hindu Social order: Its Essential Principles”, and “Hindu Social Order: Its Unique Features”, in V. Moon edited *Dr.BabasahebAmbedkarWritings and Speeches, Vol. 3*.

Barbara Harriss-White, *India Working: Essays on Economy and Society,* Cambridge University Press, 2003.

Cohn, Bernard S (1969), “Structural Change in Indian Rural Society 1596-1885”, in Frykenberg, Robert Eric edited *Land Control and Social Structure in Indian History*, The University of Wisconsin Press, Madison.

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Gupta, Dipankar, “Whither the Indian Village: Culture and Agriculture in 'Rural' India”, *Economic and Political Weekly*, Vol. 40, No. 8 (Feb. 19-25, 2005), pp. 751-758

Ludden, David E (1978a), “Ecological Zones and the Cultural Economy of Irrigation in Southern Tamilnadu”, Journal of South Asian Studies, New Series Vol. I, No. 1,

Max Weber (1916), The Religion of India: The Sociology of Hinduism and Buddhism.

Mosse, David, “Ecological Zones and the Culture of Collective Action: The History and Social Organisation of A Tank Irrigation System in Tamil Nadu”, South Indian Studies 3, Jan-June 1997.

Srinivas M. N. (2003), “An Obituary on Caste as a System”, *Economic and Political Weekly*, Vol. 38, No. 5 (Feb. 1-7, 2003), pp. 455-459

Suggestive

Ahuja, Ravi (1998), “Labour Unsettled: Mobility and Protest in Madras region, 1750-1800”, *The Indian Economic and Social Histoy Review*, Vol. 35, No. 4.

Ambedkar, B.R, “Castes in India”, and “Annihilation of Caste”, in V. Moon edited *Dr.BabasahebAmbedkarWritings and Speeches, Vol. I.*

Barbara Harriss-White, India’s Socially Regulated Economy, http://www.criticalquest.info/moreofbooks.html#book_10_2007

Hjejle, Benedicte (1967), “Slavery and Agricultural Bondage in South India in the Nineteenth Century”, *The Scandinavian Economic History Review*, Vol. XV, Nos. 1&2.

Mosse, David, *The Rule of Water: Statecraft, Ecology and Collective Action in South India*, Oxford University Press, New Delhi, 2003

Max Weber (1904), The Protestant Ethic and the Spirit of Capitalism

Course Code: **HRIP 511**

Course Title: **ENVIRONMENTAL JUSTICE AND SUSTAINABLE DEVELOPMENT**

Course Objectives:

The course discusses the birth and development of environmentalism globally. It shows the role of individuals, the state, and formation of environmental organisations it taking the agenda of a sustainable environment forward.

Course Outcomes:

1. The course helps understand environmental challenges and how that affects the human life

2. It will also explains the goal of sustainable development and the need of environmental monitoring

3. It also familiarizes various national and international legal norms for the protection of environment

4. It discusses the advantages and risks in technological innovations in relation to the environment

Syllabus:

Unit I: The History of Environmentalism: colonial and post-colonial eras; Classical founders (Durkheim, Weber and Marx), Political ecology. Population and Consumption

Unit II: Right to Clean Environment: The Stockholm Declaration on Environment and Development 1972, Agenda 21of Rio Summit on Environment and Sustainable Development 1992. Applicable legal norms in India: Articles 51-A(g), 21, 24, 42, 48-A, Environment (Protection) Act 1986 and laws relating to protection of the environment and prevention and control of pollution, Factories Act 1948, forest laws

Unit III: Environment, People and Development: Mega Projects, industrial pollution-prevention, rehabilitation; Health and Safety aspects of new technologies such as chemical and nuclear technologies; Issues of workers' safety in factories- right to work in safe environment; Displacement of people, loss and threat to livelihood

Unit IV: Right of Future Generations: Right to Environment versus Right to Development; Sustainable Development; Global commons; Climate Change; Risk society and Environmental Justice Movement

Unit V: Threats to Indian environment- Forest Denudation, Pollution of River Systems, Depletion of Rare Species, Biodiversity, Indiscriminate Industrial

Explosion, Impact of emerging problems of Science and Technological Development: Genetic Engineering, Hazardous Waste Treatment, Pollution Control Mechanism

Readings

Mandatory

Abraham, C. M. (1999). *Environmental jurisprudence in India* (Vol. 2). Martinus Nijhoff Publishers.

Bell, M. M. & Bell M. (2011). *An invitation to environmental sociology*. Pine Forge Press.

Carolyn, M. (1996). *Ecology: Key Concept in Critical Theory*. Humanities Press International

Escobar, A. (2010). Postconstructivist political ecologies. *The international handbook of environmental sociology, 2*, 91-105.

Gadgil, M. & Guha, R. (2013). *Ecology and equity: The use and abuse of nature in contemporary India*. Routledge.

Guha, R. (2000). *The unquiet woods: ecological change and peasant resistance in the Himalaya*. California: University of California Press.

Guha, R. (2005). *Environmentalism*. USA: Oxford University Press.

Jackson, N, When the Population Clock Stops Ticking, In Rob White (ed), *Controversies in Environmental Sociology* (pp. 92-112). Cambridge, UK: Cambridge University Press.

Jeffery, R. & Sundar, N. (1999). *New moral economy for India's forests?*. New Delhi: Sage Publications.

Lockie, Stewart (2010) Neoliberal regimes of environmental governance: climate change, biodiversity and agriculture in Australia. In: Redclift, Michael R., and Woodgate, Graham , (Eds.) *The International Handbook of Environmental Sociology* (pp. 364-377). Cheltenham UK: Edward Elgar.

Suggestive

Goldblatt, D. (2013). *Social theory and the environment*. John Wiley & Sons.

Gosling, D. L. (2013). *Religion and ecology in India and Southeast Asia*. Routledge.

Hinton, E. D. & Goodman, M. K. (2010). Sustainable consumption: developments considerations and new directions. *The international handbook of environmental sociology*, 245.

Ingold, Tim (2002). The Perception of the Environment. Essays in Livelihood Dwelling and Skill. Londres et New York: Routledge.

Mehta, L. (2009). *Displaced by development: confronting marginalisation and gender injustice*. Sage Publications.

Merchant, C. (1981). *The Death of Nature: Women Ecology and Scientific Revolution*.

Mies, Maria and Vandana Shiva. (1993) *Ecofeminism*. Zed Books.

Mol, A. P. (2010). Ecological modernization as a social theory of environmental reform. *The international handbook of environmental sociology*, *2* 63-76.

Murphy, R. (2010). Environmental hazards and human disasters. *The International Handbook of Environmental Sociology*, 276.

Plumwood, V. (2004). Gender eco-feminism and the environment. *Controversies in environmental sociology*, 43-60.

Sen, G. (1992). *Indigenous vision: Peoples of India attitudes to the environment*, 19 (1-2). Sage Publications.

Shiva, V. (1988). *Staying Alive: Women, Ecology and Survival in India*. New Delhi: Kali for Women.

Shiva, V. (2016). *Water wars: Privatization pollution and profit*. North Atlantic Books.

Tranter, B. (2004). The environment movement. *Controversies in environmental sociology*, 185.

Course Code: **HRIP 512**
Course Title: **GLOBALIZATION AND HUMAN RIGHTS**

Course Objectives:

The course looks at the evolution of development and globalization through the rights based approach. In this process it shows changing approaches in international and national governance, peoples' movement and citizenship.

Course Outcomes:

1. The students will understand the history of development and impact of globalization on it.
2. They will know the political economy and factors interwoven that bring out human rights concerns
3. The course will discuss consequences of development
4. The students will be exposed to Indian experiences of development.

Syllabus:

Unit I: The Evolution of Capitalism; Historical and social context in the origin and spread of Development and Globalisation; Political Economy of Globalization; Agencies of Globalization: TNC's, IGO's, INGO's, Nation-State, Media.

Unit II: Human Rights approach to Development; Declaration on Social Progress and Development 1969; UN Declaration on the Right to Development 1986

Unit III: Development and trade off on Human Rights: the divide between the developing countries and the developed countries; From ITO to WTO: Uruguay Round of GATT negotiations; Technology and workers rights; From consumer rights to human rights; Trade related sanctions for human rights violations.

Unit IV: Understanding Human Development Indicators- traditional causes of poverty, deprivation and vulnerability, and the comprehensiveness of conventional development indicators, its comparability across nations; Where does sustainable development fit?

Unit V: Social Consequences of Globalization- Case studies from India: Agriculture and Food; Occupational changes: Outsourcing, Software industry; Special Economic Zones; Climate change; Response of the marginalized groups.

Readings

Mandatory

Assayag, Jackie. (2006). 'Seeds of Wrath: Agriculture, Biotechnology and Globalization'. In Jackie Assayag and Chris Fuller (eds.) *Globalizing India: Perspectives from Below*. London: Anthem Press. Pp.65-88.

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Escobar, Arturo. (1995). *Encountering development: The making and unmaking of the third world*. Princeton: Princeton University Press. Pp.21-54.

McGoldrick, D. (1996). 'Sustainable development and human rights: an integrated conception'. *International and Comparative Law Quarterly*, 45(4), 796 - 818.

Neveling, Patrick. (2014). Structural contingencies in the making of neoliberal India: The Kandla Free Trade Zone, 1965-91. *Contributions to Indian Sociology*, 48:17-43.

Omvedt, Gail. (2005). Capitalism and Globalisation, Dalits and Adivasis. *Economic and Political Weekly*, 40(47), 4881-85.

Sen, A. (2013). *Development as freedom*. New York: Anchor Books.

Shiva, Vandana. (2007). TRIPS and monopolies on seeds and medicine. *Critical Currents,* 1: 31-40.

Stiglitz, J. E. (2003). *Globalization and its discontents*. New York: W.W. Norton.

Thomas, George. M. (2007). 'Globalization: The Major Players'. In George Ritzer (ed.) *The Blackwell Companion to Globalization*. Oxford: Blackwell Publishing Ltd. Pp.84-102.

UNDP. (2000). *Human Development Report: Human Rights and Human Development.* New York: United Nations

Van De Veer, Peter. (2008). 'Virtual India: Indian IT Labour and the Nation–State'. In Ashwani Saith, M. Vijayabaskar and V. Gayathri (eds) *ICTs and Indian social change: diffusion, poverty, governance*. Los Angeles: Sage Publications. Pp. 369-383.

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Forsythe, David P. ed., (1989). *Human Rights and Development: International Views*. New York: St. Martin's Press.

Hamm, B. I. (2001). A Human Rights Approach to Development. *Human Rights Quarterly*. 23(4), 1005-1031.

Institute of Development Studies. (2003). *The Rise of Rights: Rights Based Approaches to International Development.*

Nadella, S., Shaw, G., Nichols, J. T., & Gates, B. (2018). Hit refresh: The quest to rediscover Microsoft's soul and imagine a better future for everyone. London : William Collins.

Saxena, K. N., & Haragopal, G. (2014). *Marginalization, Development and Resistance: Essays in Tribute to S.R. Sankaran (vol.1&2)*. Aakar Books.

Sengupta, A. (2002). 'On the Theory and Practice of the Right to Development'. *Human Rights Quarterly,* 24 (4):837-889.

Vidal, Denis. (2006). 'In Search of 'Basmatisthan': Agro-nationalism and Globalization'. In Jackie Assayag and Chris Fuller (eds.) *Globalizing India: Perspectives from Below*. London: Anthem Press. Pp. 47-64.

Course Code: **HRIP 513**
Course Title: **SOCIAL MOVEMENTS AND HUMAN RIGHTS**

Course Objectives:

The course discusses the causes and key aspects of social movements from a human rights perspective and different case studies from India relating to diversity of social movements.

Course Outcomes:

1. The students will understand various social movements through a human rights perspective
2. The students will understand the process of social mobilization for rights through a number of case studies from India
3. The case studies will help to reflect on the changing political interventions.
4. The students will understand the change and continuity that social movements lead to.

Syllabus:

Unit I: Why Social movements? Key Aspects-Ideology, Organization, Mobilization, Leadership; Social and Human Rights activism.

Unit II: Social and Religious reforms movements and human rights: Budha, Bhakti movement, Brahmo Samaj, Arya Samaj, Periyar's Self-Respect Movement, Narayan Guru, Ambedkar and Dalit movement, Hindu nationalism, Linguistic movement

Unit III: Identity, labour and human rights: Caste and Conversion; Peasant Movement; Land Reform Movements; Autonomous Women's Movement- Violence Against Women; Students Mobilization and Protest

Unit IV: Political movements and human rights: Regional and sub-regional movements, Caste and sub-caste movements, Rights to information, Civil Rights movement, Right to Education.
Unit V: Environmental movements- Chipko, Bhopal tragedy, NBA and Sardar Sarovar dam; Mines, Minerals and People; Anti Globalisation movements-agriculture, farmers and seeds.

Readings

Mandatory

Ajay, G., & Vijay, G. (March 18, 2000). Civil Society, State and Social Movements. Economic and Political Weekly, 35, 12, 1035-1036.

Ambedkar, B. R., Anand, S., Roy, A., Santarāma, ., & Gandhi, . (2016). Annihilation of caste: The annotated critical edition. London : Verso.

Ambedkar, B. R., & In Ahir, D. C. (2017). Buddhist revolution and counter-revolution in ancient India. Delhi : Buddhist World Press.

Dhanagare D. N. (1983). *Peasant Movements in Indian 1920-1950*. New Delhi: Oxford University Press.

Guha, R. (1989). The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya. Berkeley: University of California Press.

Gudavarthy, A. (2013). Politics of post-civil society: Contemporary history of political movements in India. New Delhi: Sage publications.

Jaffrelot, C. (1998). *The Hindu nationalist movement in India*. New York, N.Y: Columbia University Press.

Sheth, D. L. (January 03, 2004). Globalisation and New Politics of Micro-Movements. *Economic and Political Weekly*, 39, 1, 45-58.

Teltumbde, A. (2017). Dalits: Past, present and future. New York, NY: Routledge

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Gudavarthy, A. (September 18, 2008). Human rights movements in India: State, civil society and beyond. Contributions to Indian Sociology, 42, 1, 29-57.

Mukherjee, P. N. (1977). Social Movement and Social Change: Towards a Conceptual Clarification and Theoretical Framework. *Sociological Bulletin*, 26 (1), 38-59.

Omvedt, G. (2004). 'Struggle against dam or struggle for water? Environment and the State'. In Rajendra Vhora and Suhas Palshikar (Eds.) *India: Democracy Meaning and Practices*. New Delhi: Sage Publications.

Oommen, T. K. (Ed.). (2010). *Social Movement: Vol. I & II*. New Delhi: Oxford University Press.

Oommen, T. K. (2004). *Nation Civil Society and Social Movements*. New Delhi: Sage Publications.

Rao, M. S. A. (1979). *Social Movements and Social Transformation*. Delhi: Macmillan.

Shah, G. (2014). Social movements in india: A review of literature. Sage Publications Pvt Ltd.

Saxena, K. B., Haragopal, G., Sankaran, S. R., & Council for Social Development (India),. (2014). *Marginalization, development and resistance: Essays in tribute to S.R. Sankaran*. Delhi : Aakar Books

Shiva, V. (1991). *Ecology and the Politics of Survival*. New Delhi: Sage Publications.

Teltumbde, A. (2017). Mahad: The making of the first dalit revolt with the account of Comrade R.B. More, the chief organizer of the first conference. Delhi : Aakar Books

Zelliot, E. (1995). *From Untouchable to Dalit: Essays on the Ambedkar Movement*. New Delhi: Manohar.

Course Code: **HRIP 514**

Course Title: **RESEARCH METHODOLOGY**

Course Objectives:

The course provides students with research orientation in both qualitative and quantitative methods. The course introduces students on the nature of research, formulation of research problem, design and analysis

Course Outcomes:

1. Students will learn how to formulate research question and design

2. They will be able to understand mixed methods

3. Tools of data collection and analysis will be learnt

4. Research writing through proposal and dissertation will be explained

Syllabus:

Unit I: Nature and Scope of Social Research, Formulation of Research Problem, Research Design: Facts and Hypothesis, Problem of Objectivity and Quantification, Subjectivity and Qualitative research

Unit II: Methodological orientation and logic of enquiry- Dialectic Materialism, Comparative Method, Historical Method, Analytical Method, Scientific method, Field Work Approach, Inductive and deductive Method, Ethnographic research

Unit III: Data collection and evaluation- Types and sources of Data-Sampling; Techniques of Data Collection: Observation, participant observation, interview, questionnaire, survey, interview schedule, case study method, content analysis; Data analysis; Classification, Tabulation, Graphic representation, Uni-variate, Bi-variate and multivariate, discrete and continuous variables

Unit IV: Social statistics and social research-Measure of Central Tendency; Mean, Mode and Median, Measure of Dispersion, Range, Average Deviation and Standard Deviation, Z-test, Chi-square, Co-relation test, Use of computer and information technology

Unit V: Writing culture- Project proposal, Challenges of field work, ethnographic writing and dissertation

Readings

Mandatory

Bernard, H. R. (2015). *Handbook of Methods in Cultural Anthropology*. Rowman & Littlefield.

Clifford, J., Marcus, G. E., & of American Research (Santa Fe, N. M. (1986). *Writing Culture: The Poetics and Politics of Ethnography*. University of California Press.

Galtung, John. (1967). *Theory and Methods of Social Research*. London: Allen & Unwin.

Goldthrope, John H. (2000). *On Sociology: Numbers, narratives and the Integration of Research and Theory*. Oxford: Oxford University Press.

Goode, William J. and P. K. Hatt. (1952). *Methods in Social Research*. New Delhi: McGraw -Hill.

Gupta, Akhil and James, Fergusson. (1997). *Anthropological Locations: Boundaries and Grounds of a Field Science*. California: University of California Press.

Marcus, G. E., & Press, P. U. (1998). *Ethnography Through Thick and Thin*. Princeton University Press.

Myrdal, Gunnar. (1970). *Objectivity in Social Research.* London: Gerald Duckworth.
Oakley, Ann. (2000). *Experiments in Knowing: Gender and Method in the Social Sciences*. New York: The Free Press.

Suggestive

Bharathi, R. *Marxist Methods*. Hyderabad: Malapu publications

Medawar, P. B. (1984). *Pluto's Republic*. Oxford University Press.

Porter, Theodore M. (1995). *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton NJ: Princeton University Press.

Silverman, David. (1985). *Qualitative Methodology and Sociology.* Gower Vermont.

Stavenhagen, R. (1981). *Between underdevelopment and revolution: A Latin American perspective*. New Delhi: Abhinav.

Tilly, Charles. (2004). Observations of Social Processes and their Formal representations. *Sociological Theory*, 22, 595-602

Wilkinson, T.S and P.L Bhandarkar. (1984). *Methods and Techniques of Social Research.* Bombay: Himalaya Publishing House.

Young, P. V. (1966). *Scientific Social Surveys and Research.* New Deli: Prentice Hall.

Course Code: **HRIP 521**
Course Title: **PROJECT I**

Course Objectives:

The course is aimed to provide practical field experience of research on human rights. It is not a taught course of lecture mode.

Course Outcomes:

1. Working experience with an external body

2. Report writing of the experience

3. Students will have the opportunity to work on an ongoing project

4. Readings will be listed as per the project

Syllabus:

Project I is aimed to expose students to research through internship of one semester (part-time) in a International Government Body/ National Government Body/Non Governmental Body on a topic of human rights of a socially excluded group.
Students will be evaluated based on three documents:

1. An evaluation report from the office where they carry out internship

2. A work experience report submitted by the student

3. A research report prepared by the student on the topic of human rights of the socially excluded group chosen for study

Course Code: **HRIP 522**
Course Title: **PROJECT II- DISSERTATION AND VIVA**

Course Objectives:

The course aims to provide the opportunity to carry out a short term research using the training provided through both taught courses and internship completed in the first three semesters.

Course Outcomes:

1. Students will learn to write a research proposal

2. They will carry out fieldwork based data collection

3. Theory, data and analysis will be worked into the writing of a dissertation

4. A viva voce will give students the opportunity to present and discuss the findings of their research

Syllabus:

Readings from the courses on Research Methodology, the Theory of human rights approaches and Social Exclusion and from the specialised topic of the elective course will guide students in preparing and carrying out research. Based on this they will write a dissertation and be evaluated through a viva voce.

Code: **HRIP 415**

Course Title: **MINORITIES: RIGHTS AND INCLUSIVE POLICY**

Course Objectives:

This course familiarizes the students about different types of minorities in India and their issues.

Course Outcomes:

1. This course highlights the diverse social markers in the making of minorities
2. It also highlights different national and international declarations for minority rights
3. It also examines special laws for the protection of minorities
4. It also analyses minority identity, representation and politics

Syllabus:

Unit I: The social construction of minorities- social-demographical-economic-religious-linguisticrepresentation; the logic of minority-majority; understanding diversity, tolerance and secularism

Unit II: International Norms for Protection of Minorities: Declaration on the Right of Persons Belonging to National or Ethnic, Religious and Linguistic Minorities 1992; UN Commission on Human Rights- Sub commission on Minorities

Unit III: Minorities in India; Protection of Minorities under the Constitution; National and State Commissions for Minorities

Unit IV: Policy of secularism, Issues relating to reservations, the Sachar committee;

Unit V: Human Rights violations and Politics on Minorities- Beef controversy and lynching, Women and Muslim law-case of triple talaq, 'threat perception' and xenophobic attitudes

Readings

Mandatory

Al-Haj, Majid and Rosemarie Mielke (eds.) 2007. *Cultural Diversity and the Empowerment of Minorities*. Oxford: Bergahn.

Basant, R. (2007). Social, economic and educational conditions of Indian Muslims. *Economic and Political Weekly*, 828-832.

Baumann G. (2002). *The multicultural riddle: Rethinking national ethnic and religious identities*. Routledge.

Clifford, J. (2000). Taking identity politics seriously: 'The contradictory stony ground...'. *Without guarantees: in honour of Stuart Hall 94* 112.

Dasgupta, Abhijit, (Eds.), (2011). *Minorities and the State: changing Social and Political Landscape of Bengal*. New Delhi: Sage.

Hasan, Z. (2011). Muslim Backwardeness and the Elusive Promise of Affirmative Action. In Z. Hasan, *Politics of Inclusion : Castes, Minorities, and Affirmative Action* . Delhi: Oxford India Paperbacks.

Hasan, Z. (2011). Reservation, Minority Rghts, and the Making of the Constitution . In Z. Hasan, *Politics of Inclusion : Castes, Minorities, and Affirmative Action* . Delhi: Oxford India Paperbacks.

Hasan, Z. (2011). Social Discrimination and the Reservation Claims of Muslims and Christian Dalits. In Z. Hasan, *Politics of Inclusion : Castes, Minorities, and Affirmative Action* . Delhi: Oxford India Paperbacks.

Kalam, M. A. (2007). Conditioned lives?. *Economic and Political Weekly*, 843-845.

Robinson, R. (2007). Indian Muslims: The varied dimensions of marginality. *Economic and Political Weekly*, 839-843.

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Suggestive

Kymlicka, W. (2008). The Good, the bad and the intolerable : Minority Group Rights. In M. Goodale, *Human Rights : An Anthropological reader* (pp. 58-67). United Kingdom: Wiley-Blackwell.

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Shah, G. (2007). The condition of Muslims. *Economic and political weekly*, 836-839.

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Whitaker B. (Ed.). (2013). *Minorities: a question of human rights?*. Elsevier.

Wilkinson, S. (2007). A comment on the analysis in Sachar Report. *Economic and Political Weekly*, 832-836.

Course Code: **HRIP 416**

Course Title: **SCHEDULED CASTES: RIGHTS AND INCLUSIVE POLICY**

Course Objectives:

This course focuses on the Scheduled castes of India with specific reference to the history of their social exclusion. It discusses their pursuit of human rights and social mobility. The status and implementation of inclusive policy.

Course Outcomes:

1. Students will gain an insight into history of untouchability and discrimination of the scheduled castes
2. It highlights the UN and Indian constitutional provisions and policies available for scheduled castes.
3. The students will understand how exclusion acts as a multidimensional problem
4. Students will be exposed to challenges of equality and human rights

Syllabus:

Unit I: Foundations of Caste as a socio-cultural organization, hierarchical ordering of caste, notions of purity and pollution, membership to castes, group rights, and hereditary occupations and discriminatory remunerations, foundations of untouchability and its manifestations, exclusion and discrimination in other occupations.

Unit II: Scheduled Castes and their Quest for Equality; Colonial modernity and the emergence of 'public space', Social anonymity in the Urban and emergence of egalitarian space, Early Dalit movements and Quest for civic rights (1880-1930s)– right to access public hall, public road, water from public well, etc. access to land (Depressed Class lands), Temple entry, religious conversion as emancipation.

Unit III: State and the Scheduled Castes: Hierarchical Socio-cultural order, attitudes of people and the challenges in ensuring Dalits' right to equality, Criminalisation of untouchability, Reservation in education, employment and political participation, implementation and subversions, Legal provisions- reservations and special drives-; National Commissions, State Commissions; Protection of Civil Rights (PCR) act, and the subsequent SC/ST Prevention of Atrocities (PoA) Act; Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition), Act 1999, Current Statistics from on Manual Scavenging and NCRB

Unit IV: Conventions on Freedom from Discrimination: UNESCO Declaration on Race and Racial Prejudice 1978, UNESCO Declaration of Principles on Tolerance 1995. Emergence of Dalit Political Parties, Civil Society Organisations and advocacy for Dalit rights

Unit V: Current Scenario of Dalit's Human rights challenges: Ascribed occupations of discrimination (case study- manual scavenging); Economic mobility (case study-); Political mobility (case study-); Educational mobility (case study-); Marriage and honour killings (case study-)

Readings

Mandatory

Ahuja, Ravi. (1998), Labour Unsettled: Mobility and Protest in Madras region, 1750-1800. *The Indian Economic and Social History Review*, 35(4).

Ambedar, B.R., "Book I—Untouchables or The Children of India's Ghetto. In V. Moon (ed). *Dr. Babasaheb Ambedkar Writings and Speeches, Vol.* 5.

Ambedar, B.R., "Hindu Social order: Its Essential Principles", and "Hindu Social Order: Its Unique Features", in V. Moon (ed). *Dr. Babasaheb Ambedkar Writings and Speeches, Vol. 3*.

Ambedkar, B. R, "Castes in India", and "Annihilation of Caste", in V. Moon (ed). *Dr. Babasaheb Ambedkar Writings and Speeches, Vol. I.*

Ambedkar, B. R. (1945). *What Congress And Gandhi Have Done To The Untouchables*. Bombay: Thacker & Co.

Banton, M. (1996). *International action against racial discrimination*. Oxford University Press.

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Bob C. (2007). Dalit rights are human rights: Caste discrimination international activism and the construction of a new human rights issue. *Human Rights Quarterly*, 167-193.

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Guru, G. (2011). Humiliation: Claims and context. New Delhi: Oxford University Press

Gupta, Dipankar. (2005). Whither the Indian Village: Culture and Agriculture in 'Rural' India. *Economic and Political Weekly*, 40 (8), 751-758.

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Thorat, S. (2004). *Caste, Race and Discrimination: Discourses in International Context*. Rawat Publications.

Waghmore, Suryakant.2013. *Civility against Caste: Dalit politics and Citizenship in Western India*. New Delhi: Sage Publications.

Suggestive

Karunyakara, L. (2008). Ambedkar's Contribution for the Educational Development of Dalits. In L. C. L Karunyakara, *Dalits and Human Development* (pp. 182-194). Delhi: Abhijeet Publications.

Kumar, S. (2008). Dalits and Human Development : A Human Rights Perspective. In L. C. L Karunyakaran, *Dalits and Human Development* (pp. 257-269). Delhi: Abhijeet Publications.

Mallaish, L.C. and K.B.Ratna Kumari. (2008). *Dalits and Human Development*. New Delhi: Abhijeet Publications.

Nayar, P. K. (2011). The Poetics of Postcolonial Atrocity: Dalit Life Writing Testimonial and Human Rights. *Ariel: a review of international English literature, 42* (3-4).

Review of Development and Change Special Issue on Interrogating Enquiry Commission Reports on Caste Violence, Vol XXII, No. 2, ISSN: 0972-2661.

Sheth, D. L. (2004). *Caste, ethnicity and exclusion in South Asia: the role of affirmative action policies in building inclusive societies* (No. HDOCPA-2004-13). Human Development Report Office (HDRO) United Nations Development Programme (UNDP).

Srinivas, G. (2008). Education and Social Mobility Among the Middle Class Dalit . In L. C. L Karunyakara, *Dalits and Human Development* (pp. 213-226). Delhi: Abhijeet Publications.

Srinivas, M. N. (2003), An Obituary on Caste as a System. *Economic and Political Weekly*, 38 (5), 455-459.

Course Code: **HRIP 417**

Course Title: **SCHEDULED TRIBES: RIGHTS AND INCLUSIVE POLICY**

Course Objectives:

The course takes a historical approach in understanding how the group category and identity is framed politically. It focuses on the creation of the 'indigenous' category and the UN declaration of their rights. In India it traces how the 'scheduled tribe' came to be and accordingly how tribal administration and development has changed over the colonial and post-colonial eras.

Course Outcomes:

1. The students will understand the invention of category 'tribe' 'Scheduled tribe' and 'indigenous' through a historical approach

2. They will know the transformation of tribal administration and development through the colonial and post-colonial eras.

3. The course will provide details on the heterogeneity within these categories

4. It relates how the problem of exclusion leads to impoverishment starting from alienation of resource ownership & access.

Syllabus:

Unit I: Group category and identity: colonial and post-colonial-primitive, *tribe*-a*divasi*-girijan-adimjati-vanavasi-scheduled tribe, indigenous.

Unit II: History of tribal administration: colonial and post-colonial- influence of scholar administrators, western anthropologists and Indian anthropologists; Social Exclusion and Adivasis: poverty, health, education; Changing approaches to tribal development- isolation, assimilation and integration.

Unit III: International Labour Organisation Convention 169 Indigenous and Tribal Peoples Convention (1989); UN Voluntary Fund for Indigenous Populations 1985, United Nations (2007) *Declaration on the Rights of Indigenous Peoples*; Indigenous Peoples and the UN Commission on Human Rights

Unit IV: Constitutional provisions for scheduled tribes; Five year plans and tribal development- Schemes in Education, Health, Economy; SC and ST Prevention of Atrocities Act 1989 and Rules 1995; PESA 1996; National Commission for Scheduled Tribes 2004; Forest Rights Act 2006; National Policy for Scheduled Tribes 2006, Ministry for Tribal Affairs

Unit V: Human rights, the Exclusionary regime and Resource politics- conflict in use values-Adivasi Culture, Resources, State and Market

Readings

Mandatory

Anaya, J., & Anaya, S. J. (2004). Indigenous peoples in international law. Oxford University Press, USA.

Assembly, U. G. (2007). United Nations declaration on the rights of indigenous peoples. UN Wash, 12, 1-18.

Beteille, A. (1998). 'The Idea of Indigenous People', *Current Anthropology*, Vol. 39, No. 2.

Giridhar, Gomango. (1987). *Constitutional Provisions for the SCs and STs*. New Delhi: Himalaya Publishing House.

Karlsson, B. G. (2003). Anthropology and the 'Indigenous Slot': Claims to and Debates about Indigenous Peoples' Status in India. *Critique of Anthropology*, 23 (4).

Kirsch, Stuart. (2006). *Reverse Anthropology: Indigenous Analysis of Social and Environmental Relations in New Guinea*. Stanford University Press.

Kirsch, Stuart. 2014. *Mining Capitalism: The Relationship between Corporations and Their Critics*. University of California Press.

Li, Tania Murray. 2007. *The Will to Improve: Governmentality, Development, and the Practice of Politics*. Duke University Press

Li, Tania Murray. 2014. *Land's End*. Duke University Press.

Munshi, I. (2007). Adivasi Life Stories: Context, Constraints, Choices. New Delhi: Rawat Publications.

Nathan, D. and V. Xaxa. (2012). Social Exclusion and Adverse Inclusion: Development and Deprivation of Adivasis in India. Delhi: OUP.

Pritchard, S. (1998). *Indigenous Peoples, the United Nations and Human Rights*. London: Zed.

Sundar, Nandini (Ed.), (2016). *The Scheduled Tribes and Their India*. New Delhi: Oxford University Press.

Xaxa, V. (2003). Tribes in India. *The Oxford India Companion to Sociology and Social Anthropology*. Delhi: Oxford University Press.

Suggestive

Anaya, S. J., & Crider, S. T. (1996). Indigenous peoples, the environment, and commercial forestry in developing countries: The case of Awas Tingni, Nicaragua. Hum. Rts. Q., 18, 345.

Guha, R. (1999). *Savaging the Civilized: Verrier Elwin, His Tribals, and India*. Chicago: University of Chicago Press.

Haimendorf, Von Furer, C. (1982). *Tribes in India: The Struggle for Survival*. Delhi: Oxford University Press.

Hall, D, P. Hirsch and T. Li. (2011). *Powers of Exclusion: Land Dilemmas in Southeast Asia.* Singapore: National University of Singapore Press.

Havemann, P. (ed.) (1999). *Indigenous People's Rights in Australia, Canada and New Zealand*. Oxford: OUP.

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Li, T. M. (2000). Articulating indigenous identity in Indonesia: Resource politics and the tribal slot. Comparative studies in society and history, 42(1), 149-179.

Niezen, R. (2003). *The Origins of Indigenism: Human Rights and the Politics of Identity*. Berkeley; London: University of California Press.

Osman, S. (2000). 'Globalization and Democratization: The Response of the Indigenous Peoples of Sarawak', *Third World Quarterly*, 21 (6).

Pati, B. (2011). *Adivasis in Colonial India: Survival, Resistance and Negotiation*. New Delhi: Orient Blackswan,.

The World Bank. (2011). *Poverty and Social Exclusion in India*. New Delhi: Oxford University press.

Turner, T. (1999). 'Indigenous Rights, Environmental Protection and the struggle over forest resources in the Amazon: the case of the Brazilian Kayapo'. In J. K. Conway, K. Keniston and L. Marx (Eds) *Earth, air, fire, water: Humanistic Studies of the Environment*. Amherst, Mass: University of Massachusetts Press.

Weaver, H. N. (2001). Indigenous Identity: What Is It and Who Really Has It?. *American Indian Quarterly*, 25 (2).

Xaxa, V. (1999a). Transformation of Tribes in India: Terms of Discourse. *Economic and Political Weekly*, vol.XXXIV, 24: 1519-1524.

Xaxa, V. (1999b). Tribes as Indigenous People of India". *Economic and Political Weekly*, vol.XXXIV, 51: 3589-3595,.

Course Code: **HRIP 418**
Course Title: **DISABILITY: RIGHTS AND INCLUSIVE POLICY**

Course Objectives:

1. It provides knowledge on the concept and models (social, medical, political) of disability.
2. It equips students to understand the issues faced by PWDs and their caretakers
3. It guides in sensing the disability and sharing the experiences
4. It analyses the individual and societal perspectives towards disability.
5. It examines the policies and affirmative action towards PWDs

Syllabus:

Unit I: Definition of impairment, disability, handicap; Types of various disabilities; magnitude, causes and consequences; Historical overview of disability rehabilitation-International and National contexts; Cultural Evolution of Disability – International and National Contexts Identification and Assessment of Functional abilities and Differential Diagnosis

UNIT II: Persons with disabilities-their familial and societal contexts Myth and misconceptions and societal attitudes reactions of parents', family members and ways of coping; Prevention of disabilities at primary, secondary and tertiary levels. Intervention strategies at individual, family and community levels. Contribution potential of the disabled to society: Case Studies

UNIT III: Approaches to Disability; the Charity Model, the Bio Centric Model, the Functional Model and Human Rights, Paradigm Shift of Disability Rehabilitation from Charity to Rights Mode, from transition to transformation,, UN General Assembly Declaration on the Rights of the Disabled Persons 1975,Declaration on the Rights of Mentally Retarded Persons 1971, Resolution on the rights of the disabled persons adopted by the Coordinating Committee of National Institutions for the Promotion and Protection of Human Rights 1993

UNIT IV: Acts related to Persons with Disabilities in India- Persons with Disability Act 2016, RCI ACT - 1992, NTA ACT – 1999. Role of RCI, Action taken by the government and their inclusion in development and rehabilitation using the right based perspectives, Case studies: Narratives of the Phenomenology of Disability

UNIT V: Agencies involved in the field of Rehabilitations, Education Institute, vocational rehabilitation centres, State and Central Government agencies, National and International Organisations, Non-Governmental organizations, Policies and Welfare Programmes Pertaining to PwD.

Readings

Mandatory

Addlakha, R., Blume., S., Devlieger, P. J., Nagase, O., & Winance, M. (2009). *Disability and society: a reader*. New Delhi: Orient Blackswan Publications.

Albrecht, G. L., Seelman, K. D., & Bury, M. (Eds.). (2001). *Handbook of disability studies*. New Delhi: Sage Publications.

Blaxter, M. (1976). *The Meaning of Disability: A Sociological Study of Impairment*. Pearson Education.

Campbell, J., & Oliver, M. (2013). *Disability politics: understanding our past, changing our future*. New York: Routledge.

Das Ph D, A., & Kattumuri, R. (2011). Children with disabilities in private inclusive schools in Mumbai: Experiences and challenges. *Electronic Journal for Inclusive Education*, *2* (8), 7.

Hans, A., & Patri, A. (2003). *Women, Disability and Identity*. SAGE Publications.

Kannabiran, K. (2016). *India: Social Development Report 2016: Disability Rights Perspectives.* Delhi: Oxford Universitry Press.

Karna, G. N. (1999). *United Nations and the rights of disabled persons: a study in Indian perspective*. New Delhi: APH Publishing corporation.

Suggestive

Karna, G. N. (2000). Disability rights movement: Conceptual framework and its implications for India. *Disabilities and Impairments*, *14*(1), 15-22.

Mani, D. R. (1988). *The physically handicapped in India: Policy and programme*. South Asia Books.

Rieser, R. (2012). *Implementing inclusive education: a Commonwealth guide to implementing Article 24 of the UN Convention on the Rights of Persons with Disabilities*. Commonwealth Secretariat.

Shapiro, J. P. (2011). *No Pity: People with Disabilities Forging a New Civil Rights Movement*. Crown/Archetype.

Course Code: **HRIP 424**

Course Title: **WOMEN: RIGHTS AND INCLUSIVE POLICY**

Course Objectives:

The course starts with a discussion on the origin and development of women's human rights. It discusses the role of women activism in their human rights and many international and national conventions and policy protecting the human rights of women.

Course Outcomes:

1. It familiarizes the students with the specific social and cultural contexts of women in India

2. It equips the students to be sensitized on international and national legal provisions for women and her access to justice.

3. It shares the stories of women activism in instilling human rights

4. It discusses violence and abuse against women

Syllabus:

Unit I: Theoretical visions: Origins and Development of Women's Human Rights, Women's Human Rights in the Public and Private Sphere; Status of Women in India- Changes in the values and perspectives of Indian society: social and cultural prejudices

Unit II: Violence against and abuse of women: rape, sexual exploitation, trafficking in women, sexual harassment at workplace, dowry, widowhood, domestic violence, Women and custodial crimes. Female health and family welfare issues: Reproductive freedom, genital mutilation.

Unit III: Women, Activism and Social Change: Eleanor Roosevelt to Malala Yousafzai

Unit IV: Development of International Norms for Protection of Women: ILO conventions for protection of female labour, UN Convention on Political Rights of Women 1952, Convention on Elimination of All Forms of Discrimination against Women 1979, Convention on Consent to Marriage, Minimum Age for Marriage and Registration of Marriages 1962, Convention for the Suppression of the Traffic in Persons and of the Exploitation of the Prostitution of Others 1949, Declaration on the Elimination of Violence against Women 1993, Declaration on the Participation of Women in Promoting International Peace and Cooperation 1982, UN Development Fund for Women 1975, Declaration on the Protection of Women and Children in Emergency and Armed Conflict 1974, UN Security Council Resolution 1325 (2000) on Women's Rights and International Peace

Unit V: The Constitution of India and Special provisions for the protection of women; Special Laws and Policies for Protection of Women: Suppression of Immoral Traffic Act 1956, Indecent Representation of Women (Prohibition) Act 1986, Commission of Sati (Prevention) Act 1982, Medical Termination of Pregnancy Act 1971, Maternity Benefit Act 1961, Equal Remuneration Act 1976, Dowry Prohibition Act 1961, National Commission for Women

Readings

Mandatory

Abusharaf, A. (2006). Women in Islamic communities: The quest for gender justice research. *Human Rights Quarterly*, 714-728.

Agosin, M. (Ed.) (2001). *Women, Gender, and Human Rights: A Global Perspective*. Rutgers: The State University.

Amirthalingam, K. (2005). Women's rights, international norms, and domestic violence: Asian perspectives. *Human Rights Quarterly*, 683-708.

Choudhury, S. (2016). *Women and Conflict in India*. London: Routledge.

Cook, R. J. (Ed.). (2012). *Human rights of women: National and international perspectives*. University of Pennsylvania Press.

Fraser, A. S. (1999). Becoming human: The origins and developments of women's human rights. *Human Rights Quarterly*, *21*, 853.

Kannabiran, K. (2009). "The Law, Gender and Women," Editor's Introduction, Review of Women's Studies, Economic and Political Weekly, 31 October, 2009.

Kannabiran, K. (1996). "Gendering Justice", Economic &Political Weekly, Vol.31 No.33, pp.2223-2225.

Suggestive

De Pinho, H. 2013. On the "Rights" Track: The Importance of a Rights-Based Approach to Reducing Maternal Deaths. In Michael, Gordon. (Eds.) *Health and Human Rights in a Changing World*. New York: Routledge.

El Jack, A., Bell, E., & Narayanaswamy, L. (2003). Gender and armed conflict: Overview report. Brighton: Institute of Development Studies.

Johnstone, R. L. (2006). Feminist influences on the United Nations human rights treaty bodies. *Human Rights Quarterly*, 148-185.

Kaushal, R. (2000). *Women and Human Rights in India*. Kaveri Books.

McDuie-Ra, D. (2012). Violence Against Women in the Militarized Indian Frontier: Beyond “Indian Culture” in the Experiences of Ethnic Minority Women. *Violence against women*, *18*(3), 322-345.

Mehrotra, D. P. (2009). *Burning bright: Irom Sharmila and the struggle for peace in Manipur*. Penguin Books India.

Mukhopadhyay, S. (Ed.). (1998). *In the Name of Justice: Women and Law in Society*. Manohar Publishers.

Omvedt, G. (1990). Violence against women: new movements and new theories in India.

Reardon, B. (1993). *Women and peace: Feminist visions of global security*. SUNY Press.

Reilly, N. (2011). Women's Human Rights. Seeking Gender Justice in a Globalizing Age.

Symonides, J. (Ed.). (1999). *Human rights of women: a collection of international and regional normative instruments; twentieth anniversary of the adoption of the United Nations Convention on the Elimination of All Forms of Discrimination against Women 1979-1999*. Unesco.

Yousafzai, M. 2013. *I am Malala*. London: Orion.

Course Code: **HRIP 425**

Course Title: **GENDER BEYOND BINARIES: RIGHTS AND INCLUSIVE POLICY**

Course Objectives:

The course exposes students to the diversity of gender within the 'third' gender and thereby the difference in their discrimination and demands for inclusion.

Course Outcomes:

1. The students will understand the international and national legal measures for the protection of 'third' gender rights
2. The course will expose students to gender diversity and the fact that it is not new
3. Mobilisations and demands of the 'third' gender in asserting and their rights
4. Students will also understand how taken for granted basic needs, pose a challenge in public space for the 'third' gender

Syllabus:

Unit I: Understanding gender diversity and beyond binaries gender diversity; sex and gender and sexual orientation; gender beyond binaries not new in history; Transsexualism and Transvestism as Psycho-Somatic and Somato-Psychic Syndromes; Role of Gender and the Imperative of Sex

Unit II: Exclusion and discrimination –lack of legal protection, poverty, harassment and stigma, anti-transgender violence, Genderbashing: Sexuality, Gender, and the Regulation of Public Space

Unit III: Navigating Binary spaces and the Right of inclusion- Bathrooms, Schools, Sports, Government Documents, Work, and Healthcare; Body, Technology, and Gender in Transsexual Autobiographies

Unit IV: Transgendering the politics of recognition; International Protection and Recognition of beyond binaries Gender Rights

Unit V: Protection and Recognition of beyond binaries Gender Rights in India; Debates on Article 377

Readings

Mandatory

Engelke, M. (1999). 'We Wondered what Human Rights He Was Talking About' Human rights, homosexuality and the Zimbabwe International Book Fair. Critique of Anthropology, 19(3), 289-314.

Hames-García, M. (2006). What's at Stake in "Gay" Identities?. In Identity politics reconsidered(pp. 78-95). Palgrave Macmillan, New York.

O'Flaherty, M and J. Fisher. 2013. Sexual Orientation, Gender Identity and International Human Rights Law: Contextualising the Yogyakarta Principles. In Michael Gordon. (Eds.) *Health and Human Rights in a Changing World*. New York: Routledge.

Stryker, S. and S. White (eds.). 2006. *The Transgender Studies Reader*. New York: Routledge.

Course Code: **HRIP 426**

Course Title: **CHILDREN: RIGHTS AND INCLUSIVE POLICY**

Course Objectives:

This paper unravels the concept of childhood and the development of children's rights. It discusses the many challenges faced by children that threaten their right to decent life. The role of international and national policies in protecting rights of children is discussed.

Course Outcomes:

1. Students will understand what is meant by childhood
2. They will understand the basic rights necessary for children for a secure life
3. Students will be exposed to the violence suffered by children around the globe
4. They will understand the significance of children's human rights

Syllabus:

Unit I:The concept of Childhood; History of Children's Rights; children's rights to legal, educational, health, economic and social rights; child's human rights to dignity, physical integrity and protection from harm; UN Convention on the Rights of the Child 1989

Unit II: Violence against children; global movement to end all corporal punishment of children; child exploitation; child poverty; continuing abuse and neglect of children; sale of children, trafficking in children, Child Prostitution and Child Pornography 2000, children and custodial crimes, Juvenile justice from an international children's rights perspective; Indian Juvenile Justice Acts 1986 and 2000; National Commission for Rights of the Child; child soldiers; human rights of children in the context of international migration

Unit III: Child and the family, adoption, alternative care, child homelessness; children's right to play; Declaration of Social and Legal Principles relating to the Protection and Welfare of Children (with special reference to Adoption of Children) 1986,Legal Principles relating to the Protection and Welfare of Children with Special Reference to Foster Placement and Adoption 1986, Indian Children's Act 1960, Orphanages and Other Charitable Homes (Supervision and Control) Act 1960

Unit IV: Child labour, ILO Convention on Child Labour1999, Work of UNICEF; India Child Labour (Prohibition and Regulation) Act 1986, Children (Pledging of Labour) Act,

Unit V:Social and cultural practices regarding girl child- foeticide, child marriage, IndiaChild Marriage Restraint Act 1929, Pre-Natal Diagnostic Techniques (Regulation and Prevention of Misuse) Act 1956, child citizenship, indigenous children's rights; children with psychiatric disabilities; natural resource exploitation and children's rights

Readings

Mandatory

Archard, D. (3rd eds.) (2015). *Children: Rights and Childhood*. London: Routledge.

Bueren, G. V. (1995). *The International Law on the Rights of the Child* (Dordrecht/Boston and London, Martinus Nijhoff Publishers).

Detrick, S., Doek, J. E., & Cantwell, N. (Eds.). (1992). *The United Nations Convention on the Rights of the Child: a guide to the" travaux preparatoires"*. Martinus Nijhoff Publishers.

Eugeen, Verhellen (1993), 'Children's Rights and Education: A Three-track Legally Binding Imperative', *School Psychology International*, 14, 199–208

Lenzer, G. (Ed.). (2017). *Violence Against Children: Making Human Rights Real*. London: Routledge.

Martha, F. Davis and Roslyn Powell (2003), 'The International Convention on the Rights of the Child: A Catalyst for Innovative Child Care Policies', *Human Rights Quarterly*, 25 (3), August, 689-719

Michael, J. Dennis (1999) 'The ILO Convention on the Worst Forms of Child Labor'. *American Journal of International Law*, 93 (4), October, 943–8

Suggestive

Montgomery, H. (2001). Imposing rights? A case study of child prostitution in Thailand. *Culture and rights: Anthropological perspectives*, 80-101.

Nanjunda, D.C. (2008). *Child labour and Human rights: A Prospective.*Vishal kaushik Printers : Delhi.

Nienke, Grossman. (2007). Rehabilitation or Revenge: Prosecuting Child Soldiers for Human Rights Violations. *Georgetown Journal of International Law*, 38, Winter, 323–61

Nieuwenhuys, O. (2005). *Children's lifeworlds: Gender, welfare and labour in the developing world*. Routledge.

Paulo Sérgio Pinheiro (2006), ‘An End to Violence Against Children’ in World Report on Violence Against Children, Chapter 1, Geneva, Switzerland: United Nations Secretary-General's Study on Violence against Children, 3–27

Pemberton, S. (2013). Child Rights and Child Poverty: Can the International Framework of Children’s Rights Be Used to Improve Child Survival Rates? In Michael Gordon (eds.) *Health and Human Rights in a Changing World*. New York: Routledge.

Prout, A., & James, A. (2003). *Constructing and reconstructing childhood: Contemporary issues in the sociological study of childhood*. Routledge.

Vandenhole, W. (Eds.) (2015). *Routledge International Handbook of Children’s Rights Studies*. London: Routledge.

Wouter Vandenhole (2014), ‘Child Poverty and Children’s Rights: An Uneasy Fit?’, *Michigan State International Law Review*, 22 (2), 609–36

Course Code: **HRIP 427**

Course Title: **THE AGED: RIGHTS AND INCLUSIVE POLICY**

Course Objectives:

The course focuses on the aged as a separate category of socially excluded people needing attention. It discusses the problems of their rights in a changing socio-economic scenario with respect to their health, family care and economy.

Course Outcomes:

1. To understand the vulnerability of the elderly
2. The question of elderly rights and their protection in international and national governance
3. To understand how technology has an impact on the elderly
4. To understand how the elderly are represented and voice their rights

Syllabus:

Unit I: Protection of the Aged: Vulnerability of the aged; Indian society and the aged; Poverty, illiteracy, breakdown of old social and family institutions

Unit II: Rights of the Elderly: World Assembly on Ageing, Vienna, 1982, International Norms for Protection of the Aged

Unit III: Protection of the Aged under the Indian Constitution: Fundamental Rights and Directive Principles under the Constitution; Special protection and provisions for senior citizens

Unit IV: Impact of improvements in health care on mortality; destitution; elderly care

Unit V: Institutional Mechanisms for Protection of the Aged- Non-Governmental Organizations, Information Media, Role of Education

Readings

Mandatory

Cubanski, J., Casillas, G., & Damico, A. (2015). *Poverty among seniors: an updated analysis of national and state level poverty rates under the official and supplemental poverty measures*. Los Angeles: Kaiser Family Foundation.

Doron, I., & Apter, I. (2010). The debate around the need for a new convention on the rights of older persons. *The Gerontologist*, 50, 5686–5593.

Dragset, J., Eide, G., & Ranhoff, A. (2013). Anxiety and depression among nursing home residents without cognitive impairment. *Scandinavian Journal of Caring Sciences*, 27, 872–881.

Help Age International (2010). *Strengthening older people's rights: towards a UN convention,*

Megret, F. (2011). The human rights of older persons: a growing challenge. *Human Rights Law Review*, 11, 37–66.

United Nations. (2013). *World population aging*. New York: Author.

Suggestive

Cox, C. (2014). Personal and community empowerment for grandparent caregivers. *Journal of Family Social Work*, 17, 162–174.

Cox, C., & Pardasani, M. (2013). Alzheimer's in the workplace: a challenge for social work. *Journal of Gerontological Social Work,* 56, 643–656.

United Nations. (1991). *Human Rights Council, Report of the Independent Experts on the Enjoyment of all human rights by older persons*.

Course Code: **HRIP428**

Course Title: **HEALTH: RIGHTS AND INCLUSIVE POLICY**

Course Objectives:

The course discusses about health issues in human right perspective and examines the role of government and other non-governmental organizations in health care system.

Course Outcomes:

1. The course makes a link between human rights violations and health
2. It highlights the effectiveness of the existing health delivery systems.
3. It examines the roles of state policies and other constitutional provisions and international conventions pertaining to health and its inclusiveness.
4. It analyses the ethical and legal issues of experiments on living beings

Syllabus:

Unit I: History, Principles and Practice of Health and Human Rights, What is Public Health? Human rights approach to Public Health policy; Violations of human rights and its impact on health-Nuremberg

Unit II: Constitution of the World Health Organization, WHO's Global Strategy for Health for All, UN General Assembly Resolution on Protection against Products harmful to Health and the Environment, Clinical trials-prohibition of experimentation on human person, Global Bioethics at UNESCO- Declaration on the Human Genome and Human Rights

Unit III: Protection and Provisions in Indian Law: National Health Policy-its evolution, Articles 21, 47 & 41 of the Indian Constitution

Unit IV: Human Rights and Science and Technology: Science & technology and improvement of individual and community health and hygiene, Community Health as a public service industry: Shift in character as a commercial industry, World Bank and Health systems, TRIPS and the price of medicines, Global drug control policy, changing role of government

Unit V: Medical Ethics and rights: Experiments on living beings; human cloning, foeticide and abortion, in-vitro fertilization and surrogate parenthood, organ transplantation and sale of human organs, HIV/AIDS, human performance augmenting drugs and technologies (e.g., use of steroids in sports, hormones, drugs); artificial organs, kidney dialysis, life sustaining drugs; Rights of the disabled: artificial limbs, mobile wheel chairs, hearing aids; Computer crimes, pornography online; euthanasia

Readings

Mandatory

Abhay Kadam, Karen Maigetter, Roger Jeffery, Nerges Mistry, Mitchell Weiss & Allyson Pollock, (2016). Correcting India's chronic shortage of drug inspectors to ensure the production and distribution of safe, high-quality medicines', *International Journal of Health Policy and Management.*

Amar Jesani & Purendra Prasad. (Eds.), (2018). *Equity and Access: Health Care Studies in India*. India: Oxford University Press.

Arabella Hayter, Roger Jeffery, Chitra Sharma, Audrey Prost, & Sanjay Kinra. (2015). Community perceptions of health and chronic disease in South Indian rural transitional communities: A qualitative study. *Global Health Action*, 8: 25946, http://dx.doi.org/10.3402/gha.v8.25946

Bvudzai Magadzire, Ashwin Budden, Kim Ward, Roger Jeffery & David Sanders. (2014). Frontline Health Workers as Brokers: Provider Perceptions, Experiences and Mitigating Strategies to Improve Access to Medicines. *BMC Health Services Research*, **14:** 520.

Farmer, P. and N. Gastineau. (2008). Rethinking Health and Human Rights: Time for a Paradigm Shift. In M. Goodale, *Human Rights : Anthropological Reader*(pp. 148-166). Sussex: Wiley-Blackwell

Farmer, P. (2003). Pathologies of power: Health human rights and the new war on the poor. *North American Dialogue*, *6* (1), 1-4.

Jonathan Wolff. (2012). *The Human Right to Health*. New York: W.W. Norton.

Michael Gordon. (Eds.) (2013). *Health and Human Rights in a Changing World*. New York: Routledge.

Suggestive

Peter Roderick, Rushikesh Mahajan, Patricia McGettigan, Allyson M Pollock & Roger Jeffery. (2014). Will the new Government introduce an Indian Drugs Bill to deliver rational regulation of safe and effective drugs?. *Economic and Political Weekly*, 49(33), 15-19.

Rama, Baru & Anuj Kapilashrami. (Eds), (2018). *Global Governance and Commercialisation of Public Health.* UK: Routledge.

Salla Sariola, Deapica Ravindran & Roger, Jeffery. (2015). 'Big-pharmaceuticalisation: Clinical Trials and Contract Research Organisations in India', *Social Science & Medicine*, 131: 239-246.

Sariola, S, Jeffery, R, Jesani, A & Porter, G. (2018). 'How civil society organisations changed regulation of clinical trials in India'. Science as Culture. DOI: 10.1080/09505431.2018.1493449.

Scheper-Hughes, N. (2008). Rotten Trade: Millennial Capitalism, Human Values and Global Justice in Organ Trafficking. In M. Goodale, *Human Rights : An Anthropological Reader*(pp. 372-395). Sussex: Wiley-Blackwell.

Course Code: **HRIP 515**

Course Title: **LABOUR: RIGHTS AND INCLUSIVE POLICY**

Course Objectives:

This course discusses different types of employment and labour and their rights for dignified work space.

Course Outcomes:

1. This course will help to understand different type of labour and their hardships in work place.

2. This will also highlights importance of trade unions in providing rights for labours and proper amenities for decent work.

3. This course also examines international obligations intended to be exercised in all workplace.

4. It also analyses various constitutional rights of labours for their protection.

Syllabus:

Unit I: Early ideas of production – agriculture, dissociation of use right and emergence of ownership, dissociation of human effort from the produce, classical school of economics and the idea of subsistence wage, hunger as the origin of dependence / hunger as the source of subordination, slave labour, Plantation labour, indenture and bonded labour; Abolition of Slavery Act (1843).

Unit II: Labour in Traditional Indian Society: Caste system, Division of labour Vs Division of Labourers, hereditary occupations and lack of mobility, notions of purity and pollution, the relegation of physical work as inferior, hierarchizing occupations, artisans and service castes, attached and free farm labour, notions of untouchability and unequal remuneration.

Unit III: Labour and Indian Constitutional Protection: labour and industrial laws; Ambedkar's Contribution in implementing labour reforms, Workers' Rights and Duties; Employers' Responsibilities and Duties; education, employment, and social justice; Women, formalization of maternity and child care provisions, day care centers; Minimum wages act, Workers Basic Rights- Association and Assembly, Work with Equality and Dignity, Education and Information, Trade Unionism and its Development, Industrial Discipline; Risks-Health hazards, Accidents, Occupational Diseases; Impact of Technological Developments; conflicting rights: worker's benefit v/s employer's inconvenience.

Unit IV: **International Conventions on right to work**: ILO Employment Policy Convention 1964 and Recommendations of 1964 & 1984, Discrimination

(Employment and Occupation) Convention 1958 and Recommendation of 1958; ILO Conventions on the Freedom of Association and Protection of the Right to Organize 1948, the Right to Organize and Collective Bargaining 1949; Convention on the Protection of the Rights of All Migrant Workers and Members of their Families 1990, ILO Convention on Migrant Workers.

Unit V: Labour in the Contemporary Society: Globalisation, Advent of multinationals corporates, contract labour and the inherent livelihood insecurity, attrition, large scale lay-off by corporates, Intergenerational Rigidity in shift of Occupations – Case of Barber, Washermen, Artisans, Sanitation Workers, Casualization of labour, feminization of farm labour, possibility of trade unions, and protection of labour rights.

Readings

Mandatory

Breman, J., I. Guerin and A. Prakash. (2009). *India's Unfree Workforce: Of Bondage Old and New*. New Delhi: Oxford University Press.

Breman, Jan and Marcel, Van der Linden. (2014) Informalizing the Economy: The Return of the Social Question at a Global Level. *Development and Change,* 45 (5), 920-940.

Carrier, James. (1992). Emerging Alienation in Production: A Maussian History. *Man* (n.s.), 27 (3), 539-558.

Chandavarkar, Rajnarayan. (1997). 'The Making of the Working Class': E.P. Thompson and Indian History. *History Workshop Journal,* 43 (1), 177-196.

De Neve, Geert. (2019). The sociology of labour in India. In: Srivastava, Sanjay, Abraham, Janaki and Arif, Yasmeen (eds.) *Critical Themes in Indian Sociology*. SAGE Publications. (Accepted)

Mollona, Massimiliano, De Neve, Geert and Parry, Jonathon, (eds.). (2009). *Industrial work and life: an anthropological reader*. London School of Economics monographs on social anthropology, 78, Berg.

Suggestive

De Haan, A. (1999). *Social exclusion: Towards an holistic understanding of deprivation*. Great Britain, Department for International Development, Social Development Division.

De Neve, Geert. (2005). *The Everyday Politics of Labour: working lives in India's Informal Economy.* New Delhi: Social Science Press.

Nash, K. (2015). Do Migrants have rights? In K. Nash, *The political Sociology of Human Rights* (pp. 135-155). London: Cambridge University Press

Nash, K. (2015). Humanising Capitalism. In K. Nash, *The Political Sociology of Human Rights* (pp. 89-114). London: Cambridge University Press

Thompson, Edward P. (1967). Time, Work-Discipline, and Industrial Capitalism. *Past and Present*, 38 (3), 56-97

Thorat, S. Umakant (Eds.) (2004). *Caste, race and discrimination: Discourses in international context.* Jaipur : Rawat Publications

Course Code: **HRIP 516**

Course Title: **FOOD: RIGHTS AND INCLUSIVE POLICY**

Course Objectives:

The course directs an understanding of food as a human right linked to the history of famine, hunger and its culmination in food wars. It also discusses agrarian distress and role of state market policies. It provides understanding on the difference in food security versus food sovereignty debate.

Course Outcomes:

1. Students will understand how food is related to the politics of industry
2. The course will show the significance of food as a human right
3. Students will understand the link between food, peasantry and agrarian crisis
4. The course helps reflect whether food, health, diet and nutrition are choices or compulsions

Syllabus:

Unit I: Hunger, Food, and Nutrition- Persistence of hunger, Agriculture and Economic development, Dietary standards.

Unit II: Population, Land and Food- Unequal distribution of population and foodlands, loss of foodland resources, how much food can the world produce?

Unit III: Developing food and agriculture under capitalism; the rise of farmer's suicides

Unit IV: Food Industry and Food Politics-Governments and the Global food industry lobby

Unit V: Famine, Food wars and Food Sovereignty: what does it mean and how is it a human right; the shift from food security to food sovereignty and its significance.

Readings

Mandatory

Agamben, G. (1998). *Homo sacer: sovereign power and bare life*. Stanford, CA: Stanford University Press.

Beuchelt, T.D. and D. Virchow. (2012). Food sovereignty or the human right to adequate food: Which concept serves better as international development policy for global hunger and poverty reduction? *Agriculture and Human Values*, 29 (2), 259–273.

Boyer, J. (2010). Food security, food sovereignty, and local challenges for transnational agrarian movements: The Honduras case. *Journal of Peasant Studies*, 37(2), 319–351.

Burnett, K. and S. Murphy. (2013). What place for international trade in food sovereignty? Presented at the *Food Sovereignty: A Critical Dialogue International Conference*. Yale University.

Claeys, P. (2012). The creation of new rights by the food sovereignty movement: The challenge of institutionalizing subversion. *Sociology*, 46 (5), 844–860.

Clapp, J. (2012). *Food*. Cambridge, UK: Polity Press.

Clay, E. (2003). Food security: Concepts and measurement. In: FAO, ed. *Trade reforms and food security: conceptualizing the linkages*. (pp. 25–34). Rome: FAO.

Eide A, Eide WB, Goonatilake S, Gussow J, Omawale, (Eds.), (1984). *Food as a Human Right*. Tokyo: United Nations Univ. Press

Sen, A., & Drèze, J. (1999). The Amartya Sen and Jean Drèze Omnibus: (comprising) Poverty and Famines; Hunger and Public Action; and India: Economic Development and Social Opportunity. OUP Catalogue.

Suggestive

Claeys, P. (2013). From food sovereignty to peasants' rights: An overview of via Campesina's struggle for new human rights. In: *La via Campesina's open book: Celebrating 20 years of struggle and hope*. (pp. 1–10). Jakarta: Via Campesina,.

John, Warnock. (1987). The Politics of Hunger. London: Methuen.

Mead, M . (1950). Food and the Family. Paris: UNESCO

Messer, E. (1984). Anthropological perspectives on diet. Annu. Rev. Anthropol. 13:205-49 1 72.

Messer, E. (1989). "Small But Healthy?": Some cultural perspectives. Hum. Organ. 48:39-52

Messer, E. (1989). The right to food and freedom from hunger: cross-cultural perspectives. Abstr. 88th Annu. Meet. Am. Anthropol. Assoc., Washington, DC., p. 37

Messer, E. (1991). Food Wars: Hunger as a Weapon of War in 1990. Providence, Rl:Brown Univ. World Hunger Program Res. Rep. 9 1-3

Messer, E. (1991). Human Rights to Food: Religious Promise and Practice. Human Rights to Food: Religious Promise and Practice Lecture Series, Brown Univ.

Mohanty, B. B. and Papesh K. Lenka. (2016). Neoliberal Reforms, Agrarian Capitalism and the Peasantry. In B. B. Mohanty and Papesh K. Lenka. Critical Perspectives in Agrarian Transition: India in the Global Debate. India: Routledge.

Mohanty, B.B. (2018). *Agrarian Transformation in Western India: Economic Gains and Social Costs*. India: Routledge.

Newman, L. (Ed.). (1990). Hunger in History. Food Shortage, Poverty, and Deprivation. Cambridge: Blackwell

O'Brien J, Gruenbaum E. (1991). A social history of food, famine, and gender in twentieth-century Sudan. See Ref. 70, pp. 1 77- 203

Watts, M. (1983). Silent Violence: Food, Famine and Peasantry in Northern Nigeria. Berkeley: Univ. Calif. Press.

Course Code: **HRIP 517**

Course Title: **RELIGION: RIGHTS AND INCLUSIVE POLICY**

Course Objectives:

The course provides students a reading into different religious traditions and the voice of human rights in them. It then discusses the development of secularisation and religious fundamentalism. The presence of both historically and globally or universally is discussed from a human rights approach.

Course Outcomes:

1. The students will understand human rights ethics through religious diversity

2. They will see the historical transformation from religious fundamentalism to secularisation as a continuity in human society

3. The students will be exposed to cases of religious fundamentalism being in conflict with human rights

4. The students will reflect and question why religious fundamentalism continues to surface in world history

Syllabus:

Unit I: Human Rights and Religious Traditions-I: What do religions have to say about human rights? Jewish theory, Christianity, Islam, Hinduism

Unit II: Human Rights and Religious Traditions-II: Buddhism, Confucianism, Indigenous Religion

Unit III: Secular, Secularisation and Law: Rule of law, Role and limits of Secular Rationale, Religion, public reason and morality in democratic authority

Unit IV: Religious fundamentalism and Human Rights: case studies, Violence and Right to Peace; How to think ethically about religious violence and terrorism; Cultural turn to religious ethics

Unit V: Religion and International Affairs: Freedom of Religion, Religion State relations; Economic, Social and Cultural Rights, Equality and Non-Discrimination

Readings

Mandatory

Chan, Joseph. (1999). A Confucian Perspective on Human Rights for Contemporary China. In Joanne R. Bauer and Daniel A. Bell, (Eds.), *The East Asian Challenge to Human Rights*, (pp.212-237). Cambridge: Cambridge University Press.

Howland, C. (1999). *Religious fundamentalisms and human rights of women*. New York: Palgrave Macmillan.

Nussbaum, M. C. (2001). "The Role of Religion", In Nussbaum, M. C. *Women and human development: The capabilities approach* (Vol. 3). (pp.167-240).Cambridge: Cambridge University Press.

Van der Vyver, J. D. (1996). Religious fundamentalism and human rights. *Journal of International Affairs*, 21-40.

Suggestive

Miller, Richard. (2010). *Terror, Religion and Liberal Thought*. New York: Columbia University Press.

Miller, Richard. (2016). *Friends and Other Strangers: Studies in Religion, Ethics, and Culture*. New York: Columbia University Press.

Tambiah S. (1992). *Buddhism Betrayed?:Religion, Politics, and Violence in Sri Lanka*. Chicago: Univ. Chicago Press

Witte, John. Jr. And M. Christian Green. (2012). *Religion and Human Rights: An Introduction*. New York: Oxford University Press. Chapters: 1-8 & 12, 15, 16, 17, 19, 21, 22.

Course Code: **HRIP 518**

Course Title: **HUMAN RIGHTS IN WAR AND PEACE**

Course Objectives:

The course helps understand the history and causes of war and how technologies facilitate war. It looks at both the economics of war and the economic reasons for war situating peace solutions in economic solidarity.

Course Outcomes:

1. It familiarizes the students with the evolution of International Humanitarian Law.
2. It facilitates the students to understand thecauses of armed conflict
3. The importance and right to peace will be discussed
4. Students will understand the role of governance and their economic interests in facilitating peace

Syllabus:

Unit I: Why War? Understanding Aggression; War an invention not a biological necessity; Causes of War; Resource competition in the 21stcentury

Unit II: Technologies of War- Weapons, drones and nuclear proliferation; Terrorism- Past and Present- case studies, UN General Assembly resolution 54/164 on Human Rights and Terrorism 2000

Unit III: War and Human Rights violations: Case studies;Protection of Human Rights during Violence and Armed Conflict- Discrimination of civilians and civilian objects from military objects, Protection of civilians and humane treatment of the sick and the wounded in conflict and the prisoners of war

Unit IV: Peace, the moral alternative to war; Transforming the war economy into a peacekeeping economy; Peace building; Global Economic Solidarity; Non violence; Peace Movements; On Humane Governance; Antiwar Activists, where are you? Right to peace: Disarmament, eventual destruction of all weapons, means and methods of warfare and violence, problems of dual use technologies, the core problem of mutuality of suspicions, lack of commitment on the part of nations – issues of security of nations, human security.

Unit V: Just war doctrine, Historical Background and Origins of International Humanitarian Law(IHL), Relationship between jus ad ellum and jus in bello, Development of the Geneva Conventions and Additional Protocols; Conclusions of the UNESCO International Colloquium on the Right to Humanitarian Assistance, Paris, 1995, UN Declaration on the Right of Peoples to Peace 1984, Declaration on the Use of Scientific and Technological Progress in the Interests of Peace and for the Benefit of Mankind 1975, UNESCO Declaration and Programme of Action on A Culture of Peace 1999, UNESCO Declaration on Fundamental Principles concerning

the Contribution of the Mass Media to Strengthening Peace and International Understanding

Readings

Mandatory

Baxi U. (1994). *Inhuman wrongs and human rights: unconventional essays*. Har-Anand Publications.

Burgers J. H. (1988). *The United Nations Convention against Torture: A handbook on the Convention against Torture and other cruel inhuman or degrading treatment or punishment* (Vol. 9). Martinus Nijhoff Publishers.

Forrest D. (1996). *A glimpse of hell: Reports on torture worldwide*.

Ghosh S. (1993). *Torture and rape in police custody: an analysis*. Ashish Publishing House.

Jervis R. (2002). Theories of war in an era of leading-power peace presidential address American political science association 2001. *American Political Science Review, 96*(1) 1-14.

Oommen, T. K. (2008). *Reconciliation in post-Godhra Gujarat: The role of civil society*. Pearson Education India.

Samaddar, R. (Ed.). (2004). *Peace studies: An introduction to the concept, scope and themes*. SAGE Publications India.

Singh, N. (1986). *Enforcement of Human Rights: In Peace & War and the Future of Humanity*. Martinus Nijhoff Publishers.

Suggestive

Barash, D. (ed.) 3rd edition. 2013. *Approaches to Peace: A Reader in Peace Studies*. London: OUP.

Bassiouni M. C. (Ed.). (1987). *A draft international criminal code and draft statute for an international criminal tribunal*. Martinus Nijhoff Publishers.

Curtis M. (2017). *Mass atrocity collective memory and the law*. Routledge.

Das S. K. (Ed.). (2005). *Peace processes and peace accords*. SAGE Publications India.

Lederach, J. P. (1995). *Preparing for peace: Conflict transformation across cultures*. Syracuse University Press.

Upadhyaya, P. (2008). Peace and conflict: Reflections on Indian thinking. *Strategic Analysis, 33*(1),71-83.

Wallensteen, P. (2006). Understanding Conflict Resolution: War, Peace and the Global System (Arabic edition).

Woodhouse T. Miall H. Ramsbotham O. & Mitchell C. (2015). *The Contemporary Conflict Resolution Reader*. Polity Press.

Course Code: **HRIP 519**

Course Title: **REFUGEES: RIGHTS AND INCLUSIVE POLICY**

Course Objectives:

The course aims at familiarizing the students with the historical evolution of forced migration and with conceptualizing the idea of Refugees. The role of International organizations and other actors working in this field will be discussed in detail. It also equips the students with insights on legal provisions for the protection of refugees.

Course Outcomes:

1. It familiarizes the students about the ancient roots of protection of foreigners, origins of modern refugee protection, and the state of the world's refugees and forced migrants.

2. It facilitates the students to engage with the legal framework and actors pertaining to the protection of the refugees.

3. It enables the students to critically look at what the UN and human rights standards say about refugee and asylum seekers rights and what States do to guarantee those rights.

4. The specific case studies will enable the students to understand the ground reality in terms of women and children in the refugee camp as well as the gender-based violence in the asylum

Syllabus:

Unit I: What constitutes a refugee- United Nations (1954) *Convention relating to the Status of Refugees;* Contradiction of relevance from II World War to now

Unit II: Convention Relating to Status of Refugees 1951, United Nations (1967) Protocol Relating to the Status of Refugees; UN General Assembly Resolution 54/180 on Human Rights and Mass Exoduses 2000, and the role of UN High Commissioner for Refugees, Declaration on Territorial Asylum 1967, UN General Assembly Declaration on the Human Rights of Individuals who are not Nationals of the Country in which They Live 1985

Unit III: Asylum seekers and rejecting refugees; Evolution of the International Refugee Protection Regime

Unit IV: International Humanitarian Law and International Refugee Law- origin, development, role and status; Indian position on Legal status of refugees; Humanitarian assistance for refugees in India

Unit V: Violations of the Human Rights of Refugees and Asylum Seekers: Case studies

Readings

Mandatory

Benhabib, S. (2004). *The rights of others: Aliens, residents, and citizens* (Vol. 5). Cambridge University Press.

Bhabha, J. (2009). Arendt's children: Do today's migrant children have a right to have rights. *Hum. RTs. Q.*, *31*, 410.

Bohmer, C., & Shuman, A. (2007). *Rejecting refugees: Political asylum in the 21st century*. Routledge.

Chakrabarty, M. (1998). *Human Rights and Refugees: Problems, Laws, and Practices*. New Delhi: Deep & Deep Publications.

Chimni, B. S. (1998). The geopolitics of refugee studies: A view from the South. *Journal of refugee studies*, *11*(4), 350-374.

Chimni, B. S. (Ed.). (2000). *International refugee law: A reader*. SAGE Publications Pvt. Limited.

Suggestive

Dembour, M. B., & Kelly, T. (Eds.). (2011). *Are human rights for migrants?: critical reflections on the status of irregular migrants in Europe and the United States*. Routledge.

Eastmond, M. (2007). Stories as lived experience: Narratives in forced migration research. *Journal of refugee studies*, *20*(2), 248-264.

Fuglerud, O. (2004). Constructing exclusion. The micro-sociology of an immigration department. *Social Anthropology*, *12*(1), 25-40.

Goodwin-Gill, G. S., & McAdam, J. (2007). *The refugee in international law*. Oxford University Press.

Kalam, M.A. (2019). Human history has been a saga of migrations. *The Free Press Journal.*

Knox, K., & Kushner, T. (2012). *Refugees in an age of genocide: Global, national and local perspectives during the twentieth century*. Routledge.

Koehn, P. H., & Sorenson, J. (1994). Refugees from revolution: US policy and Third-World migration. *Refuge: Canada's Journal on Refugees*, *12*(3).

Mantāphǭn, W., & Muntarbhorn, V. (1992). *The status of refugees in Asia*. Oxford University Press.

National Council for Civil Liberties (Great Britain). Human Rights Convention, Foley, C., & Shutter, S. (1995). *The Last Resort: Violations of Human Rights Against Refugees and Asylum Seekers*. The Council.

M.A. HUMAN RIGHTS AND INCLUSIVE POLICY

ADMISSIONS 2019 - 2020

(Offered by Centre for Study of Social Exclusion & Inclusive Policy)

PONDICHERRY UNIVERSITY

(A Central University established under Parliament Act No.53 of 1985)

Why Human Rights ?

The biggest challenge to humanity is to live with tolerance appreciating diversity in all life forms and cultures. This challenge leads to the rising conflicts and human rights violation. Understanding Human Rights is crucial for the wellbeing of people globally in promoting peace.

Highlights

The M.A. Human Rights and Inclusive Policy at Pondicherry University, does not limit its perspective to a legal-political approach but brings in a multidisciplinary Social Science approach to facilitate better understanding of different conflicts and the possibilities in promoting peace and tolerance.

The programme is structured to provide experiential learning with the fourth semester dedicated for Internship and Project work.

Recognition

The Programme is recognized by UGC-NET/JRF examinations and UPSC examinations.

Scope

The programme provides opportunities for higher education and research besides employment in Governmental organizations (both National and International) and Non-Governmental organizations.

Eligibility

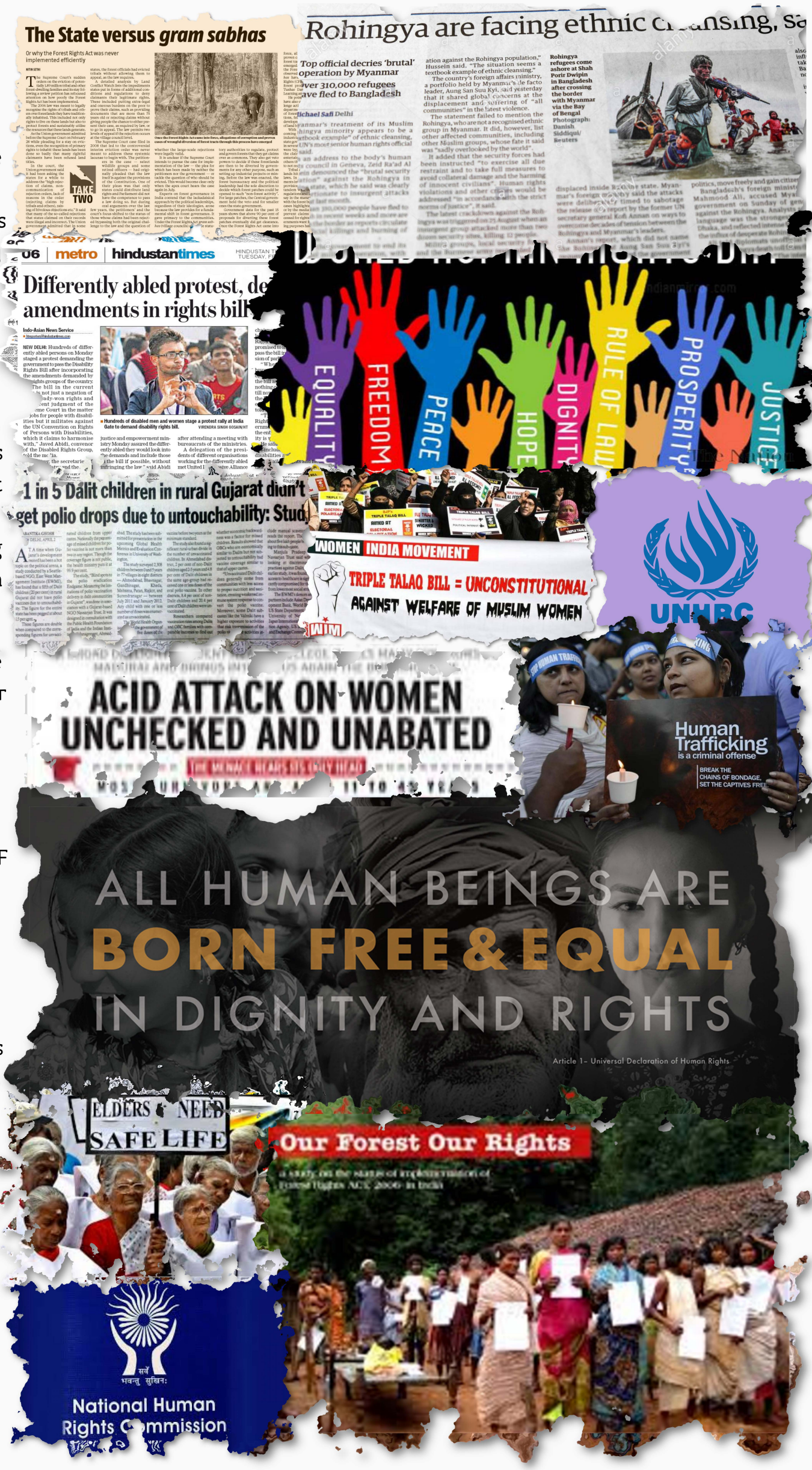
Bachelor's Degree in any discipline with a minimum of 50% marks.

Apply & Admission

https://pu.onlineregistrationform.org/pondiuni

Course Structure & Syllabus

http://www.pondiuni.edu.in/syllabus-oncampus



Online Registration : FROM 22nd March 2019 TO 22nd April 2019

Entrace Examination : 8th June 2019

PONDICHERRY UNIVERSITY

(A Central University under Ministry of Education, Govt. of India.)

School of Management

Department of Commerce

Course Structure & Syllabus

M.Com (Accounting & Taxation)

Choice Based Credit System (CBCS)

For the Candidates admitted in the Academic Year 2023-24

DEPARTMENT OF COMMERCE, SCHOOL OF MANAGEMENT
PONDICHERRY UNIVERSITY
M. COM (ACCOUNTING & TAXATION) (CBCS) DEGREE PROGRAMME
PROGRAMME OUTCOME & COURSE SPECIFIC OUTCOME – MODEL
(APPLICABLE FROM THE ACADEMIC YEAR 2023-24 ONWARDS)

Semester	Course Code	Title of the Paper	Course Specific Outcome
I	**COMM4101**	**Public Finance**	Understanding various resource mobilization techniques Role of taxation and public policy Management and control of public expenditure Impart the knowledge on the key areas in public finance like resource mobilization, public expenditure policy for the good governance.
	COMM4102	**Income Tax Law and Practice**	Computation income Assessment of Tax Liabilities Basic provisions of International Taxation Create the capacity to manage various tax issues in their practical Life and help them to undertake advisory positions in any organization.
	COMM4103	**International Financial Reporting Standard**	Reporting of accounting information in line with the International Accounting Standard Computations of Accounting information's Harmonization of standards Expose the prevailing International Accounting and reporting Systems and to increase the employability of students in MNCs.
	COMM4104	**Financial Management**	Provides greater insights into the broad framework of Financial Management Create better understanding of present value, future value and Annuity concepts It also attempts to impart the skills necessary for making financial decisions Various decision making like, Investment, capital structure, working capital and dividend Able to make return analysis and risk analysis
	COMM4105	**Comprehensive Viva**	Recollect and comprehend the knowledge gained Learn the nuances of facing any interview Develop communication skills Gives finishing school experience Prompting presence of mind and critical thinking
II	**COMM4201**	**Decisions Accounting**	Helps to gain acquaintance with the principles of financial, Cost &Management Accounting and enable the students to take decisions using management accounting tools. Recall the importance of Management accounting and Imbibe critical thinking skills to analyze financial statements. Understanding the different costing methods and techniques and to build knowledge on new costing techniques for effective cost management. Able to determine Optimal managerial decisions like make or buy decisions, shut down or continue. Think critically and creatively about accounting issues and Communicate accounting information effectively in both written and oral form.
	COMM4202	**Advanced Corporate Accounting**	Computations of Goodwill and shares Making decisions on Amalgamation, absorption and reconstructions Calculations and reporting of income and balance sheets of holding and subsidiary companies To enable the students to understand and apply accounting procedure relating to Joint Stock Companies and Public utility undertakings.
	COMM4203	**Advanced Auditing**	Planning and execution of audit Implementation procedures of audit and forensic audit Understanding the audit regulations To acquire the ability to analyse current auditing practices. procedures and application of the same in auditing engagements
	COMM4204	**GST and Customs Law**	Understand the concept of Indirect Tax and Custom Laws and exemption of duties Build knowledge on concepts of GST and the implementation of GST in India Classify the Goods and services exempted from tax and understand the

			procedures of registration and collection of tax. Develop knowledge about Input Tax credit, tax credit in special circumstances and Reverse Charge Mechanism. To understand the indirect tax provisions and recent amendments regarding indirect tax system in India. To get expert opinion to finalize management decisions in connection with various indirect tax issues.
	COMM4205	**Comprehensive Viva**	Recollect and comprehend the knowledge gained Learn the nuances of facing any interview Develop communication skills Gives finishing school experience Prompting presence of mind and critical thinking
	COMM4206	**Business Internship**	
III	**COMM5101**	**Accounting Theory**	Formulation, testing of accounting theory, Reporting practices of accounting information Understanding the relationship between Behavioral research and accounting This course is aimed at students who seek accounting as their profession or anarea for research. This course is indented to develop an in-depth knowledge inthe area of accounting and study the differences in accounting theory and practice.
	COMM5102	**Financial Statement Analysis**	Applications of financial statement analysis tools Financial forecasting Valuation of various items of financial statements This course provides an indebt knowledge on the tools and techniques of analyzing financial statement.
	COMM5103	**Personal Tax Planning**	Understanding the basic concept of personal tax planning Application of tax provisions with respect residence, heads of income and investment Usages of personal tax planning tools To educate the students with the various tax planning measures and instruments and devices and management of personal tax matters
	COMM5104	**Strategic Cost Management**	Understanding the cost strategies Cost control and cost reduction Cost management for specific industry This paper provides advanced cost management tools and strategies for controlling and managing the cost in an organisation
	COMM5105	**Summer Project and Viva Voce**	Helps to identify the research issues/problem and Conduct independent research on a relevant topic in the field of commerce and business Finance. Learn the nuances of application skills Apply their knowledge and skills to solve real-world business problems. Develop skills of data collection and analysis Communicate their research findings effectively in a written report and oral presentation Gives exposure to establish contacts Prompting critical thinking and reviewing a problem and making report
IV	**COMM5201**	**Computerized Accounting**	Understanding the functions of accounting functions through computer Usage and application accounting software Valuations of financial information using computer The purpose of this course is to give hands-on experience to students on cloud computing and help them to maintain the accounts of a firm independently
	COMM5202	**Accounting for Derivatives**	Measurement and Valuations of derivatives Techniques of derivatives accounting Reporting practices of derivatives accounting Impart the knowledge on the derivatives accounting and its implications on the balance sheet items
	COMM5203	**International Taxation**	This course aims at providing basic concepts in international taxation and comparison of Indian tax system with international tax system Learning Outcomes Understanding the basic principles of international taxation Avoidance of double taxation Applications of international tax provisions on cross border merger and acquisition
	COMM5204	**Forensic Accounting and Fraud Risk Management**	Fraud Investigating and Managing the Fraud Supporting the criminal Prosecution in case of need To impart knowledge of using accounting and other tools to detect fraud and manage the fraud risk in the business organization.

	COMM5205	**Comprehensive Viva**	Recollect and comprehend the knowledge gained Learn the nuances of facing any interview Develop communication skills Gives finishing school experience Prompting presence of mind and critical thinking
	COMM5206	**Conferences/Workshops/Publications**	

POOL OF SOFT CORE COURSES

COURSE SPECIFIC OUTCOME
(APPLICABLE FROM THE ACADEMIC YEAR 2023-24 ONWARDS)

Course Code	Title of the Paper	Course Specific Outcome
	Management and Decision	
SCOM01	**Managerial Economics**	Demonstrate a comprehensive understanding of the core concepts and theories of managerial economics, including demand analysis, production and cost analysis, market structure, and pricing strategies. Apply their knowledge to solve real-world business problems, such as investment decisions, capital budgeting, and product pricing. Think critically and creatively about business issues, and develop innovative solutions to problems. Communicate their ideas and findings effectively in both written and oral form. Apply economic theory to analyze business problems and make informed decisions.
SCOM02	**Marketing Strategy**	Understand the key concepts and theories of marketing strategy. Apply their knowledge to develop and implement marketing strategies for a variety of products and services. Conduct market research and analyze market data to inform marketing decisions. Develop and manage marketing campaigns across a variety of channels. Evaluate the effectiveness of marketing strategies and campaigns.
SCOM03	**Human Resource Management**	Understand the key concepts and theories of human resource management (HRM). Apply HRM principles and practices to real-world business situations. Analyze and solve HRM problems effectively. Develop and implement HRM strategies to support organizational goals. Demonstrate ethical and responsible HRM practices.
SCOM04	**Strategic Management**	Understand the fundamental concepts and theories of strategic management. Analyze the internal and external environment of an organization to identify opportunities and threats. Formulate and implement effective strategies to achieve organizational goals. Evaluate the performance of strategies and make necessary adjustments Demonstrate ethical and responsible decision-making in the context of strategic management.
SCOM05	**Family Business Management**	Understand the unique challenges and opportunities faced by family businesses. Apply their knowledge of business management principles to family businesses. Develop strategies for managing family businesses effectively. Communicate their ideas and findings effectively in both written and oral form. Think critically and creatively about family business issues.
SCOM06	**Direct and Indirect Tax Administration**	Demonstrate a comprehensive understanding of the various administrative and regulatory provisions of direct and indirect taxes in India. Gain exposure on different types of taxes. Understand the organisational setup of direct and indirect tax administration. Understand the settlement and composition under direct and indirect tax laws. Apply their knowledge to solve real-world tax problems.
SCOM07	**Corporate Tax Planning and Management**	Understand the basic concepts of corporate taxation in India, including the computation of taxable income and tax liability. Identify and analyze various tax planning strategies for corporations. Advise corporations on how to comply with tax laws and regulations. Prepare tax returns and other tax-related documents for corporations. Represent corporations in tax audits and other tax proceedings..

Decision Tools and Techniques		
SCOM08	**Machine Learning for Financial Decisions**	Understand the basic concepts and principles of machine learning. Apply machine learning algorithms to solve financial problems. Identify and apply the appropriate machine learning algorithm to a given financial problem. Evaluate the performance of machine learning models. Communicate machine learning findings effectively to stakeholders.
SCOM09	**Principles of Artificial Intelligence**	Define artificial intelligence (AI) and explain its key concepts and theories. Identify and apply a variety of AI techniques to solve real-world problems. Understand the ethical implications of AI and its impact on society. Think critically about AI and its applications. Evaluate AI research papers and identify promising new ideas.
SCOM10	**Computer applications in Business**	Demonstrate a comprehensive understanding of the fundamental concepts of computer applications in business. Use various business application software, such as word processing, spreadsheet, presentation, and database software. Apply their knowledge to use various computer applications to solve real-world business problems. Communicate their ideas and findings effectively in both written and oral form. Think critically and creatively about the use of computer applications in business.
SCOM11	**Research Methodology**	Understand the basic concepts and principles of research methodology. Identify and apply appropriate research methods to different types of research problems. Collect, analyze, and interpret data using appropriate statistical methods. Write research reports and articles in a clear and concise manner. Communicate research findings effectively to both academic and non-academic audiences
SCOM12	**Statistics for Business Decisions**	Understand the basic concepts and principles of statistics. Apply statistical methods to analyze business data and make informed business decisions. Communicate the results of statistical analysis effectively to both technical and non-technical audiences. Describe the different types of data and how to collect and organize them. Calculate and interpret descriptive statistics, such as mean, median, mode, standard deviation, and correlation coefficient.
SCOM13	**Operations Research**	Understand the fundamental concepts and principles of operations research. Formulate and solve real-world problems using operations research techniques. Apply operations research to various business functions, such as production, transportation, and inventory management. Use operations research software to solve complex problems. Communicate the results of operations research studies effectively.
Investment and Risk Management		
SCOM14	**Stock and Forex Trading Lab**	Understand the operations of the stock and forex markets. Apply their knowledge to trade stocks and currencies using a simulated trading platform. Analyze market data and trends to make informed trading decisions. Develop and implement trading strategies to manage risk and maximize profits. Use various trading tools and techniques to enhance their trading performance.
SCOM15	**Multinational Financial Management**	Demonstrate a comprehensive understanding of the unique challenges and opportunities facing multinational corporations in managing their finances. Apply their knowledge to make informed financial decisions in a global context. Analyze and interpret global financial markets and data. Assess and manage foreign exchange risk. Develop and implement global financing strategies.
SCOM16	**Fund Management in Commerce Banks**	Demonstrate a comprehensive understanding of the principles and practices of fund management in commercial banks. Apply their knowledge to manage the funds of commercial banks effectively.

		Analyze the financial performance of commercial banks and develop strategies to improve their performance. Make informed decisions about the allocation of funds and the investment of funds. Manage the risks associated with fund management in commercial banks.
SCOM17	**Commodity derivatives markets & applications**	Demonstrate a comprehensive understanding of the concepts of commodity derivatives markets and their applications. Apply their knowledge to the functioning of commodity exchanges and different types of commodity derivatives contracts. Analyze the risks and rewards associated with commodity derivatives trading. Develop strategies for hedging and speculation in commodity derivatives markets. Communicate their ideas and findings effectively on commodity derivatives markets and their applications.
SCOM18	**Investment Valuation**	Understand the different types of investments and their valuation methods. Apply various valuation techniques to different investment assets, such as stocks, bonds, and real estate. Conduct investment research and make informed investment decisions. Analyze the performance of investment portfolios and make necessary adjustments. Communicate their investment analysis and recommendations in a clear and concise manner.
SCOM19	**Financial Risk Management**	Demonstrate a comprehensive understanding of the different types of financial risks and the tools and techniques used to manage them. Apply their knowledge to identify, assess, and mitigate financial risks in real-world business settings. Communicate their understanding of financial risk management effectively in both written and oral form. Think critically and creatively about financial risks and develop innovative solutions to manage them. Demonstrate the research skills necessary to conduct independent research on financial risk management.
SCOM20	**Forensic Accounting and Fraud Risk Management**	Apply the knowledge of forensic accounting and fraud risk management to real-world business problems. Analyze business cases and develop solutions to fraud risk management problems Communicate their ideas and findings effectively in written and oral form. Think critically and creatively about fraud risk management issues, and develop innovative solutions to problems. Conduct independent research in the field of forensic accounting and fraud risk management, and communicate their findings in a scholarly manner.
SCOM21	**Personal Finance**	Understand the fundamental concepts of personal finance, including budgeting, saving, investing, and insurance. Apply their knowledge to develop and implement a personal financial plan. Make informed financial decisions that are aligned with their personal goals and objectives. Evaluate and compare different financial products and services. Manage their financial resources effectively and efficiently
SCOM22	**Financial Derivatives (For students from AT and Other Departments)**	Demonstrate a comprehensive understanding of the concepts and theories of equity derivatives. Apply their knowledge to price and hedge equity derivatives. Communicate their ideas and findings effectively in both written and oral form. Think critically and creatively about equity derivative markets. Demonstrate the research skills necessary to conduct independent research in the field of equity derivatives.
Finance and Accounting		
SCOM23	**Merchant Banking and Financial Services**	Understand the concept and role of merchant banking in the financial system. Identify the different types of merchant banking services and their features. Analyze the financial performance of companies and assess their creditworthiness. Structure and document merchant banking transactions. Advise companies on corporate finance and strategic matters.
SCOM24	**Corporate Governance**	Demonstrate a comprehensive understanding of the principles and practices of corporate governance.

		Apply their knowledge to analyze and evaluate corporate governance practices in different contexts. Identify and assess the risks associated with poor corporate governance. Develop and recommend corporate governance reforms that promote transparency, accountability, and sustainability. Communicate their ideas and findings on corporate governance effectively in both written and oral form.
SCOM25	**Strategic Financial Management**	Understand the theoretical and practical aspects of strategic financial management. Apply financial management concepts and tools to solve real-world business problems. Make informed financial decisions that align with the organization's strategic goals and objectives. Communicate financial information effectively to both internal and external stakeholders. Analyze the financial performance of an organization and identify areas for improvement.
SCOM26	**International Accounting**	Understand the key concepts and principles of international accounting. Apply their knowledge to prepare and analyze international financial statements. Understand the different accounting standards used in different countries. Identify and address the challenges of accounting for international transactions. Develop the skills necessary to work as an accountant in a multinational company.
General		
SCOM27	**Value added courses (Only up to III Semester)**	Discuss the key concepts and theories of banking and finance. Apply their knowledge to various banking and financial operations, such as deposit mobilization, loan processing, and investment management. Communicate the benefits and risks of various banking and financial products and services to their customers in a clear and concise manner. Provide customer service in a professional and efficient manner
SCOM 30	**Entrepreneurship Development**	Define and explain the key concepts and theories of entrepreneurship, such as entrepreneurial orientation, innovation, and risk-taking. Discuss the entrepreneurial process, including opportunity identification, business planning, and venture launch and management. Identify and assess business opportunities, taking into account factors such as market needs, competitive landscape, and financial resources. Develop and implement business plans, including setting goals and objectives, developing strategies, and forecasting financial performance. Manage entrepreneurial ventures, including making strategic decisions, managing resources, and leading teams
SCOM 33	**Contemporary Legal Framework**	Demonstrate an understanding of the key concepts and principles of contemporary legal frameworks that are relevant to business organizations. Identify and analyze the various legal issues that can arise in the course of business operations. Apply their knowledge of contemporary legal frameworks to solve real-world business problems. Communicate their ideas and findings effectively in both written and oral form on legal matters. Explain the key features of competition law, foreign exchange management law, consumer protection law, and environmental law.
Softcore courses from Other Departments		

PONDICHERRY UNIVERSITY

(A Central University under Ministry of Education, Govt. of India.)

School of Management

Department of Commerce

Course Structure & Syllabus

M.Com (Business Finance)

Choice Based Credit System (CBCS)

For the Candidates admitted in the Academic Year 2023-24

Programme Specific Outcomes (PSOs)

The M.Com course provides an extreme and rigorous base for teaching, research and allied business administration. It serves the needs of academics and prepares students for research and teaching. The course is well received in the industry and for years they have been serving the needs of finance and accounting professionals in business and industry. M.Com Course offers research in diverse areas of Commerce discipline and has large base of research contribution. Teaching pedagogy and andragogical methods are adopted to ensure all round learning for the students. Department of Commerce aligns itself with the overall vision of the University i.e. M.Com Course attempt to kindle their sense of responsibility, honesty, conscience, justice and above all commitment to human values.

This M.Com Course aims to upgrade the standards of teaching and research and deliver an education system that is a source of building wisdom thinking, integrity and commitment which are the need for national pride and public confidence. The curriculum has been designed in such a way that our students are getting into teaching positions of HEIs of IIM, IIT, Central Universities and many state universities and colleges. The programme specific outcomes are listed below:

- The student can meet the prospective employer requirements like: Learning, aptitude, job proficiency and job needs/requirements and also pursue research in commerce and management areas.
- After completion of the program the students can seek placement in the areas of Corporate bodies, Banks & Financial institutions, NBFCs and NGOs to get into the position of Accounting Executives, Financial Analyst, Tax Manager, HR and Marketing Researcher/Analyst.
- The M.Com. Course provides an extreme and rigorous base for teaching, research and entrepreneurial ventures/ startups
- Gives domain specific knowledge with critical thinking and Problem Solving ability and kindle their sense of responsibility, honesty, conscience, justice and above all commitment to human values.
- Help to gain Analytical reasoning power, skills, Application skills and Decision making skills. And also impart exponential learning, reflective thinking, Employability
- Empirical Knowledge, Information, life skills and moral/ ethical awarewness and values for life and character building

DEPARTMENT OF COMMERCE, SCHOOL OF MANAGEMENT
PONDICHERRY UNIVERSITY
M. COM (BUSINESS FINANCE) (CBCS) DEGREE PROGRAMME

COURSE SPECIFIC OUTCOME
(APPLICABLE FROM THE ACADEMIC YEAR 2023-24 ONWARDS)

Semester	Course Code	Title of the Paper	Course Specific Outcome
I	MCOM4101	**Financial Management**	Various decision making like, Investment, capital structure, working capital and dividend. To provide an insight into the broad framework of Financial Management. It also attempts to impart the skills necessary for making financial decisions
	MCOM4102	**Organizational Behavior**	Demonstrate the applicability of the concept of Organisational Behaviour to understand the individual and group behavior of people in the organisation. To provide comprehensive introduction to the area of organizational behaviour and to familiarize the functioning of the organizational environment.
	MCOM4103	**Statistics for Business Decisions**	Emphasis will be on the application of the concepts learnt to various managerial situations. To familiarize the students with various Statistical Data Analysis tools that can be used for effective decision making. Emphasis will be on the application of the concepts learnt to various managerial situations.
	MCOM4104	**Income Tax Law and Practice**	Assessment of tax for person, provisions relating to deductions and International perspectives of Taxation. To create the capacity of the stakeholder to manage various tax issues for their practical Life and help them to undertake advisory positions in any organization.
	MCOM4105	**Comprehensive Viva**	Purpose of this Viva is to assess and examine the understanding of subjects studied/learned during this semester.
II	MCOM4201	**Decisions Accounting**	To gain acquaintance with the principles of financial, Cost &Management Accounting. To enable the students to take decisions using management accounting tools. Recall the importance of Management accounting and Imbibe critical thinking skills to analyze financial statements. Understanding the different costing methods and techniques and to build knowledge on new costing techniques for effective cost management. Able to determine Optimal managerial decisions like make or buy decisions, shut down or continue. Apply the financial statement like cash flow statement and funds flow statement in decision making process.
	MCOM4202	**Financial Mathematics**	Restate the Definition, Concept, Importance and scope of Financial mathematics Gaining conceptual knowledge and application skills on Vector analysis, Multiple integration and linear integral Solve the problems on Differential equations Application skills on numerical techniques in Finance Understanding the nature, assumptions and working of different models of Financial Markets. Aims at the active and practical use of mathematics in Financial Market To gain knowledge on different models of Financial Markets

	MCOM4203	**GST and Customs Law**	Understand the concept of Indirect Tax and Custom Laws and exemption of duties Build knowledge on concepts of GST and the implementation of GST in India Classify the Goods and services exempted from tax and understand the procedures of registration and collection of tax Develop knowledge about Input Tax credit, tax credit in special circumstances and Reverse Charge Mechanism Understand the taxability procedure on goods and services and advanced ruling and e-Invoice To understand the indirect tax provisions and recent amendments regarding indirect tax system in India. To get expert opinion to finalize management decisions in connection with various indirect tax issues.
	MCOM4204	**Financial Modeling**	Hands on experience in excel for financial functions Developing and Documenting excel models Insights on mechanics of Equity Analysis Testing methodology of Security Market Line Methodology and conduct of Event Studies Teaching with visual aids and Excel worksheet To introduce you to the application of excel in finance To develop your ability in using spreadsheets for financial modeling
	MCOM4205	**Comprehensive Viva**	Purpose of this Viva is to assess and examine the understanding of subjects studied/learned during this semester.
	MCOM4206	**Business Internship**	
III	MCOM5101	**Financial Institutions and Instruments**	Indian Financial Systems with instruments and the role of intermediaries. To familiarize students with Financial System, Institutions & Market and to help them to acquire skill to deal with various financial instruments
	MCOM5102	**Investment & Portfolio Management**	1.Learn to compute historical and expected returns as well as the risk measures 2.Construct and Manage a Portfolio To expose students on the various avenues available for effective investment and possible way to avoid risk in investments through portfolio Management.
	MCOM5103	**Computer Aided Multivariate Data Analysis**	1.Understanding the assumptions made in performing each analysis and test, 2.Decide what method to use with their dataset, 3.Analyse the data and get the results, 4.And interpret the results and explain the findings to others. The course is aimed at imparting advanced data analysis skills using software's like MINITAB and SPSS to enhance the research capability of a student.
	MCOM5104	**Business Analytics for Decision Making**	Gaining exposure on different types of business analytics Knowledge on Measurement Scales and its applications Understanding the working of Linear Programming Workings on different methods of data forecasting Insights about data analytics softwares. The objective is to provide relevant experience in data analytics to take business decisions scientifically.
	MCOM5105	**Summer Project and Viva Voce**	Students will be equipped with practical skills and knowledge. This paper aimed to equip student with the advances and industry specific activities of the business through research or internship and apply the theoretical knowledge learned.
	MCOM5201	**International Finance**	Apply the knowledge in foreign exchange

			To mitigate the exposure of currency fluctuations To help students to trade in foreign exchange To know various tools in handling currency exposure To explain the outcomes and reactions of MNC on various decisions To check the viability of an international project in terms of profitability and cash flows Effectively communicate the outcome of the analysis t all the stakeholders.
IV	MCOM5202	**Equity Derivatives**	Explain the need to hedge Calculate the payoffs one can receive through options Make option strategies To help students understand the concepts and equip them to take investment and trading positions in the options and futures market.
	MCOM5203	**Behavioral Finance**	Decision Making Avoiding heuristic bias Behavioral economics The purpose is to develop a strategic and policy perspective of Behavioural Finance and Investment Management.
	MCOM5204	**Corporate Finance Lab**	To enable the students to conduct Fundamental Analysis and Technical Analysis of company using real time data. Gives the hands on experience using real live data also it will help the students to give financial consultancy firms
	MCOM5205	**Comprehensive Viva**	Purpose of this Viva is to assess and examine the understanding of subjects studied/learned during this semester.
	MCOM5206	**Conferences/Work shops/Publications**	Gaining acquaintance with different HEIs to participate in conference and present papers. Developing publication skill.

POOL OF SOFT CORE COURSES

COURSE SPECIFIC OUTCOME

(APPLICABLE FROM THE ACADEMIC YEAR 2023-24 ONWARDS)

Course Code	Title of the Paper	Course Specific Outcome
Management and Decision		
SCOM01	**Managerial Economics**	Basic application of Economics in Business Decision Making. Objective of this paper is to provide the basic concepts in Managerial Economics.
SCOM02	**Marketing Strategy**	Devising strategies to sell the product and segmentation. The Objective of this course is to develop both theoretical and practical understanding to the various concepts of International Marketing.
SCOM03	**Human Resource Management**	Gives insights about the basic concept of HRM and itsevolution and challenges. Articulate human resource planning using quantitative and qualitative Dimensions. Knowledge on different methods of training and performance appraisal methods and their link with compensation. Strategies of Talent Management and Change Management. Understand the concept of HR Analytics and its applications. Acquaintance with the essential functions of HRM
SCOM04	**Strategic Management**	Learn to Think Critically and understand complex business challenges. Learn to Strategize, Collaborate for better implementation of Strategies. Acquire Leadership skills to solve and implement strategic understanding to work for success in business. Understand the Global Business Scenario and manage the Global Work Force. The course introduces the students with the global business conditions and familiarizes them with the strategies for meeting global competition..
SCOM05	**Family Business Management**	Development and implementation of effective governance. Devising strategies for family business. Understanding the basics of succession planning. Gives exposure on situational aspects of family owned business, its growth and sustainability.
SCOM06	**Direct and Indirect Tax Administration**	Gaining exposure on different types of taxes. Organisational setup of Direct tax administration. Organisational setup of Indirect tax administration. Settlement and composition under direct and indirect tax laws. Understand the various administrative and regulatory provisions ofDirect Tax andIndirect taxes in India.
SCOM07	**Corporate Tax Planning and Management**	Giving expert advice in corporate tax planning. Able to independently handle corporate tax planning. Due diligence and compliance of tax laws. Understand the innovative ideas in corporate tax in India and to give expert advices to whom is required regarding various tax issues for decision-making.
Decision Tools and Techniques		
SCOM08	**Machine Learning for Financial Decisions**	Design a neural network for an application of your choice Identify applications suitable for different types of machine learning with suitable justification

		Implement probabilistic discriminative and generative algorithms for an application of your choice and analyze the results Use a tool to implement typical clustering algorithms for different types of applications Design and implement on HMM for a sequence model type of application Gaining understanding on the concepts of machine learnings Appreciate the supervised and unsupervised learning and its applications Understand the theoretical and practical aspects of Probabilistic Graphical Models Learn the concepts and algorithms of reinforcement learning, computational learning theory
SCOM09	**Principles of Artificial Intelligence**	Understanding the basic areas of artificial intelligence including problem solving, knowledge representation, reasoning, decision making, planning, perception and action, and learning - and their applications (e.g. Data mining, information retrieval). Able to design and implement key components of intelligent agents of moderate complexity in Java and/or Lisp or Pro-log and evaluatetheir performance provides AI application in Business, Finance and Accounting
SCOM10	**Computer applications in Business**	Understanding of the basic areas of computer applications. This course is intended to introduce you to the application of excel infinance. The course seeks to develop your ability in using spreadsheets for financial modelling
SCOM11	**Research Methodology**	Sensing the importance of Research and development of Research design. Gain knowledge about Data Acquisition, Data Pre-processing and preparation Understand the concepts and applications of **R and Excel Programming.** Computational skills on widely using statistical techniques in various business research areas. Impart knowledge on Research Methodology Theory and Techniques for identifying, analysing and interpreting research problems in the real life situations.
SCOM12	**Statistics for Business Decisions**	Applications of statistical softwares Interpretations of the results Making decisions based on the results Familiarising various Statistical Data Analysis tools that can be used for effective decision making. Application of the concepts learnt to various managerial situations
SCOM13	**Operations Research**	Cost cutting and profit maximisation through Liner programming Assigning the job Management and control of Inventory Knowing the application of Operations Research techniques for taking managerialdecisions
Investment and Risk Management		
SCOM14	**Stock and Forex Trading Lab**	Students who complete this course can do stock and forex trading. Understating the operations of the security market Gaining knowledge on the Trading Process, settlement, and legal frameworks
SCOM15	**Multinational Financial Management**	Gain insights on the basics of Multinational FinancialManagement Demonstrating the International portfolio, capital structure and working capital management. Create understanding on financial management of MNC's with special emphasis on cost of capital, Portfolio investment, Internationaltaxation and managing political risk
SCOM16	**Fund Management in Commerce Banks**	Create better understand about the general banking scenario of India The student will also acquaint himself with practical banking application and the regulation governing this sector Demonstrate an understanding of the financials of the bank.

		Able to test the soundness of the bank thorough CAMEL mode Gain knowledge on credit analysis, financial distress prediction and investment practices of banks
SCOM17	**Commodity derivatives markets & applications**	Helps to understand the general commodity market scenario inIndia Acquaint with practical aspects of commodity derivative market application and the regulation governing this sector. Knowledge on Commodity derivative markets, regulatory framework, risk management and Spot and Futures Market Operations
SCOM18	**Investment Valuation**	Provide practical knowledge on Valuing the Equity and Firm. Understanding the various investment valuation techniques. Measuring the earnings valuation implications on market efficiency. Helps in developing Financial models practiced in Industry.
SCOM19	**Financial Risk Management**	Measurement of various financial risk viz, equity, forex and commodity Application of risk management techniques Understanding the hedging techniques The course aims at familiarizing the students with principle and practices of Financial Risk Management and enables them to develop decision making skills in management risk.
SCOM20	**Forensic Accounting and Fraud Risk Management**	Fraud Investigating and Managing the Fraud. Supporting the criminal Prosecution in case of need Impart knowledge of using accounting and other tools to detect fraud and manage the fraud risk in the business organization.
SCOM21	**Personal Finance**	Knowledge on investment selections, Investment evaluation & Portfolio construction. Find direction and guidance in one's financial decisions Understand how each financial decision affects other areas of finance Ensure the financial stability for adapting to life changes
SCOM22	**Financial Derivatives (For students from AT and Other Departments)**	Explain the need to hedge Calculate the payoffs one can receive through options Frame option strategies Understand the concepts and equip investment trading positions in options and futures market.
Finance and Accounting		
SCOM23	**Merchant Banking and Financial Services**	Aware of Role and responsibilities of Merchant Banker, Rules and Regulations to Merchant banking in India Knowledge on financial services to get job opportunities in companies which are specializing in it.
SCOM24	**Corporate Governance**	Give insights on the evolution and development of corporate Governance along with the issues and practices that governs corporate sectors. Understand the concepts of corporate governance Value the shareholder and stakeholder rights and responsibilities Relationship between Corporate Governance, Corporate Finance, Investments and Shareholders wealth maximisation
SCOM25	**Strategic Financial Management**	Effective application of strategies Making strategic decisions Familiarize the concepts and approaches of managing corporate finance from Strategic perspective.
SCOM26	**International Accounting**	Understand the concepts of International accounting system Identifying the country differences in accounting practices Comparative analysis of major accounting issues Narrate the prevailing International Accounting Systems Enhance the employability of students in MNCs
General		
SCOM27	**Value added courses (Only up to III Semester)**	Student can opt their subject based on their interest & requirements The student has to register and complete a certification course offered by any one of the online platforms such as NISM, Swayam-NPTEL, MOOC etc.

		(certification from any one module)
SCOM 30	**Entrepreneurship Development**	Develop awareness about entrepreneurship and successful entrepreneurs. Develop an entrepreneurial mind-set by learning key skills such as design, personal selling, and communication. Understand the DNA of an entrepreneur and assess their strengths and weaknesses from an entrepreneurial perspective. Create and validate a business model and business plan for their idea Gain awareness about the availability of institutional support for young entrepreneurs.
SCOM 33	**Contemporary Legal Framework**	Understanding the various Laws that are applicable to business entity Basics provisions of the enactment and its scope Give an overview about contemporary legislation very well applicable to Modern Business units
Softcore courses from Other Departments		

Course Structure and Syllabus

for

M.A. Women's Studies

Approved by

Board of Studies, Centre for Women's Studies

on

17-04-2019

CENTRE FOR WOMEN'S STUDIES

SCHOOL OF SOCIAL SCIENCES AND INTERNATIONAL STUDIES

PONDICHERRY UNIVERSITY

(A Central University)

Course Code	**WS 411**
Course Title	**INTRODUCTION TO WOMEN'S STUDIES**
Course Objectives	This course is designed for people with a strong interest in Women's Studies as a field of academic study. The aim of this course is to enable students to understand their world and themselves better and thereby to empower them to make change.
Course Outcomes	• The course provides an insight into the basic concepts related to sex, gender, femininity etc. • The students will understand the rationale for women's studies • It discusses contemporary Gender Equality Issues and Movements and key debates in Women's Studies
Syllabus	
Unit I	Basic Concepts: Sex – Gender – Femininity – Masculinity- Gender role Socialisation – Nature vs. Nurture - Gender Equality - Biological Determinism & Social Constructionism - Gender Stereotypes - Doing Gender – Perspectives on Transgender
Unit II	Understanding Patriarchy & Oppression: Understanding "social location" and "the intersectionality of oppression" Androcentrism – Heteronormativity – sexuality and power – Public-Private dichotomy – Sexual/Gendered division of work - Understanding Patriarchy (Individual & Institutional) and oppression
Unit III	Achieving Gender Equality: Gender Planning - Gender Mainstreaming – Gender Budget – Gender Audit
Unit IV	Rationale for Women's Studies: What is Women's Studies? - Why Women's Studies? — Women's Studies as an interdisciplinary field – Development of Women's Studies in India – UGC's initiatives
Unit V	Global Issues: Contemporary Gender Equality Issues and Movements – Key debates in Women's Studies

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Course Code	**WS 412**
Course Title	**WOMEN'S MOVEMENTS**
Course Objectives	Movements are a primary agent of social and political change for nation-states, groups and individuals. The course is structured to briefly review previous women's movements and their central concerns for the purpose of understanding those issues that have been resolved (or still remain) and to discuss how previous movements formed. This is a chance to update women's concerns through the fresh lens of a new generation.
Course Outcomes	• The course provides opportunity for students to know the details of women's movements in India and the Western world. • The students will understand the emergence of women's question in India and Women's Activism/Movements in Post-Independence India. • It discusses contemporary debates surrounding Women's Activism/ Movement in India
Syllabus	
Unit I	Contextualizing Women's Movements: Understanding the category of Woman - Women's Movement as a Social Movement - History of Women's question (Suffrage, Working Women issues, Birth Control Movement) – Brief overview of Women's Movement in USA, Europe, Africa, Asia and Latin America
Unit II	Women's Movements in the Western World: Rise of Feminism as a concept, ideology and practice - Ideas of Enlightenment and the quest for women's rights; History of women's/feminist movements in Western world – women's socio-economic conditions during pre-industrial and industrial times ¬ The Seneca Falls Convention - Suffrage Movement - Waves of Feminism - History of women's/feminist movements in non-Western world.
Unit III	Emergence of Women's Question in India: Colonial/pre-independence times: Women's issues in colonial India, bride price, sati, child marriage, plight of widows, religious dedication etc. Social reform movement - Contribution of women in colonial India - emergence of social reform movements and the Woman's Question – Colonial & Nationalist responses - Women's representation in Karachi Congress Resolution, Women's Participation in National Movement, establishment of important women's organizations such as AIWC - Important women leaders
Unit IV	Women's Activism/Movements in Post-Independence India: Towards Equality Report – select movements and women's participation - Women's groups and organizations, some autonomous Women's Movement- Roop Kanwar incident and anti-sati agitation - Movements for Uniform Civil code and Shah Bano case.
Unit V	Contemporary debates surrounding Women's Activism/ Movement in India: Constitutional rights of women and Hindu civil code; property rights of minority women; Dalit feminism and the question of double marginality; women's participation in civil organizations and public sphere activities; challenges to feminism: globalization and religious fundamentalism - Gender Wage Gaps and Glass Ceiling, development programmes and rural, poor women – Retrieving the forgotten female activists and leaders from colonial to post-independence times – Focus on their selected texts – Challenges to

	Women's Movements in India: casteism, moral policing, marginalization of women's issues.

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Course Code	**WS 413**
Course Title	**WOMEN AND SOCIETY**
Course Objectives	This course will highlight the social construction of gender in Indian society and the role of social institutions in the socialization process. Gendered family relations do not occur in vacuum and the course work help trace the reasons of gender inequality and gender discrimination.
Course Outcomes	• The students will understand the Social construction of Gender, Gender Roles and Gender stereotyping. • The course will enable students to understand Women and Religion and Religious conceptualization of women. • It discusses Social Structures, Changing Status of Women in India and Contemporary Debates on Indian women and Empowerment.
Syllabus	
Unit I	Social Construction of Gender: Sex and Gender - Nature versus Culture, Equality versus Difference - Gender Roles, Gender stereotyping.
Unit II	Women and Religion: women as repositories of cultural practices and traditions - Sexual division of labour -, Public-Private Dichotomy - Religious conceptualization of women.
Unit III	Social Structures : Kinship - Forms of Family and Household - Institutions of Marriage and Divorce, Politics of reproduction, Dowry, Property Rights - Class/Caste: hierarchy, difference and mobility
Unit IV	Changing Status of Women in India: Women in Ancient and Pre-Colonial India - Women in Colonial Period: Women's participation in the freedom movement, and women's organization - Women in Post-Colonial India: Towards Equality Report, Sharamshakti Report
Unit V	Contemporary Debates: Indian women: Identity and Illusion - Representation and Issues of marginalised women - Violence, victimhood and agency – Empowerment.

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Course Code	**WS 421**
Course Title	**FEMINIST THEORIES AND CRITIQUES**
Course Objectives	The course will investigate contemporary feminist thought from a variety of disciplinary perspectives and theoretical orientations. The focus is on key issues in feminist theory such as the sex/gender debate, sexual desire and the body and the construction of masculinity among others. This course aims also to think through the ways in which these issues intersect with race, class, colonialism and the nation. We will discuss
Course Outcomes	• The course will facilitate students to understand feminism and feminist consciousness. • The students will have a detailed understanding of different waves of feminism such as liberal, radical and black feminism. • It familiarizes students with key contributions of pioneers in feminism.
Syllabus	
Unit I	Understanding Feminism – origins and history of feminism – who is a feminist – feminist consciousness – being a woman/ becoming a woman - Why theory?
Unit II	First wave of feminism - Liberal feminism and focus on individualism, liberty, equality, rationality - Marxist feminism and class, alienation, domestic labour, production-reproduction, Socialist feminism and Dual system & unified system theory - critique
Unit III	Second wave of feminism - Radical Feminism – the personal is political – debate on abortion, reproduction, sexuality, pornography - Sisterhood and Sexual Oppression - Radical Rejection of Patriarchy - Feminism of Difference - Politics of the Private Sphere
Unit IV	Questioning Universals - Black feminism and the issue of race – intersectionality - Post-Structural/Post-Modern Feminism and the Rejection of Grand Narrative and Essentialism - Difference and Deconstruction – Backlash against feminism - Queer Theory/perspectives – Psychoanalytic feminism - Masculinities – Ecofeminism – Feminist standpoint theory
Unit V	Focus on key feminist texts – The Feminine Mystique (Betty Friedan), A Vindication of the Rights of Woman (Mary Wollstonecraft), In Search of Our Mother's Gardens (Alice Walker), The Second Sex (Simone de Beauvoir), The Beauty Myth (Naomi Wolf), The Subjection of Women (J S Mill), Origins of the Family, Private Property and the State (F. Engels) etc.

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Course Code	**WS 422**
Course Title	**GENDER, POLITICS AND LEADERSHIP**
Course Objectives	The objective of this course is to develop an understanding of the issues related to political participation of women and the gendered structures of governance and polity. It also aims to sensitize the students about the practical issues concerning gender and politics.
Course Outcomes	• The course will focus on the concepts of democracy, politics, gender notion of citizenship etc. • The gendered political participation, struggle for political participation and women in politics are provided in detail. • The students get to understand the critical debates on challenges of gender stereotypes, feminism and biopolitics.
Syllabus	
Unit I	Conceptualizing democracy, politics, gendered notion of citizenship, the citizenship and government – power and participation
Unit II	Historical exploration of women's struggle for political participation – struggle for suffrage rights – feminist critique of power & 'malestream' politics - Why gender and politics?
Unit III	Analysing Gendered political participation and representation globally – reasons for gender gaps in politics – governance and gendered structures
Unit IV	Women in politics: Indian perspective – examining existing and possible barriers – difference made by women in the sphere of politics – politics of reservation – women's participation in local self-governance - gender and leadership - Do women make a difference?
Unit V	Critical debates: challenging gender stereotypes in political sphere – importance of capacity building - feminism & biopolitics

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Course Code	**WS 423**
Course Title	**WOMEN AND DEVELOPMENT**
Course Objectives	The course is premised on the Gender specific development needs. It seeks to provide exposure to students regarding development process and development indicators and the place of women in it. It aims to train the students in engendering national policies and programmes
Course Outcomes	• The students will understand the key concepts of development, gender and development and gender disparity etc. • The course will enable students to understand different approaches to women development and international interventions. • It discusses national machinery for women's development and international agencies for women's development.
Syllabus	
Unit I	Introduction: Conceptual analysis of development - Theoretical perspectives of Gender and Development - Measures of development - Gender disparity: Global and Indian scenario – Literacy – Labour force participation – Political participation – Health - HDI
Unit II	Approaches to Women and Development: Women in Development (WID) - Women and Development(WAD) - Gender and Development(GAD) -Women Empowerment – key issues in Development
Unit III	Women's Development and International Interventions: International Women's Decade - Plan of Action-Mexico 1975 - CEDAW -Programme of Action-Copenhagen1980 - Forward Looking strategies-Nairobi 1985 - Platform for Action-Beijing 1995 – MDGs - SDGs.
Unit IV	National Machinery for Women's development: Ministry of Women and Child Development- National Commission for Women, Central Social Welfare Board (CSWD) - National Institute of Public Co-operation and Child Development (NIPCCD) - Rashtriya Mahila Kosh (RMK) - State Departments of Women and Child Development - Mahila Samakhya - State Commission for Women- GeM
Unit V	International Agencies for Women's Development: UNFPA, UNICEF, UNIFEM, FORD Foundation, UNDP, OXFAM, UNWOMEN

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Course Code	**WS 511**
Course Title	**WOMEN AND HEALTH**
Course Objectives	The course discusses the issues of Women's health and policies and programmes in India to address health care of women. It also stresses the potential for women's agency and autonomy with respect to improving their health and environments.
Course Outcomes	• The course will facilitate students to understand Women's health, status of women's health in India etc. • The students will know the accessibility of health care services and critical issues in women's health. • It discusses health policy in India and international perspectives on health.
Syllabus	
Unit I	Conceptualizing Women's Health: Health as a Gender Issue - Status of Women's health in India - Maternal Morbidity, Maternal mortality, Infant Mortality, Life Expectancy and Fertility.
Unit II	Access to Health Care Services: Maternal and Child health Services in India - Food and nutrition, Anaemia, Pre-natal care, Factors Influencing Women's Health.
Unit III	Critical Issues in Women's Health: Sexual and Reproductive health, Mental health, Occupational health, Environmental health - Family planning - Impact of violence on women's health. Women as care givers and Feminization of elderly.
Unit IV	Health Policy in India: Welfare to Empowerment - Family Planning, Surrogacy Laws, Maternity Benefit Act. Reproductive health and health care - Debates around Pre-Conception and Pre-Natal Diagnostic Test (PCPNDT) Act, abortion and medical termination of pregnancy - Women's health and the global environment - Women as consumers of health care and health insurance.
Unit V	International Perspectives on Health: Health as a Critical area of concern in the Beijing platform for action - Women's health at ICPD, WHO, UNICEF, UNESCO, CARE and others - MDG's, SDG's and women's health.

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Course Code	**WS 512**
Course Title	**WOMEN AND LAW**
Course Objectives	The basic aim of the course is to provide an overview of various laws enacted for women based on international initiatives and local specific requirements. It also provides specific information regarding the core laws so that the students have greater confidence to utilise it for self or to apply it in future work life or community life.
Course Outcomes	• The course will focus on the legal concepts, law and feminism, sources of law etc. and students will have an understanding of the foundational aspects of women and law. • The course enables students to understand Indian constitution, the specific rights of women and children, laws related to family and marriage etc. • It also discusses laws related to gender based violence and work, Labour law related to women, women and criminal law etc.
Syllabus	
Unit I	Understanding Law: Legal Concepts, Law and Feminism, Sources of Law - Primary sources - Religion, Custom and Conventions - Socio-Political Philosophy and Law - Secondary Sources - The Constitution, Statutes and Judicial Decisions - Convention on the Elimination of all forms of Discrimination against Women
Unit II	Indian Constitution: Fundamental rights: directive principles of state policy – rights to equality – rights against exploitation – cultural and educational rights – the right to constitutional remedy. Enforcement of Human Rights for women and children
Unit III	Laws related to Family and Marriage: Personal laws, Laws of Marriage (Hindu and Muslim) registration of Marriages , Minimum age at marriage, Special Marriage act 1954, Divorce Laws, Judicial Separation and Divorce, Hindu Divorce Laws, Muslim Divorce Laws - Women and Property Rights including Right to Succession and Inheritance (with reference to Hindu and Muslim Laws) – Issues & Rights related to abortion (Medical termination of pregnancy), Domestic violence, Dowry prohibition Act and Family court act –Legal Services Authority -
Unit IV	Laws related to Gender based Violence and Work: Laws against violence & sexual crimes: eve teasing, rape, abduction and kidnapping – Immoral trafficking – prevention of sati – Devadasi act. Laws for working women: Labour law relating to women – minimum wages act, - Equal wages & Equal remuneration – Maternity benefit & child care – ESI – sexual harassment at work place and Visakha Judgment - POCSO
Unit V	Women and Criminal Law: Indian penal code, 1860 – Bigamy, Adultery, Rape, Cruelty to Wife; Criminal Procedure Code, 1973 - Indecent Representation of Women (prohibition) Act, 1986 - Protection in cases of Arrest and Detention of Women in Police Custody – women & criminal law amendment - Rape Laws - Adoption Laws – Surrogacy laws
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Course Code	**WS 513**
Course Title	**FEMINIST RESEARCH METHODS**
Course Objectives	The course attempts to provide a description about the methods to be applied in research focusing on women. It provides a link between feminist theories and research while it also addresses the Quantitative and Qualitative approach.
Course Outcomes	• The course will make students to understand the research strategies in women's studies, streams of feminism and scope and significance of women's studies. • The students will understand methods, techniques and tools for research in women's studies. • It discusses sampling and data collection methods, data analysis and reporting.
Syllabus	
Unit I	Research in Women's Studies: Scope and significance of Women's Studies- Doing social science research as a feminist - Exploring the interconnections of Epistemology, Methodology and Method.
Unit II	Streams of Feminism: Liberal Feminism: Equality – Rationality - Freedom - Mary Wollstonecraft - Betty Friedan - Harriet Taylor - J.S Mill ; Marxist Feminism: Marx and Engels -Production – Reproduction – Class – Alienation - Marriage and Family.
Unit III	Methods, Techniques and Tools: Historical, Experimental, Case study, Case History, Trend study, Follow-up study and Content Analysis; Techniques - Observation, Interview, Survey; Scaling Techniques; Tools - Questionnaire, Schedules
Unit IV	Sampling and Data Collection; Sampling methods – Quantitative & Qualitative Data - Collection of Data -Analysis of data; Interpretation; Conclusion and Generalization - Research Report: Reporting- General format; Styles of report writing; bibliography, proof reading; synopsis.
Unit V	Social Sciences Research Methods Vs. Feminist Research Methods: Feminist research concepts – Need for Feminist research methodology

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Course Code	**WS 521**
Course Title	**WOMEN AND WORK**
Course Objectives	The course focuses on the gendered division of work and inequalities arising out of it. It also examines the vulnerability of women and women's work in the context of globalization. It also draws upon the need for gender segregated data and appropriate policies to address it.
Course Outcomes	• The students will understand the concept of work, nature of women's work and trends in women's employment. • The course will enable mapping of women in various sectors, globalization and women's work. • It discusses new economic policy and its impact on women's employment, emerging issues of women etc.
Syllabus	
Unit I	Concept of Work: Understanding the concept of work – Unpaid domestic work and care giving - Gender role expectations and work - Gendered division of domestic labour -Estimating Women's Work
Unit II	Nature of Women's Work: Work in the private sphere and in the public sphere - Women's representation in the workforce - Women's contribution through unpaid work - Work and the access to power and resources – Trends in Women's employment (formal, informal, self-employment)
Unit III	Mapping Women in Various Sectors: Organized sector and unorganized sector - Women in the corporate world - Women entrepreneurs - Self-Help Groups and women's cooperatives.
Unit IV	Globalization and Women's Work: Impact of globalization on women's work - Gender implications of tourism – Exploitation of Women
Unit V	Women's Employment: New Economic Policy and its impact on Women's Employment - Training, skills and income generation - Employment in Export Processing Zones- Migration of women – Challenges/ Workplace harassment

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Course Code	**WS 522**
Course Title	**GENDER, MASS MEDIA AND CULTURE**
Course Objectives	The purpose of this course is to explore the relationship between gender, race and mass media. Topics to be discussed will include: theories of mass communication and the process of studying gender, race and class in media; representations of race, class and gender in media; media's role in covering issues of concern to discrete groups. This course will help students to understand how media structure our understandings of gender.
Course Outcomes	• The course will provide insights on key concepts such as gender, media, culture, fundamentals of mass communication etc. • The students will understand importance of media and representation, types of media, women as producers of media etc. • Through discussions on cultural construction of gender, need for alternative media, Indian women and media it provides better understanding of gender related issues in mass media
Syllabus	
Unit I	Understanding key concepts: gender, media, culture, fundamentals of mass communication – hegemonic ideology – need to study gender in media – importance of studying audiences
Unit II	Media and representation- Different Types of Mass Media and their characteristics – gender representation in various media: Posters, Pamphlets, Newspapers, Magazines, Special Supplements, Journals, radio programmes, films, theatres etc. – gendered representation through jokes, articles, stories, advertisements, illustrations
Unit III	Cultural construction of gender - Understanding the Male Gaze - Trivialization, Gender Stereotype, negative portrayals and commodification of female body in media - Feminist challenges to cultural constructions of gender in literature, visual arts, film, posters, science and technology and sports – muted group theory etc.
Unit IV	Women as producers of Media - Women as consumers of Media – Indian women and media – legal strategies against indecent representation of women – media as a tool for empowerment of women - Cyber Crimes through social media (Twitter, Facebook, Instagram, Snapchat)
Unit V	Need for Alternative Media – Perceptions of gender in various media programmes – Commercial Media and social responsibility – strategies for positive social change through media

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Course Code	**WS 523**
Course Title	**PROJECT - DISSERTATION AND VIVA-VOCE**
Course Objectives	The course aims to provide the opportunity to carry out a short term research using the training provided through course work in the semesters.
Course Outcomes	• The students will understand the basics in conducting research in women's studies. • The students will have hands on experience in conducting research on issues related to women.
Syllabus	
	Readings from the courses on Research Methodology, Feminist Theory, Women and Society, Women and Health and from the specialised topic of the elective course will guide students in preparing and carrying out research. Based on this they will write a dissertation and be evaluated through a viva voce.

Course Code	**WS 414**
Course Title	**WOMEN AND ENVIRONMENT**
Course Objectives	This course will focus on the links between feminist activism and environmental activism. It will also try to introduce students to the relationship between women and environment and to make them aware about the history of the gendered constructions of nature/environment. Students will be expected to look into the disproportionate goal of environmental degradation and its impact on women and children especially in the developing/under-developed nations.
Course Outcomes	• The students will understand the meaning of ecology, relationship between women and environment and Nature. • The course will provide inputs for understanding the negative impact of ecological/environmental destruction on women and rise of ecofeminists philosophy and activism. • It discusses need for environmental awareness and challenges faced by ecofeminism.
Syllabus	
Unit I	Introduction: Meaning of ecology, environment, development, feminism etc. – reasons for various environmental movements across the globe – Natural resources management
Unit II	Relationship between women and environment – understanding nature-culture divide – challenging binary representations of nature and culture - concept of mother nature
Unit III	Negative impact of ecological/environmental destruction on women - development programmes and women – food, fuel, water crisis faced by rural poor women in developing countries – environment & tribal women
Unit IV	Rise of Ecofeminist philosophy & activism - Perspectives on Ecofeminism from developed and developing worlds
Unit V	Need for environmental awareness – contribution of ecofeminists – challenges faced by ecofeminism – Focus on key ecofeminist texts – Criticisms.

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Course Code	WS 415
Course Title	**RETHINKING FEMINISM FROM INDIAN PERSPECTIVES**
Course Objectives	This course is designed to meet the following specific objectives: • To help students develop an appreciation of how different cultural perspectives on selfhood, gender identity, relation between individual and society, human existence and aims of life result in different conceptual and theoretical frameworks for sociological inquiry. • To help students understand the significance of situating woman-centric or feminist inquiry in appropriate and culturally sensitive philosophical or theoretical frameworks. • To help students gain an appreciation of the need to rethink feminism in the light of the Indian vision of gradual and progressive evolution of consciousness – individually and collectively.
Course Outcomes	• The course will help students to understand and appreciate the need for Indian perspectives on feminism, the ideal and practice of Indigenous feminism. • It discusses on the post-colonial perspectives on feminism in India and rethinking feminism from consciousness perspective.
Syllabus	
Unit I	Need for Indian Perspectives on Feminism: Overview of the Course - Why do we need Indian Perspectives on Feminism and Women-centric Inquiry? - Indian Views on Culture, Relation between Individual and Society, Aims of Life, Human Development.
Unit II	The Ideal and Practice: A Historical Look at the Women's Status in India: Women in Ancient Indian Society and the Gradual Change in Indian Women's Status - Ancient Indian Perspectives on the Ideal Relation between Man and Woman: Ideal and Practice; Implications for Today Women in Today's India – Realities, Victories, Challenges, Solutions
Unit III	Shakti Feminism: Indian views on Womanhood, Selfhood, Gender Identity - Indian View of Shakti and the Divine Feminine: Rethinking Feminism - Wisdom, Courage, Love & Harmony, Execution & Organisation: Four-fold Development of Women - Women Pioneers in India – Examples from Ancient to Contemporary Times.
Unit IV	Post-colonial Perspectives on Feminism in India: Post-colonial/Anti-colonial Critiques to Western Feminism: Significance for Indian Feminism - Feminism or Women's Movement in India – Imitative or Indigenous?
Unit V	Rethinking Feminism from Consciousness Perspective: Rethinking Feminism in the Light of Indian Views of Freedom, Diversity, Equality, Harmony - Rethinking Women's Issues as Societal Issues in the Light of Indian Vision of Gradual and Progressive Evolution of Consciousness

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Course Code	**WS 416**
Course Title	**WOMEN AND GLOBALIZATION**
Course Objectives	The course is to make the students aware of the various key issues in the process of globalization and its impact on women across regions
Course Outcomes	• The students will understand the concept of globalization, its economic and social aspects and the impact of globalization on women. • The course will help students to understand the structural adjustment program and employment of women, unemployment etc. • It discusses Organization of Production and the Institutional Support
Syllabus	
Unit I	Globalization – Economic and social Aspects – Implications for Less Developed countries and women – Impact of Globalization in the light of multiple role of women – Globalization from the perspective of Developed countries - Dimensions -Diverse and Adverse Effects – Implications for Women and Men.
Unit II	Impact of Globalization on women – Feminization of poverty – Rapid Casualization – Contract Labour System – Mechanization – Changing cropping Pattern –non-agricultural use of land and implications on Women's Employment – Environment Degradation – Deforestation – Women as Social Capital – Networking of Women - Conservation – bearing on resources, index of failure of Government – LPG policies & women
Unit III	Structural Adjustment Program and Employment of Women – Widening wage differentials between men and women – Set back in Education – Decline in Health and Food security Standards – Corporatization of resources: Denial and Loss - Commercial exploitation and lack of access to resources – Losing water security - Decline of Income in Women Headed Households. Unemployment – Displacement from traditional roles– Constantly lags in skills and skill development
Unit IV	Organization of Production and Institutional Support – Quantum jump in Professionalism – Access to Credit and Assets – Letting out System – Assembly Line Production - Developing Women's Organizations – State Policies for redefinitions on Women Empowerment – Redefined self-Image – Collective emancipation
Unit V	Globalization and Changing consumerist culture –Feminism under Consumerism – Westernization – Influence of Media – Advertisement Ethics – Commodification – and Degrading women – Reinforcing Gender Stereotyping - Need for changing role of Media in the Globalization context – Freedom of Career choice – Consequences of Characteristic of Modernity – Information Flooding – Increasing Violence – Trafficking- recommendations & reforms
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Course Code	**WS 417**
Course Title	**WOMEN AND ENTREPRENEURSHIP**
Course Objectives	The paper provides scope to understand and apply entrepreneurship for empowerment. It deals with the concept, process, and strategies considering the group in individual and collective growth. The paper also provides scope to understand the opportunities and challenges in entrepreneurship.
Course Outcomes	• The students will understand the concept of entrepreneurship and competing theories of entrepreneurship. • The students will enhance skills on self-assessment, entrepreneurial process and the business idea. • It discusses methods of generating innovative ideas and special aspects in entrepreneurship
Syllabus	
Unit I	Introduction: Concept of Entrepreneurship - Nature and Development of Entrepreneurship - Entrepreneurial decision process - Entrepreneurial traits – types - Culture and structure - competing theories of Entrepreneurship - Entrepreneurial motivation - Establishing Entrepreneurial Systems - development of woman entrepreneurs and the future of entrepreneurship.
Unit II	Self-Assessment and Entrepreneurial Process: Identifying and evaluation the opportunity - developing a business plan - resources required and the managing the enterprise. Strategic orientation - commitment to opportunity – resources - control of resource and management structure. Entrepreneurial Careers – education – training - Entrepreneurial Ethics.
Unit III	The Business Idea: Sources of new ideas: The unexpected - incongruities - process need - industry and market structures – demographics - changes in perception - new knowledge – Consumers - existing companies - distribution channels – start-ups – Make in India – MUDRA – state & central govt. programmes
Unit IV	Methods of Generating Ideas: Product Planning and development Process: Establishing evaluation criteria - Establishing role in creative groups - Taking the lead in Group problem solving
Unit V	Special aspects in Entrepreneurship: Intra-preneurship - International Entrepreneurship: Problems and Opportunities - Entrepreneurship in Rural sectors and Service Institutions - Ecological Niches - Legal aspects
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Course Code	**WS 424**
Course Title	**VIOLENCE AGAINST WOMEN**
Course Objectives	This course will discuss the forms of violence and how it gets legalized by social custom and tradition. The aim of the course is to explore the connection between gender, sexuality, culture and violence. The evolution of society's response to violence and the laws, programmes and services to address violence will be discussed.
Course Outcomes	• The course will help students to understand the issues related to violence on women, different forms of violence, causative factors etc. • It discusses violence against women, Nirbhaya and after, violence and media reporting etc.
Syllabus	
Unit I	Women and Violence: Masculinity and male identity – role of social customs and tradition- subtle forms of gendered violence and cultural sanction. Crimes against women as under the IPC, understanding the status from Statistics
Unit II	Different forms of Violence: Physical and Non-Physical violence -dowry, domestic violence, rape, including custodial rape (Mathura Rape Case), intimate partner violence (Marital rape debate), Honour related violence.
Unit III	Violence against women: weapon in war - child abuse – self-inflicted violence and suicide, female genital mutilation, molestation and teasing, trafficking.
Unit IV	Nirbhaya and after: Legal Interventions, Criminal Amendment Act 2013, society's response, role of media, services and programmes - feminisation of elderly and violence against elderly citizens (protection) – CEDAW, PCPNDT etc.
Unit V	Violence and media reporting: Case studies (National and Local) -Indecent Representation of Women and trolling.

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Course Code	**WS 425**
Course Title	**WOMEN AND LOCAL GOVERNANCE**
Course Objectives	Primary objectives of this course are to present the political participation of women in Local Governance and enable to understand the issues related to women's participation and leadership in local governance. The course will also sensitize students on Gender Equality in local governance
Course Outcomes	• The students will understand the political participation of women in Local Governance, differential representation of women in Local Governance etc. • The students will also understand the significance of mainstreaming Women in Local Governance, gender auditing, and budgeting in local governance. • It discusses Women and Good Governance and Women and Political Empowerment.
Syllabus	
Unit I	Introduction: Political Participation of Women in Local Governance - Significance of 73 rd and 74 th Amendment for women empowerment -Women in Local Governance : Rhetoric and Reality-Mainstreaming women in politics- localizing SDGs
Unit II	Representation of Elected Women leaders in Local Governance: Differential representation of women in Local Governance-Intersectionality of caste, class and gender -Response of various stakeholders -Dalit women's representation in Local Governance
Unit III	Mainstreaming Women in Local Governance: Participatory democracy – Enabling environment in Local Self Governance - Gender auditing, and budgeting in local governance - Best Practices in Women Leadership -Assertive Women Leaders in Panchayat Raj Institutions
Unit IV	Women and Good Governance: Feminist perspectives of Power - Gender Responsive Local Governance - Good governance practices by women leaders -Women and Social Capital
Unit V	Women and Political Empowerment: Political conscientisation of women -Challenging gender stereotypes in political sphere - Leadership development -Capacity building- Networking – Concerns of the marginalised – MGNREGA - SHGs

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Course Code	**WS 426**
Course Title	**WOMEN'S EDUCATION IN INDIA**
Course Objectives	The course provides scope to understand the present status of women with regard to education. It also traces the causes for gender gap in education and its key interlink with various other gender inequalities.
Course Outcomes	• The students will understand the perspectives of women's education, status of women in education, the relevance of education on health etc. • The students will understand the relevance of education in women's empowerment and recent trends in women's education. • It discusses the role of women in development and national perspective plan for women's education.
Syllabus	
Unit I	Perspectives of Women's Education: Women's education: Objectives, Significance and Scope of education for girls and women Historical perspective of Women's Education in India Early, Colonial and Modern Periods
Unit II	Status of Women, Education and Health conditions, Sex Ratio, Family Planning and Welfare - Education: Literacy & Gender Bias - Work Related Issues: Existing Prejudices, Sex Related Violence, Gender Discrimination - Political participation: Lack of women's representation - Economic Conditions: Prostitution - Social Conditions: divorce, rape, domestic violence.
Unit III	Education for Women's Empowerment: Approaches to Women's Education - Education for achieving quality of life, equality of opportunities, and equity; Women's education - gender bias in enrolment - Curriculum content - Dropouts negative capability in education - Values in education-Vocational education - Recent trends in Women's education.
Unit IV	Role of Women in Development: Women in developing countries with special reference to India - Women in National Development - Women in Decision Making; Present Status of Women's Education - A brief account of the growth of Women's Education - Trends of research in Women's Education.
Unit V	National Perspective Plan for Women's Education: Women's Education - Literacy and Population Growth - Role of UGC, MHRD, National policy of education- 1968, 1986, Constitutional Provision; Committees and Commissions on Women's Education - Radhakrishnan, Mudaliar and Kothari Commission.Durgabai Deshmukh Committee, Hansraj Mehta Committee and Bhaktabatsalam Committee - NCERT

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Course Code	**WS 427**
Course Title	**MENSTRUAL HEALTH AND HYGIENE: CREATING AWARENESS AND CULTURAL SENSITIVITY**
Course Objectives	This course is organised under THREE closely inter-related parts, each building upon the other and together facilitating a holistic understanding of the subject matter of various issues related to menstruation, promote a deeper awareness and cultivate a greater awareness and sensitivity toward menstrual health and hygiene practices and action-oriented training to work in their local communities, and/or reach out to schools and colleges in their areas and promote the much-needed awareness about this significant public health issue.
Course Outcomes	• The course focuses on need for creating greater awareness and cultural sensitivity on the topic of menstruation, menstrual health and other related areas. • The students will understand menstrual health and hygiene; menstruation and menstrual health.
Syllabus	
Unit I	Need for creating greater awareness and cultural sensitivity on this topic of menstruation, menstrual health and other related areas. - Cross-cultural views on menstruation and menstruation related practices: Indian traditions, Ancient Western traditions, other Indigenous Traditions. - Views on menstruation in various religious traditions: Hindu, Jain, Buddhism, Sikhism, Judaism, Christianity, Islam.
Unit II	Evaluating and decoding contemporary research and debates on menstruation in India - Modernity vs. Tradition: Significance for today - Menstruation, Fertility and Womanhood: Some deeper insights
Unit III	Menstrual health and hygiene: Personal practices - Insights from Ayurveda and Yoga on menstruation and menstrual health - Paying attention to emotional and psychological aspects; issues concerning identity and self-worth
Unit IV	Menstruation and menstrual health: A public health issue - The impact of commercially available menstrual hygiene products on the health of the environment; sustainable alternatives
Unit V	Training and Awareness: Training for creating awareness and cultural sensitivity about menstruation and menstrual health - Training apprenticeship

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Course Code	**WS 514**
Course Title	**WOMEN AND POLITICS**
Course Objectives	The course provides an overview of political participation in pre and post-independent India. It also enables students to understand issues related to women leadership, participation in local governance and gender issues in governance
Course Outcomes	• The students will understand the political participation of women in Pre-independent and independent India and politics of reservation bill for women. • The course will provide updated information on the role of women in Local Governance. • Through discussions on women and governance, gender issues in governance and gender and political empowerment the students will gain on ground information on the practical realities on Women and Politics.
Syllabus	
Unit I	Introduction: Political Participation of Women in Pre-Independent India - Political Participation of Women in Independent India - Significance of 73rd and 74th Amendment for women empowerment - Politics of Reservation Bill for Women
Unit II	Political Participation of Women: Gender Imbalance in Political Representation in Parliament and Legislative Assembly - Gender perspectives of Voting Behaviour and Electoral Process - Gender Discrimination in Indian Polity - Political Participation of Women: Opportunities and constraints.
Unit III	Women in Local Governance: Women Leaders in Panchayati Raj Institutions (PRI'S) - Women's Participation in Local Self Governance - Factors Affecting Women's Participation in Local Governance - Gender auditing, and budgeting in local governance - Best Practices in Women Leadership
Unit IV	Women and Governance: Feminist Critique of Power- Weber - Governance and Gender Structures - Gender Issues in Governance - Role of women for good governance
Unit V	Gender and Political Empowerment: Political conscientisation of women - Challenging gender stereotypes in political sphere - Leadership development - Capacity building – pending reservation bill

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Course Code	**WS 515**
Course Title	**WOMEN'S RIGHTS AS HUMAN RIGHTS**
Course Objectives	This course examines the human rights framework through a gender lens. It explores why and how women as a group continues to experience discrimination as a consequence of their gender and to what extent human rights can be useful to challenge the social, economic and political position of women.
Course Outcomes	• The course will enable students to understand the feminist theory, rights theory and rights critique. • The students will comprehend gendering Human Rights, development discourse and women's international human rights. • It will provide deeper understanding gender specific needs woman's rights and human rights.
Syllabus	
Unit I	Understanding feminist theory, rights theory and rights critique - What are Human Rights? - Need for balance between rights and duties - International discourse on human rights- various international human rights documents etc.
Unit II	Gendering Human Rights – What are Women's Human Rights - its origins both as a movement and as policy approach – Protecting & Institutionalizing women's Human rights - key international laws and conventions governing women's human rights – movements that mobilized for the reforms
Unit III	Tensions & debates: Religion, Culture and Gender equality – Marriage and family rights – women's rights in war and in times of peace state sponsored violence against women – development discourse & women's international human rights - international protections, national compliance?
Unit IV	Reproduction and women's human Rights: gender identity & sexual freedoms as human rights - trafficking
Unit V	Women's human rights in India - concept of Substantive Equality as reflected in the Constitution of India - systems of access to justice - legislating women specific legislation such as Protection of Women from Domestic Violence Act, 2005, and judgments such as Vishaka Judgment – 16 days of activism against gender based violence – Human Rights Day

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- Hilary Charlesworth, What are "Women's International Human Rights?" in *Human Rights of Women*, 1994, pp. 58-84.
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- Millennium Development Goals
- Olivia Ball & Paul Gready, A powerful idea' in the No-Nonsens Guide to Human Rights, 2006, pp. 11-30
- The Cairo Declaration of Human Rights.
- The Universal Declaration of Human Rights (UDHR)

Course Code	**WS 516**
Course Title	**WOMEN, SCIENCE AND TECHNOLOGY**
Course Objectives	The course provides basic knowledge about the intersection of gender, science and technology. The course will focus upon how gender theories can provide analyses of women, science and technology. Further technology transfer can be facilitated to bridge the gender divide.
Course Outcomes	• The course will enable students to understand the present position about women in science and need for gender-just science, integrating gender perspective in science education and research. • Students can connect between women and technology, women and information technology and technology transfer.
Syllabus	
Unit I	Women in Science: Concepts of Gender and Science - Myths about women in science - Feminist critique of science - Women in Science: Women's career in science, Exclusion of women from scientific research
Unit II	Gender-Just Science: Integrating Gender Perspective in Science Education and Research - Emerging ethical questions – Science - Sustainability and Indian Values
Unit III	Women and Technology: A historical perspective – Technology as masculine culture – Household technology – medical technology: New Reproductive technologies – Impact of Technological Change on Women.
Unit IV	Women and Information Technology: The Digital Divide: Unequal Access, Unequal Effects – Outcome and impact of ICT's Policies and projects for women – Women's Agency and IT Industry.
Unit V	Technology Transfer: Women and value orientation - Family primacy, Fatalism, aversion to risk taking, short time goals, mechanisms for technology transfer - Appropriate Technology for Women - Characteristics, Low cost, quality output; Adaptability process – Awareness evaluation and trail, decision stage – acquisition – basic principles of certain Technologies – Technology replacing women & technology serving women

References

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Course Code	**WS 517**
Course Title	**INDIGENOUS FEMINISMS**
Course Objective	This course will enable students to think critically about the politics of visibility and invisibility even in progressive movements and require them to reflect on questions of location and privilege especially in relation to scholarship and activism. It will also examine feminist scholarship that speaks to these concerns, contextualizing them within and around debates on colonialism, post-colonialism, and globalization. The course will engage contemporary debates around sexuality, nationalism, racism, casteism, and morality to name only some, examining them in relation to questions of agency, claim, and co-optation.
Course Outcomes	• The students will understand the concepts relevant to indigenous feminism such as indigenism, indigenousness, aboriginal, native, postcolonial, transnational etc. • The course provides deeper insights on the indigenous feminism and the importance of it. • It discusses Indigenous feminism & diverse perspectives from North America, Africa & Latin America and Asia.
Syllabus	
Unit I	Introduction: Conceptualizing indigenous, indigenism, indigenousness, aboriginal, native, postcolonial, transnational – definitional dilemmas of 'indigenous people' – postcolonial and indigenous thinking and resistance practices
Unit II	Women and the indigenous: Indigenous communities – women in indigenous communities - Indigenous feminism – differences between indigenous and western feminisms – alternatives to western or white feminism?
Unit III	Indigenous feminism & diverse perspectives from North America: lived experiences of Native American & First Nations women – decolonization, indigenous sovereignty – sexual victimization of Native American women & girls - The Missing and Murdered Indigenous Women (MMIW) - aboriginal and native feminist theories
Unit IV	Indigenous feminism & diverse perspectives from Africa & Latin America: Race and the appropriation of Black women in struggle and scholarship – influence of machismo culture and hypermasculinity in Latin America etc.
Unit V	Indigenous feminism & diverse perspectives from Asia: Globalization & Chinese women - Dalit, Muslim, Tribal and Queer Women experiences with hegemonic feminism etc.

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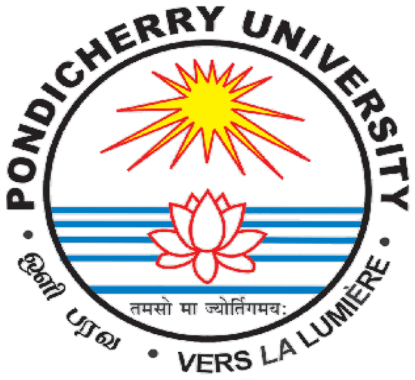

PONDICHERRY UNIVERSITY

SUBRAMANIA BHARATHI SCHOOL OF TAMIL LANGUAGE & LITERATURE

COURSE STRUCTURE AND SYLLABUS

(For the Subramania Bharathi School of Tamil Language & Literature of Pondicherry University)

B.A., Tamil (Honors)

Four Year Program as per NEP Recommendations

(Effective from Academic Year 2023 – 2024)

SEMESTER I

MAJOR

1.பாடத்திட்டத்தின் பெயர்: **இளங்கலைத் தமிழ் (Honors)**

2.பாடத்தலைப்பு: **தகவல் தொடர்பியல் (Mass Communication)**

3.பாடக் குறியீடு: **TAML 111**

4. கற்றல் விளைவுகள்: (Learning outcomes)
அ) நோக்கம்
1. தகவல் தொடர்புமுறைகளைக் கற்பித்தல்
2. தகவல் தொடர்பு சாதனங்களின் இயல்புகள், போக்குகள், சட்டங்கள் முதலியவற்றைக் கற்பித்தல்
3. இதழ்களின் வாயிலான தகவல் தொடர்புகளைக் கற்பித்தல்
4. வானொலி, தொலைக்காட்சி வழியிலான தகவல் தொடர்பு முறை பற்றிக் கற்பித்தல்
5. இணையம் வாயிலாக நடைபெறும் தகவல் தொடர்புகளை இனம் காட்டுதல்
ஆ) பயன்
1. தகவல் தொடர்புமுறைகளைக் கற்றல்
2. தகவல் தொடர்பு சாதனங்களின் இயல்புகள், போக்குகள், சட்டங்கள் முதலியவற்றைக் கற்றல்
3. இதழ்களின் வாயிலான தகவல் தொடர்புகளை அறிந்துகொள்ளல்
4. வானொலி, தொலைக்காட்சி வழியிலான தகவல் தொடர்பு முறை பற்றி அறிதல்
5. இணையம் வாயிலாக நடைபெறும் தகவல் தொடர்புகளை இனம் காணுதல்
5. திறன் பயிற்சி: (Skill Training)
1. செய்தி வாசிப்பும் எழுதும் திறனும் பெறுதல்
2. வானொலி உரை நிகழ்வுகளில் உரையாடும் திறன் பெறுதல்
3. தொலைக்காட்சி உரைகளில் பங்கெடுத்தல்
4. இணைய ஊடகங்களை ஆக்கப்பூர்வமாகப் பயன்படுத்துதல்
5. இணையச் சட்டங்கள் குறித்து விழிப்படைதல்
6. முன் – தேவைகள்: (Pre-requisites)
1. செய்தி இதழ், வானொலி, தொலைக்காட்சி, இணையம் பற்றி அறிந்திருத்தல்.
7. விவரக்குறிப்புகள்: (Specifications) • பாடத்தின் இயல்பு: **முதன்மைப் பாடம்** • மதிப்பீடுகளின் எண்ணிக்கை: **4 மதிப்புகள்** • கற்பித்தல் முறை: **விளக்கமுறை**
8. இணைப்புப் பாடங்கள்: (Bridge courses to be done)

1. தகவல் தொடர்பின் தோற்றப் பின்னணி
2. தகவல் தொடர்பு வளர்ந்த முறைமை

9. அலகு விவரம்

அலகு எண்	அலகின் தலைப்பு	விரிவான பாடத்திட்டம்	பாடவேளை எண்ணிக்கை
I	**தகவல் தொடர்பு வரலாறு**	• தகவலியல் அறிமுகம் – தகவல் தொடர்பியலின் அடிப்படைகள் • காலந்தோறும் தகவல் தொடர்பு • தொடர்பியல் கூறுகள் – பண்புகள் – இயல்புகள் • தொடர்பு சாதனங்களின் வளர்ச்சி நிலைகள் • தகவலியல் பணிகள் – சேகரித்தல் - வெளிப்படுத்துதல் - அவற்றின் பயன்கள் – நன்மைகள் - தீமைகள்	
II	**இதழ்கள் வழி தகவல் தொடர்பு**	• அச்சு ஊடகம் - தோற்றம் வளர்ச்சி • இதழ் பகுப்பு முறைகள் – இதழியல் சட்டங்கள் இதழ்களின் சுதந்திரம் • செய்தி – சேகரித்தல் – செம்மைப்படுத்துதல் – வெளியிடுதல் • செய்தி வகைகள் – தலையங்கம் – செய்திக்கட்டுரை • வாசகர் கடிதம் – கருத்துப்படங்கள் – பத்தி எழுதுதல்	
III	**வானொலி வழி தகவல் தொடர்பு**	• ஒலி ஊடகம் - வானொலி – தோற்றம் வளர்ச்சி • ஒலிபரப்பு அலைவரிசைகள் – முதன்மை, சிற்றலை, பண்பலைகள் • ஒலிபரப்பு வகைகள் - பன்னாட்டு, இந்திய, தமிழக, புதுச்சேரி ஒலிபரப்புகள் • உரை, நாடகம், வானொலி செய்தி, நேர்காணல் • வானொலி நிகழ்ச்சித் தயாரிப்பு - மொழிநடை - அரசு, தனியார் வானொலிகள்	

IV	**தொலைக் காட்சி வழி தகவல் தொடர்பு**	• காட்சி ஊடகம் – திரைப்பட வரலாறு • திரைப்பட வகைகள் – திரைப்படத்தின் பண்புகள் – மகிழ்வூட்டல் – அறிவூட்டல் • திரைப்படத்தின் வணிகச் செயல்பாடுகள் – நவீன முயற்சிகள் • தொலைக்காட்சியின் வரலாறு – நிகழ்ச்சி – வகைகள் - உத்திகள் – தயாரிப்புகள் – விளம்பரங்கள் • அரசு, தனியார் தொலைக்காட்சிகள்	
V	**இணைய வழி தகவல் தொடர்பு**	• இணையம் - தோற்றம் வளர்ச்சி • சமூக ஊடகங்கள் – வலைத் தளங்கள் – வலைப் பூக்கள் - புலனம் (WhatsApp) - முகநூல் (Facebook) - வலையொளி (Youtube) - கீச்சகம் (X/ Twitter) • படவரி (Instagram) - அளாவி (WeChat) – பற்றியம் (Messenger) - காயலை (Skype) • மின் இதழ்கள் – மின் நூல்கள் – மின் நூலகம் – மின் விளம்பரம் • இணையக் குற்றங்களும் சட்டங்களும்	

10. அலகு வாரியாக மாணாக்கர் செயல்பாடுகள்

1. தகவல் தொடர்பில் மொழியின் அவசியம் குறித்து உரையாடுதல்
2. வகுப்பில் செய்தித்தாள் வாசித்து அதன் உள்ளடக்கங்கள் குறித்து விவாதித்தல்
3. வானொலியில் கல்விசார் நிகழ்வுகளில் பங்குபெறுதல்.
4. தொலைக்காட்சியில் 'தமிழ்ப்பேச்சு' உள்ளிட்ட உரைநிகழ்வுகளில் பங்கெடுத்தல் மற்றும் விளம்பரங்களுக்கு வாசகங்கள் எழுதும் பயிற்சி பெறுதல்.
5. சமூக ஊடகங்களில் உள்ள சிக்கல்களையும் பயன்களையும் விவாதித்தல்

11. அடிப்படைப் பாடநூல்கள்

1. இராசா.கி., மக்கள் தகவல் தொடர்பியல் அறிமுகம், பாரதிதாசன் பல்கலைக்கழகம், திருச்சி.
2. தயாளன்.வே., ஜெயா.ஏ., மக்கள் தகவல் தொடர்பியல், ஜெயா பதிப்பகம், கோயம்புத்தூர், 1989.
3. குருசாமி மா.ரா.போ., இதழியல் கலை, தேமொழி பதிப்பகம், திருச்செந்தூர், 1988.

12. நோக்கு நூல்கள்

1. சோமலெ, தமிழ் இதழ்கள், சென்னைப் பல்கலைக்கழக வெளியீடு, சென்னை, 1975.

2. தங்க. மணியன், பத்திரிகையியல், மாணிக்கம் பதிப்பகம், மைசூர் - 570 006, 1998.
3. திரவியம்.கா., தேசியம் வளர்த்த தமிழ், பூம்புகார் பிரசுரம், சென்னை, 1974.
4. மணிகண்டன்.துரை., தமிழ்க் கணினி இணையப் பயன்பாடுகள், கமலினி பதிப்பகம், சென்னை, 2017.
5. முத்துராசன்.கு., இதழியல் வளர்ச்சியும் மொழிபெயர்ப்பும், ஐந்திணைப் பதிப்பகம், திருவல்லிக்கேணி, சென்னை, 2001.
6. விஜயராணி.இரா., தொலைக்காட்சி விளம்பரங்கள், கண்மணி பதிப்பகம், திருச்சி, 2002.

13. வலை வளங்கள்

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5. Chennai Library - www.chennailibrary.com http://www.chennailibrary.com
6. Tamil Universal Digital Library - www.ulib.prg http://www.ulib.prg
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9. Catalogue of the Tamil books in the Library of British Congress archive.org
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1. https://store.hindutamil.in/publications
2. https://puthu.thinnai.com/
3. https://keetru.com/
4. https://irjt.iorpress.org/index.php/irjt
5. https://journals.asianresassoc.org/index.php/ijot

15. மதிப்பீட்டு முறைமை

1. பருவத் தேர்வு – விளக்கமுறை
2. அகமதிப்பீட்டு முறை

   (ஒப்படைப்பு / வகுப்புத் தேர்வு / குழுவிவாதம் / களப்பணி / கருத்தரங்கம் முதலானவை)

MINOR

1. பாடத்திட்டத்தின் பெயர்: **இளங்கலைத் தமிழ் (Honors)**

2. பாடத்தலைப்பு: **தமிழ் - மொழித்திறன்**

3. பாடக் குறியீடு: **TAML 121**

4. கற்றல் விளைவுகள்: (Learning outcomes)
அ) நோக்கம்
1. மாணவர்களின் தமிழ் மொழித்திறனை வளர்த்தல்
2. தமிழ் மொழியின் அடிப்படை இலக்கணத்தைக் கற்பித்தல்
3. சந்திப் பிழையின்றி எழுதவும் வல்லினம் மிகும் மிகா இடங்களையும் கற்பித்தல்
4. பெயர், வினை, இடை, உரிச்சொற்களைக் கற்பித்தல்
5. எழுத்துகளையும் அதன் வகைகளையும் கற்பித்தல்
ஆ) பயன்
1. மாணவர்கள் தமிழ் மொழித்திறன் பெறல்
2. தமிழ் மொழியின் அடிப்படை இலக்கணத்தைக் கற்றல்.
3. சந்திப் பிழையின்றி எழுதவும், வல்லினம் மிகும் மிகா இடங்களையும் அறிந்து கொள்ளுதல்
4. பெயர், வினை, இடை, உரிச்சொற்களைக் கற்றல்
5. எழுத்துகளையும் அதன் வகைகளையும் தெரிந்து கொள்ளுதல்
5. திறன் பயிற்சி: (Skill Training)
1. பிறமொழிக் கலப்பின்றிப் பேச மற்றும் எழுத திறன் பெறுதல்
2. எழுத்துகளை ஒற்றுப் பிழையின்றி எழுதும் பயிற்சி பெறுதல்
3. பெயர், வினை, இடை, உரிச் சொற்களின் வேறுபாடுகளைக் கண்டறிதல்
4. வல்லினம் மிகும், வல்லினம் மிகா இடங்களைக் கண்டறிதல்
5. எழுத்துகளின் புணர்தலைப் பற்றிப் பயிற்சி பெறல்
6. முன் – தேவைகள்: (Pre-requisites)
1. தமிழ் மொழியின் அடிப்படை இலக்கணம் தெரிந்திருத்தல்.
7. விவரக்குறிப்புகள்: (Specifications) • பாடத்தின் இயல்பு: **துணைமைப் பாடம்** • மதிப்பீடுகளின் எண்ணிக்கை: **4 மதிப்புகள்** • கற்பித்தல் முறை: **விளக்கமுறை**
8. இணைப்புப் பாடங்கள்: (Bridge courses to be done) 1. தமிழ்ச் சொற்கள், அவற்றின் வகைகளை அறிமுகப்படுத்துதல் 2. தொடர் அமைப்பு பற்றி அறிதல்

9. அலகு விவரம்

அலகு எண்	அலகின் தலைப்பு	விரிவான பாடத்திட்டம்	பாடவேளை எண்ணிக்கை
I	**எழுத்தியல்**	• எழுத்தியல் – எழுத்தும் அதன் வகைகளும் – முதல் எழுத்துகள், சார்பெழுத்துகள் • முதனிலை, இறுதிநிலை, இடைநிலை எழுத்துகள் – மெய்ம்மயக்கம் – சுட்டு, வினா எழுத்துகள் – எழுத்துப்போலி. • சொல்லியல் – சொல்லின் அமைப்பு – பகுபதம், பகாபதம் – பகுபத உறுப்பிலக்கணம் • சொல் வகைகள் – இலக்கண வகை – இலக்கிய வகை • பெயர்,வினை, இடை, உரிச் சொற்கள் – இயற்சொல், திரிசொல், திசைச்சொல், வடசொல் – தற்சமம், தற்பவம் – திணை, பால், எண், இடப்பகுப்பு முறை	
II	**பெயரியல்**	• பெயரியல் – பெயர்சசொல் விளக்கம் – பெயர்ச்சொல்லின் தன்மைகள் – வகைகள் • இலக்கண வகை – மொழியியில் அடிப்படையிலான வகைப்பாடு • மாற்றுப் பெயர், ஆக்கப் பெயர், கூட்டுப் பெயர், வினையாலணையும் பெயர் • ஆகுபெயரும் அதன் வகைகளும் • எண்வகை வேற்றுமைகள்	
III	**வினையியல்**	• வினையியல் – வினைச் சொல் பற்றிய விளக்கம் – வினைச்சொல்லின் அமைப்பு – வினைச் சொல் வகைகள் • முற்றுவினை, எச்ச வினை – செய்வினை, செயப்பாட்டு வினை • செயப்படுபொருளகுன்றிய,குன்றா வினை • தன் வினை – பிறவினை – காரண வினை	

		• முதல் வினை, துணைவினை, தனிவினை, கூட்டு வினை	
IV	**இடை மற்றும் உரியியல்**	• இடை மற்றும் உரியியல் – இடைச்சொல் வகைகள் – உம், ஏகார, ஓகார முதலிய இடைச்சொற்கள் • உரிச்சொல் வகைகள் – ஒருகுணம் தழுவிய உரிச்சொல் – பலகுணம் தழுவிய உரிச்சொல் • பெயரடை, வினையடை. தொடரியல் • தனிவாக்கியம் – கூட்டு வாக்கியம் – கலவைவாக்கியம் • பெயர்ப்பயனிலை – வினைப் பயனிலை – எதிர்மறை, வினா வாக்கியங்கள்	
V	**பிழைகளும் திருத்தங்களும்**	• பிழைகளும் திருத்தங்களும் – சந்திப் பிழையை நீக்குதல் • வலி மிகும் இடங்கள், மிகா இடங்கள் - இயல்புப் புணர்ச்சி – விகாரப்புணர்ச்சி • ரகர, றகர வேறுபாடுகள் • ளகர, ழகர வேறுபாடுகள் • ணகர, னகர, நகர வேறுபாடுகள்	

10. அலகு வாரியாக மாணாக்கர் செயல்பாடுகள்

1. பகுபத வாய்பாடு கொண்டு சொற்களைப் பிரித்தல்
2. சொற்களில் இடம்பெற்றுள்ள வினைமுற்றுகளைக் கண்டறிதல்
3. காலம் காட்டும் இடைநிலைகளைப் பிரித்துப் பார்த்தல்
4. எழுத்துகள் புணர்தலை, புணர்ச்சி வாய்பாட்டின் வழி சேர்த்துப் பார்த்தல்
5. ரகர, றகர, ளகர, ழகர, ணகர, னகர, நகர வேறுபாடுகளைச் சரியாக உச்சரித்தல்

11.அடிப்படைப் பாடநூல்கள்

1. நுஃமான்.எம்.ஏ., அடிப்படைத் தமிழ் இலக்கணம், அடையாளம், புத்தாநத்தம், 2007.
2. மீனாட்சிசுந்தரனார்.தெ.பொ., தமிழ் மொழி வரலாறு, சர்வோதய இலக்கியப் பண்ணை, செயப்பிரகாசம்.ச. (தமிழாக்கம்), மதுரை, 1982.

12.நோக்கு நூல்கள்

1. சண்முகம்.செ.வை., எழுத்திலக்கணக் கோட்பாடு, உலகத்தமிழாராய்ச்சி நிறுவனம், சென்னை.

2. சண்முகம்.செ.வை., சொல்லிலக்கணக் கோட்பாடு, உலகத்தமிழாராய்ச்சி நிறுவனம், சென்னை.

3. சண்முகதாஸ்.அ., தமிழ் மொழி இலக்கண இயல்புகள், முத்தமிழ் வெளியீட்டுக் கழகம், யாழ்ப்பானம்.

4. பரந்தாமனார்.அ.கி., நல்லதமிழ் எழுதவேண்டுமா? அல்லி நிலையம், சென்னை.

5. பரமசிவம்.கு., நற்றமிழ் இலக்கணம், பட்டுப் பதிப்பகம், சென்னை.

6. பரமசிவம்.கு., இக்காலத் தமிழ் மரபு, அடையாளம், புத்தாநத்தம்.

7. சீனி நைனா முகம்மது.செ., நல்ல தமிழ் இலக்கணம், அடையாளம், புத்தாநத்தம், 2017.

13.வலை வளங்கள்

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4. Project Madurai - www.projectmadurai.org.
5. www.tamilvu.org/ library
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7. Tamil Universal Digital Library - www.ulib.prg http://www.ulib.prg
8. Tamil E-Books Downloads - tamilebooksdownloads. blogspot.com
9. Tamil Books on line-books.tamil cube.com

14.இதழ்கள்/மலர்கள்

1. ஆவணம், அரிமாநோக்கு
2. தமிழ்மொழி மற்றும் இலக்கியப் பன்னாட்டு ஆய்விதழ்
3. காலச்சுவடு, மணற்கேணி
4. உங்கள் நூலகம், பெயல்
5. தமிழியல், வரலாறு

15. மதிப்பீட்டு முறைமை

1. பருவத் தேர்வு – விளக்கமுறை
2. அகமதிப்பீட்டு முறை

(ஒப்படைப்பு / வகுப்புத் தேர்வு / குழுவிவாதம் / களப்பணி / கருத்தரங்கம் முதலானவை)

SKILL ENHANCEMENT COURSE

1. பாடத்திட்டத்தின் பெயர்: **இளங்கலைத் தமிழ் (Honors)**

2. பாடத்தலைப்பு: **கணினித் தமிழ் (Tamil Computing)**

3. பாடக் குறியீடு: **TAML 131**

4. கற்றல் விளைவுகள்: (Learning outcomes)
அ) நோக்கம்
1. கணினியின் செயல்பாடுகளையும் இணையத்தமிழ் வளர்ச்சியையும் அறிமுகம் செய்தல்
2. கணினி மொழியியல் - இயற்கைமொழி ஆய்வு - தொழில் நுட்பக் கருவிகள் - பயன்பாட்டு மென்பொருட்கள் கற்பித்தல்
3. தமிழ் மென்பொருட்கள் குறித்து கற்பித்தல்
4. தமிழ் தட்டச்சு மற்றும் வலைப்பூ உருவாக்கம் (Blog creation) செய்யக் கற்பித்தல்
5. மின்னூல் உருவாக்கம் குறித்துப் பயிற்சி வழங்குதல்
ஆ) பயன்
1. கணினியின் செயல்பாடுகள் மற்றும் இணையத்தமிழ் குறித்து அறிதல்
2. கணினி மொழியியல் மற்றும் இயற்கைமொழி ஆய்வுகளை ஒப்பு நோக்கி ஆராய்தல்
3. தமிழ் மென்பொருட்கள் குறித்து அறிதல்
4. தமிழ் தட்டச்சு மற்றும் வலைப்பூ உருவாக்கம் (Blog creation) செய்ய கற்றல்
5. மின்னூல் உருவாக்கம் குறித்துப் பயிற்சிபெறுதல்
5. திறன் பயிற்சி: (Skill Training)
1. கணினியின் தனித்தனிப் பாகங்களை மொத்தமாகப் பொருத்திப் பழகுதல்
2. தட்டச்சு பயிற்சி பெறுதல்
3. நழுவப்படங்கள் (பவர்பாயிண்ட்) வழி வகுப்பு எடுக்கும் ஆற்றல் பெறுதல்
4. மின்னஞ்சல் அனுப்புதல், வலைப்பூ உருவாக்குதலில் பயிற்சி பெறல்
5. வலைதளங்களையும் தமிழ் மென்பொருட்களையும் கணினி வழி பயன்படுத்துதல்
6. முன் – தேவைகள்: (Pre-requisites)
1. அடிப்படைக் கணினி அறிவினைப் பெற்றிருத்தல்
7. விவரக்குறிப்புகள்: (Specifications) • பாடத்தின் இயல்பு: **திறன் மேம்பாடு பாடம்** • மதிப்பீடுகளின் எண்ணிக்கை: **3 மதிப்புகள்** • கற்பித்தல் முறை: **விளக்கமுறை மற்றும் செயல்முறைகள்**
8. இணைப்புப் பாடங்கள்: (Bridge courses to be done) 1. Fundamental CC+ Program 2. Fundamental Java Program

9. அலகு விவரம்

அலகு எண்	அலகின் தலைப்பு	விரிவான பாடத்திட்டம்	பாடவேளை எண்ணிக்கை
I	**கணினி வரலாறு**	• கணினித் தலைமுறைகள், கணினியின் கட்டமைப்பு • கணினி வன்பொருள், மென்பொருள் • மென்பொருள் வகைகள் • முறைமை மென்பொருள் (System Software) • பயன்பாட்டு மென்பொருள்	
II	**கணினித் தமிழ் வரலாறு**	• தமிழ் எழுத்துருக்கள் – குறியாக்கம் - தகுதரம் - ஒருங்குறி (Unicode) – வரலாறு • தமிழ் உள்ளீட்டுத் தொழில்நுட்பம் - தமிழ் எழுத்து உள்ளீட்டுக் கருவிகள் – விசைப்பலகை • தட்டச்சு இடைமுகச் செயலி - ஒளியெழுத்துணரி (Optical Character Recognition) • கையெழுத்துணரி – (Handwriting Recognition) • பேச்சுரை மாற்றி (Speech Recognition)	
III	**இணையம்**	• தோற்றம் – வளர்ச்சி - இணையத் தமிழ் வரலாறு • மின்நூலகம் அறிமுகம் – பயன்கள் • தமிழ் மின்நூலகங்கள் - தமிழ் இணையக் கல்விக்கழகம் • மதுரை திட்டம் - முனைவர் பட்ட ஆய்வேட்டு இணையதளம் (Shodhganga) • விக்கிப்பீடியா, விகாஷ்பீடியா, இணைய வழியாகக் கற்றல் கற்பித்தல்	
IV	**கணினி மொழியியல்**	• கணினி மொழியியல் விளக்கம் • இயற்கைமொழி ஆய்வு – (Natural Language Processing) – விளக்கம் – அணுகுனுறைகள் • இயற்கை மொழியாய்வுக் கருவிகள் • தமிழ்மொழிக்கான தொழில்நுட்பக் கருவிகள் • பயன்பாட்டு மென்பொருட்கள்	

V	**பயிற்சிகள்**	• ஒருங்குறி தட்டச்சுப் பயிற்சி • MS Word, Power Point, Excel • கோப்புகள் - ஊருவாக்கல் - சேமித்தல், தேடல் பயிற்சி • வலைப்பூ உருவாக்கப் பயிற்சி (Blog creation) • மின்னூல் உருவாக்கப் பயிற்சி	

10. அலகு வாரியாக மாணாக்கர் செயல்பாடுகள்

1. கணினி வழி ஓவியம் வரைதல்
2. தங்களுடைய கட்டுரைகளைத் தாங்களே தட்டச்சு செய்தல்
3. நழுவப்படங்கள் (பவர்பாயிண்ட்) மூலம் படங்களையும் எழுத்துகளையும் வடிவமைத்தல்
4. மின்னஞ்சல் அனுப்புதல் மற்றும் வலைத்தளங்களைப் பயன்படுத்துதல்.
5. வலைப்பூக்களை உருவாக்கும் முயற்சி மேற்கொள்ளுதல்

11. அடிப்படைப் பாடநூல்கள்

1. இராதா செல்லப்பன், தமிழும் கணினியும், கவிதை அமுதம் வெளியீடு, 2011.

2. சுப்பையா பிள்ளை, இயற்கை மொழி ஆய்வு தமிழ், உலகத் தமிழாராய்ச்சி நிறுவனம், தரமணி, சென்னை - 600 113, 2003.

12. நோக்கு நூல்கள்

1. இராதா செல்லப்பன், தமிழும் கணினியும், கவிதை அமுதம் வெளியீடு, 2011.

2. ஆண்டோ பீட்டர்.மா., தமிழும் கணிப்பொறியும், கற்பகம் புத்தகாலயம், 2002.

3. இளங்கோவன்.மு., இணையம் கற்போம், வயல்வெளி பதிப்பகம், 2009.

4. சுந்தரம்.இல., கணினித்தமிழ், விகடன் பிரசுரம், அண்ணா சாலை, சென்னை - 02, 2014.

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7. பொன்னவைக்கோ.மு., இணையத் தமிழ் வரலாறு, பாரதிதாசன் பல்கலைக்கழக வெளியீடு, 2010.

8. மணிகண்டன்.துரை., இணையத்தில் தமிழ் வலைப்பூக்கள், கவுதம் பதிப்பகம், சென்னை, 2010.

9. வீரநாதன்.ஜெ., இணையத்தை அறிவோம், பாலாஜி கணினி வரைகலைப் பயிலகம், 2010.

13. வலை வளங்கள்

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14. இதழ்கள்/மலர்கள்

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3.தனலட்சுமி.வ., கணினி மொழியியல் கருவிகளின்வழி தமிழ்மொழி கற்றல் கற்பித்தல், உலகத்தமிழாராய்ச்சி நிறுவனம் மாநாட்டுக் கட்டுரை, சென்னை.

4. உங்கள் நூலகம், பெயல்

5. தமிழியல், வரலாறு

15. மதிப்பீட்டு முறைமை

1. பருவத் தேர்வு – விளக்கமுறை

2. அகமதிப்பீட்டு முறை

(ஒப்படைப்பு / வகுப்புத் தேர்வு / குழுவிவாதம் / களப்பணி / கருத்தரங்கம் முதலானவை)

SEMESTER II

MAJOR

1. பாடத்திட்டத்தின் பெயர்: **இளங்கலைத் தமிழ் (Honors)**

2. பாடத்தலைப்பு: **இதழியல் (Journalism)**

3. பாடக் குறியீடு: **TAML 211**

4. கற்றல் விளைவுகள்: (Learning outcomes)
அ) நோக்கம்
1. இதழியல் பற்றிய அடிப்படை அறிவைக் கற்பித்தல்
2. செய்தியினை இதழுக்கு ஏற்றவாறு எழுதும் முறைகளைக் கற்பித்தல்
3. இதழ் வடிவமைப்பு உத்திகளைக் கற்பித்தல்
4. இதழ் உள்ளடக்கங்களை அடையாளம் காண வழி காட்டுதல்
5. தகவல் தொடர்பிற்கு இதழ்களின் பங்கைக் கற்பித்தல்
ஆ) பயன்
1. இதழியல் பற்றிய அடிப்படை அறிவைக் கற்றல்
2. இதழியல் துறையில் பணி புரியும் அறிவைப் பெறல்
3. இதழ் வடிவமைப்பு உத்திகளைக் கற்றல்
4. இதழ் உள்ளடக்கங்களை அடையாளம் காணுதல்
5. தகவல் தொடர்பிற்குப் பயன்படும் இதழ்களின் பங்களிப்பைக் கற்றல்
5. திறன் பயிற்சி: (Skill Training)
1. 1. செய்திகளைச் சேகரிக்கும் திறன் பெறுதல்
2. செய்தி எழுதும் திறன் பெறுதல்
3. செய்திகளை வகைப்படுத்தும் நுணுக்கம் கற்றல்
4. செய்திகளை இணைய வழியாக வெளியிடும் பயிற்சி பெறுதல்
5. செய்தி நிறுவனங்களின் அமைப்புகளையும் பணிகளையும் புரிந்துகொள்ளல்
6. முன் – தேவைகள்: (Pre-requisites)
1. செய்தித்தாள் போன்ற அச்சு இதழ்கள் பற்றி அறிந்திருத்தல்
7. விவரக்குறிப்புகள்: (Specifications) • பாடத்தின் இயல்பு: **முதன்மைப் பாடம்** • மதிப்பீடுகளின் எண்ணிக்கை: **4 மதிப்புகள்** • கற்பித்தல் முறை: **விளக்கமுறை**
8.இணைப்புப் பாடங்கள்: (Bridge courses to be done) 1. அச்சு ஊடகம் பற்றிய அறிமுகம் 2. தமிழில் அச்சு முறை தோன்றிய பின்னணி

9. அலகு விவரம்

அலகு எண்	அலகின் தலைப்பு	விரிவான பாடத்திட்டம்	பாடவேளை எண்ணிக்கை
I	**இதழியல் வரலாறு**	• இதழியல் விளக்கம் - இதழியல் தோற்றமும் வளர்ச்சியும் • ஐரோப்பிய, இந்திய இதழியல் • இதழ்களின் பணிகள், கடமைகள், பொறுப்புகள் • இதழ் வகைகளும் இயல்புகளும் • மக்களாட்சியில் இதழியல் – இதழ்களின் சுதந்திரம்.	
II	**இதழியல் சட்டங்கள்**	• இதழியல் சட்டங்கள் – நீதிமன்ற அவமதிப்பு • அலுவலக ரகசியங்கள் சட்டம் - பதிப்புரிமைச் சட்டம் – இதழ்களின் பதிவுச் சட்டம் • செய்தி நிறுவனங்கள் – உலகச் செய்தி நிறுவனங்கள் – இந்தியச் செய்தி நிறுவனங்கள் • இணைய ஊடகங்கள் – மின்னிதழ்கள் - நெறிமுறைகள்	
III	**இதழ்களில் செய்தி**	• செய்தி விளக்கம் - செய்தியின் இயல்பு • செய்தியின் வகைகள் – செய்தி மூலங்கள் • செய்தி திரட்டும் வழிமுறைகள் • செய்தியாளர் - தகுதி – கடமை • செய்தி சேகரித்தலில் ஏற்படும் இடர்ப்பாடுகள்	
IV	**இதழ் அமைப்பு முறை**	• செய்தி எழுதும் முறை – செய்தியின் உள்ளடக்கம் • செய்தி அளிக்கும் முறை – ஆழ்ந்த செய்தி அளித்தல் – புலனாய்வு, சிறப்புச் செய்தி அளித்தல் • படங்கள் – நகைச்சுவைத்துணுக்குகள் – படத்துணுக்குகள் • செய்திச் செம்மையாக்கம் – ஆசிரியர், துணை ஆசிரியர் பணி • சுருக்கம், தெளிவு – அச்சுப்படி, மெய்ப்புப்படி திருத்துதல் – மேற்பார்வையிடுதல்	

V	**இதழ் உள்ளடக்க வகைகள்**	• பக்க வடிவமைப்பு – தலைப்பு – முகப்பு – உடல் - பக்க அமைப்புக்கொள்கைகள் • பக்க அமைப்புக்குத் துணை செய்வன • இதழியல் மொழிநடை • தலையங்கம் – சிறப்புத் தனிக்கூறுகள் • கட்டுரைகள், திறனாய்வுகள், வாசகர் கடிதங்கள், விளம்பரங்கள்.	

10. அலகு வாரியாக மாணாக்கர் செயல்பாடுகள்

1. தகவல் தொடர்பில் இதழ்களின் அவசியம் குறித்து உரையாடுதல்
2. வகுப்பில் செய்தித்தாள் வாசித்து அதன் உள்ளடக்கங்கள் குறித்து விவாதித்தல்
3. மாதிரி செய்தித்தாள் தயாரித்துக் காண்பித்தல்
4. இதழ்களில் கட்டுரைகள், துணுக்குகள், வாசகர் பக்கம் போன்றவற்றிற்குப் பங்களிப்புச் செய்தல்.
5. சமூக முன்னேற்றத்தில் இதழ்களின் முக்கியத்துவம் குறித்து விவாதித்தல்

11. அடிப்படைப் பாடநூல்கள்

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12. நோக்கு நூல்கள்

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2. சோமலெ, தமிழ் இதழ்கள், சென்னைப் பல்கலைக்கழக வெளியீடு, சென்னை, 1975.
3. மணியன்.தங்க., பத்திரிக்கையியல், மாணிக்கம் பதிப்பகம், மைசூர் - 570 006, 1998.
4. நவீன் குமார், தமிழில் சில முதலிதழ்கள், நர்மதா பதிப்பகம், சென்னை, 2011.
5. பாலசுப்பிரமணியன்.ப., இதழியல் வரலாறும் வழிகாட்டுதலும், சங்கர் பதிப்பகம், சென்னை.
6. சம்பந்தன்.மா.சு., தமிழ் இதழியல் வரலாறு, தமிழர் பதிப்பகம், சென்னை, 1987.
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13. வலை வளங்கள்

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15. மதிப்பீட்டு முறைமை

1. பருவத் தேர்வு – விளக்கமுறை
2. அகமதிப்பீட்டு முறை

(ஒப்படைப்பு / வகுப்புத் தேர்வு / குழுவிவாதம் / களப்பணி / கருத்தரங்கம் முதலானவை)

MINOR

1. பாடத்திட்டத்தின் பெயர்: **இளங்கலைத் தமிழ் (Honors)**

2. பாடத்தலைப்பு: **தமிழ் இலக்கிய வரலாறு**

3. பாடக் குறியீடு: **TAML 221**

4. கற்றல் விளைவுகள்: (Learning outcomes)
அ) நோக்கம்
1. தமிழ் இலக்கிய வரலாற்றை வகைமை நோக்கில் கற்பித்தல்
2. காலப் பின்னணியும் இலக்கிய ஆக்கங்களுக்கும் உள்ள தொடர்பைக் கற்பித்தல்
3. சங்க இலக்கியம் மற்றும் அற இலக்கியம் குறித்த அடிப்படைகளைக் கற்பித்தல்
4. காப்பியங்கள், பக்தி இலக்கியங்கள், சிற்றிலக்கியங்கள் பற்றித் தெளிவை ஏற்படுத்தல்
5. ஆங்கிலேயரின் வருகைக்குப் பின்னர் வளர்ந்த இலக்கியங்கள், நாடக வளார்ச்சி ஆகியன பற்றிக் கற்பித்தல்
ஆ) பயன்
1. வகைமை நோக்குடன் தமிழ் இலக்கிய வரலாற்றை அறிந்துகொள்ளுதல்
2. இலக்கியத்திற்கும் அது தோன்றிய காலத்திற்கும் இடையே உள்ள தொடர்பை தெரிந்துகொள்ளுதல்
3. சங்க இலக்கியம் மற்றும் அற இலக்கியம் குறித்த அடிப்படைகளை அறிந்துகொள்ளுதல்
4. காப்பியங்கள், பக்தி இலக்கியங்கள், சிற்றிலக்கியங்கள் பற்றித் தெளிவு பெறுதல்
5. ஆங்கிலேயரின் வருகைக்குப் பின்னர் வளர்ந்த இலக்கியங்கள், நாடக வளார்ச்சி ஆகியன பற்றித் தெரிந்துகொள்ளுதல்
5. திறன் பயிற்சி: (Skill Training)
1. போட்டித் தேர்வுகளுக்கு தயாராகுதல்
2. திருக்குறளைச் சீர் பிரிக்கும் பயிற்சி பெறல்
3. பக்தி இலக்கியங்களை இசையோடு பாட பயிற்சி எடுத்தல்
4. நாவல் படிக்கும் ஆர்வத்தை பெறல்
5. புதுக்கவிதை எழுதும் ஆற்றலை வளர்த்தல்
6. முன் – தேவைகள்: (Pre-requisites)
1. தமிழ் மொழி இலக்கியங்கள் பற்றித் தெரிந்திருத்தல்
7. விவரக்குறிப்புகள்: (Specifications) • பாடத்தின் இயல்பு: **துணைமைப் பாடம்** • மதிப்பீடுகளின் எண்ணிக்கை: **4 மதிப்புகள்** • கற்பித்தல் முறை: **விளக்கமுறை**
8. இணைப்புப் பாடங்கள்: (Bridge courses to be done) 1. மலேசியத் தமிழ் இலக்கிய வரலாறு

2. ஈழத்து தமிழ் இலக்கிய வரலாறு

3. சிங்கப்பூர் தமிழ் இலக்கிய வரலாறு

9. அலகு விவரம்

அலகு எண்	அலகின் தலைப்பு	விரிவான பாடத்திட்டம்	பாடவேளை எண்ணிக்கை
I	**இலக்கிய வரலாறு அறிமுகம்**	• இலக்கிய வரலாறு எனும் பயில்துறையின் அறிமுகம் • இலக்கியத்தின் வரலாற்றுக்கும் இலக்கியத்தின் வழி வரலாற்றுக்கும் உள்ள வேறுபாடுகள் • இலக்கிய வரலாறு எழுதியலில் பின்பற்றப்படும் பகுப்பு முறைகள் - கால அடிப்படையிலான பகுப்பு முறை • ஆட்சியாளர்கள் அடிப்படையிலான பகுப்பு முறை – சமய அடிப்படையிலான பகுப்பு முறை – வகைமை நோக்கிலான பகுப்பு முறை • தமிழில் எழுந்துள்ள இலக்கிய வரலாற்று நுல்கள்	
II	**அற இலக்கியங்கள்**	• இறையனார் களவியல் உரை தெரிவிக்கும் முச்சங்க வரலாறு • பாட்டும் தொகையும் – கீழ்க்கணக்கு அக, புற இலக்கியங்கள் • முத்தொள்ளாயிரம் – அற இலக்கியம் • கீழ்க்கணக்கு அற இலக்கிய நூல்கள் • பிற்கால அற இலக்கியங்கள்	
III	**காப்பியம் முதல் சித்தர் இலக்கியம் வரை**	• காப்பிய இலக்கியம் – ஐம்பெருங்காப்பியங்கள் – ஐஞ்சிறு காப்பியங்கள் – பெருங்கதை • புராணங்கள் – பெரிய புராணம் – கந்தபுராணம் – திருவிளையாடற்புராணம் – வில்லி பாரதம் – நளவெண்பா – நைடதம் • இசுலாமிய காப்பியங்கள் – கிறித்துவ காப்பியங்கள் – இருபதாம் நூற்றாண்டுக் காப்பியங்கள் • பக்தி இலக்கியம் - பன்னிரு திருமுறை – தொகுப்பும் பகுப்பும் -அறுபத்து மூன்று	

		நாயன்மார்கள் - திருமுறை ஆசிரியர்கள் – நாலாயிர திவ்ய பிரபந்தம் – தொகுப்பும் வைப்புமுறையும் – பன்னிரு ஆழ்வார்கள் – ஆழ்வார்களின் கால நிலையும் ஆக்கங்களும் • சித்தர் இலக்கியம் – பதினெண் சித்தர்கள் – சித்தர் நெறி - பிற்கால பக்தி இலக்கியப் போக்குகள் - பட்டினத்தடிகள் – அருணகிரிநாதர் – தாயுமானவர் – குமரகுருபரர் – வள்ளலார் – குணங்குடி மஸ்தான் சாகிபு	
IV	**சிற்றிலக்கியம் முதல் சித்தர் இலக்கணம் வரை**	• சிற்றிலக்கியம் – வகைகள் – ஆற்றுப்படை – அந்தாதி – மாலை – கோவை – உலா – பரணி – தூது – கலம்பகம் – பிள்ளைத்தமிழ் • இசுலாமிய சிற்றிலக்கியங்கள் – கிறித்துவ சிற்றிலக்கியங்கள் - தத்துவ இலக்கியம் – சைவ சித்தாந்த சாத்திர நூல்கள் – உரைகள் – வைணவ உரையாசிரியர்கள் – உரை வரலாறு • தமிழ் இலக்கண வரலாறு – தொல்காப்பியம் – ஐந்திலக்கண நூல்கள் – வீர சோழியம் – இலக்கண விளக்கம் – தொன்னூல் விளக்கம் – முத்துவீரியம் – சுவாமிநாதம் – நன்னூல் – நேமிநாதம் • பொருள் இலக்கண நூல்கள் – இறையனார் அகப்பொருள் – நம்பியகப்பொருள் – மாறன் அகப்பொருள் – புறப்பொருள் வெண்பாமாலை – யாப்பிலக்கண நூல்கள் – யாப்பருங்கலம் – யாப்கருங்கலக்காரிகை – அணியிலக்கணம் – தண்டியலங்காரம் • பாட்டியல் நூல்கள் – நிகண்டுகள் – அகராதி உருவாக்கம் – இசைத்தமிழ் வரலாறு – நாடக வரலாறு	
V	**இக்கால இலக்கியம்**	• இக்கால இலக்கியம் – ஐரோப்பியர் வருகை – நவீனமயமாக்கம் – ஐரோப்பிய பாதிரிமார்களின் பங்களிப்புகள் • வசன கவிதை, புதுக்கவிதை, ஹைக்கூ • சிறுகதை வரலாறும் வளர்ச்சியும் – புதினம்	

		தோற்றமும் வளர்ச்சியும் • நாடக வரலாறும் ஆக்கங்களும் • காந்திய – திராவிட - மார்க்சிய – பெண்ணிய – தலித்திய பங்களிப்புகள்	

10. அலகு வாரியாக மாணாக்கர் செயல்பாடுகள்

1. தொன்ம இலக்கியங்களைப் பயின்று வினாநிரல் தயாரித்தல்
2. இலக்கணங்களை வாழ்க்கையோடு பொறுத்தி கற்றல்
3. நவின இலக்கியங்களைப் பற்றி குழுவாக கலந்துரையாடுதல்
4. காப்பியங்கள், புராணங்கள் தொடர்பாக கட்டுரை எழுதுதல்
5. சிற்றிலக்கியம், சித்தர் இலக்கியம் குறித்து வகுப்பு எடுத்தல்

11. அடிப்படைப் பாடநூல்கள்

1. தமிழண்ணல், புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு, சோலை பதிப்பகம், மதுரை.
2. வரதராசன்.மு, தமிழ் இலக்கிய வரலாறு, சாகித்திய அகாதெமி, சென்னை, 1972.

12. நோக்கு நூல்கள்

1. சிவத்தம்பி.கா, தமிழில் இலக்கிய வரலாறு, என்.சி.பி.எச்., சென்னை, 1988.
2. அருணாசலம்.மு., தமிழ் இலக்கிய வரலாறு (தொகுதி 1-14), த பார்க்கர், சென்னை, 1975.
3. சுப்பிரமணியன்.ச.வே., தமிழ் இலக்கிய வரலாறு, மணிவாசகர் பதிப்பகம், சென்னை, 1999.
4. சுபாஷ் சந்திர போஸ், தமிழ் இலக்கிய வரலாறு, பாவை பப்ளிகேஷன்ஸ், சென்னை, 2010.
5. பாலசுப்பிரமணியன்.சி., தமிழ் இலக்கிய வரலாறு, பாரி நிலையம், சென்னை, 2010.

13. வலை வளங்கள்

1. http://www.ulakaththamizh.org/JOTSAArticle.aspx?id=413
2. Tamil Heritage Foundation - www.tamilheritage.org
3. Tamil virtual University Library - http://www.virtualvu.org/library
4. Project Madurai - www.projectmadurai.org.
5. www.tamilvu.org/ library
6. Chennai Library - www.chennailibrary.com http://www.chennailibrary.com
7. Tamil Universal Digital Library - www.ulib.prg http://www.ulib.prg
8. Tamil E-Books Downloads - tamilebooksdownloads. blogspot.com

14. இதழ்கள்/மலர்கள்

1. ஆவணம், அரிமாநோக்கு
2. தமிழ்மொழி மற்றும் இலக்கியப் பன்னாட்டு ஆய்விதழ்
3. காலச்சுவடு, மணற்கேணி
4. உங்கள் நூலகம், பெயல்
5. தமிழியல், வரலாறு

15. மதிப்பீட்டு முறைமை

1. பருவத் தேர்வு – விளக்கமுறை
2. அகமதிப்பீட்டு முறை

   (ஒப்படைப்பு / வகுப்புத் தேர்வு / குழுவிவாதம் / களப்பணி / கருத்தரங்கம் முதலானவை)

SEMESTER II

1. பாடத்திட்டத்தின் பெயர்: **இளங்கலைத் தமிழ் (Honors)**
2. பாடத்தலைப்பு:**பொதுத்தமிழ்** - 1
3. பாடக்குறியீடு: TAML 241

4.கற்றல் விளைவுகள்: (Learning outcomes)
அ) நோக்கம்
1.தமிழ் இலக்கியங்களை அறிமுகப்படுத்துதல்
2.தமிழ் மொழியைப் பிழையின்றி எழுதக் கற்பித்தல்
3. மொழி அறிவு இலக்கண அறிவை வளர்த்தல்
4. இலக்கிய வரலாற்று பின்புலங்களைக் கற்பித்தல்
5. மொழி சார்ந்த வேலைவாய்ப்புப் பயிற்சி அளித்தல்
ஆ) பயன்
1.தமிழ் இலக்கியங்களை அறிந்து கொள்ளல்
2. தமிழ் மொழியைப் பிழையின்றி எழுதக்கற்றல்
3. மொழி அறிவு இலக்கண அறிவைப் பெறல்
4. இலக்கிய வரலாற்று பின்புலம் அறிதல்
5. மொழி சார்ந்த வேலைவாய்ப்பு பயிற்சி பெறல்
5.திறன் பயிற்சி: (Skill Training)
1.கவிதை எழுதப் பயிற்சி எடுத்தல்
2.சிறுகதை எழுத முயற்சித்தல்
3. சொற்பிழை, எழுத்துப்பிழை, மரபுப்பிழையின்றி பேச எழுதப் பழகுதல்
4.பக்தி இலக்கியங்களை பண்ணோடுப் பாட முயற்சித்தல்
5.தமிழ் மொழி அகரவரிசைப் படுத்தும் முறையை பயிற்சி செய்தல்
6.முன் – தேவைகள்: (Pre-requisites)
1.தமிழ் மொழியை அறிந்திருத்தல்
7. விவரக்குறிப்புகள்: (Specifications) • பாடத்தின் இயல்பு: **மொழித்திறன்பாடம்** • மதிப்பீடுகளின் எண்ணிக்கை: 2+1**மதிப்புகள்** • கற்பித்தல் முறை: **விளக்கமுறை** **8. இணைப்புப் பாடங்கள்: (Bridge courses to be done)** 1. தேவிரா இலக்கிய வரலாறு 2. பாக்கியமேரி இலக்கிய வரலாறு

9.அலகு விவரம்

அலகு எண்	அலகின் தலைப்பு	விரிவான பாடத்திட்டம்	பாடவேளை எண்ணிக்கை
I	**கவிதைகள்**	• பாரதியார் - எங்கள்நாடு (முதல் மூன்று பாடல்கள்) • பாரதிதாசன் – தமிழின் இனிமை (முதல் ஐந்து பாடல்கள்) • வாணிதாசன் - என்வேலை (முதல்நான்குபாடல்கள், ப.92) • நா.காமராசன் - வானவில் (கறுப்பு மலர்கள், ப.50) • மீனாட்சி - பிள்ளைக்கூடம் (கொடி விளக்கு, பக்.136,137)	
II	**புனைகதைகள் மற்றும் நாடகங்கள்**	• புனைகதை மற்றும் நாடகம் - அறிமுகம் - வரலாறு • தி.ஜானகிராமன் - பாயசம் • பாமா – கிசும்புக்காரன் • திலகவதி - கல்மரம் • கே.ஏ.குணசேகரன் - பேயோட்டம்	
III	**சிற்றிலக்கியங்கள்**	• சிற்றிலக்கியமும் பக்திஇலக்கியம் – அறிமுகம் –வரலாறு • தமிழ்விடுதூது – தமிழின் சிறப்பு (கண்ணி 70 முதல் 100 வரை) • முக்கூடற்பள்ளு – பள்ளியர் ஏசல் (முதல் 10 பாடல்கள்) • குற்றாலக் குறவஞ்சி – மலைவளம் (வானரங்கள் கனிகொடுத்து முதல் கொல்லி மலை வரை) • நந்திக்கலம்பகம் – தலைவன் நெஞ்சொடு கிளத்தல் (பாடல் எண்கள் 10, 25), கலிங்கத்துப்பரணி – பேய் பாடியது (முதல் பத்து பாடல்கள்)	

IV	**பக்தி இலக்கியம்**	• திருநாவுக்கரசர் – (திருநல்லூர்த் திருத்தாண்டகம் (பாடல் 6380 – 84), காரைக்கால் அம்மையார் – அற்புதத் திருவந்தாதி (5 பாடல்கள், 44 முதல் 48 வரை) • நம்மாழ்வார் - பெரிய திருவந்தாதி (முதல் 10 பாடல்கள்), ஆண்டாள் – திருப்பாவை (முதல் ஐந்து பாடல்கள்) • திருமூலர் - திருமந்திரம் (பாடல் 251 முதல் 255 வரை) • வள்ளலார் - பிள்ளைசிறு விண்ணப்பம் (முதல் 5 பாடல்கள்) • குணங்குடி மஸ்தான் - நிராமயக் கண்ணி (கண்ணி 21 முதல் 30 வரை), எச்.ஏ.கிருட்டிணப்பிள்ளை - இரட்சணிய யாத்திரீகம் - குருதரிசனப் படலம் (15 பாடல்கள்)	
V	**மொழித்திறன்**	• மொழித் திறன், பிழையின்றி எழுதுதல் • எழுத்துப்பிழை, சொற்பிழை • தொடர்பிழை, மரபுப்பிழை • அகர வரிசைப் படுத்துதல் • வல்லினம் மிகும், மிகா இடங்கள்	

10. அலகு வாரியாக மாணாக்கர் செயல்பாடுகள்

1. கவிதை எழுதுதல்
2. சிறுகதை எழுதுதல்
3. கவிதைப் போட்டியில் பங்கு பெறுதல்
4. பக்தி இலக்கியம் குறித்து குழுவாகக் கலந்துரையாடல்
5. சிற்றிலக்கியம் குறித்து வினாடி வினா நடத்துதல்

11. அடிப்படைப் பாட நூல்கள்

1. பாலசுப்பிரமணியம். சிற்பி., பத்மநாபன் .நீல., புதிய தமிழ் இலக்கிய வரலாறு, சாகித்திய அகாதெமி, 2013.
2. அருணாச்சலம்.மு., தமிழ் இலக்கிய வரலாறு, தி பார்க்கர் பதிப்பகம், சென்னை.

12. நோக்கு நூல்கள்

1. வரதராசன். மு., தமிழ் இலக்கிய வரலாறு, சாகித்திய அகாதெமி, 2015.
2. பக்தி இலக்கியம் உரையுடன் கூடிய மூலநூல்கள்
3. சிற்றிலக்கியம் மூலநூல்கள்
4. விமலானந்தம். மது.ச., தமிழ் இலக்கிய வரலாறு, பாரி நிலையம், சென்னை.
5. தமிழண்ணல், புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு, மீனாட்சி புத்தக நிலையம், 2022.

13. வலைவளங்கள்

1.http://www.ulakaththamizh.org/JOTSAArticle.aspx?id=413

2.Tamil Heritage Foundation - www.tamilheritage.org

3.Tamil virtual University Library - http://www.virtualvu.org/library

4.Project Madurai - www.projectmadurai.org.

5.www.tamilvu.org/ library

6.Chennai Library - www.chennailibrary.com http://www.chennailibrary.com

7.Tamil Universal Digital Library - www.ulib.prg http://www.ulib.prg

8.Tamil E-Books Downloads - tamilebooksdownloads. blogspot.com

9.Tamil Books on line-books.tamil cube.com

10.Catalogue of the Tamil books in the Library of British Congress archive. Org

14. இதழ்கள்/மலர்கள்

1.ஆவணம், அரிமா நோக்கு

2.தமிழ் மொழி மற்றும் இலக்கியப் பன்னாட்டு ஆய்விதழ்

3.காலச்சுவடு, மணற்கேணி

4.உங்கள்நூலகம், பெயல்

5.தமிழியல், வரலாறு

15. மதிப்பீட்டு முறைமை

1. பருவத்தேர்வு – விளக்கமுறை

2. அகமதிப்பீட்டு முறை

(ஒப்படைப்பு/ வகுப்புத் தேர்வு / குழுவிவாதம் / களப்பணி / கருத்தரங்கம் முதலானவை)

1. பாடத்திட்டத்தின் பெயர்:**இளங்கலைத் தமிழ் (Honors)**

2. பாடத்தலைப்பு:**அடிப்படைத்தமிழ் - 1**

3. பாடக்குறியீடு: **TAML 242**

4.கற்றல் விளைவுகள்: (Learning outcomes)
அ) நோக்கம்
1.பிறமொழி பேசும் மாணவர்களுக்குத் தமிழை எழுதக் கற்பித்தல்
2. பிறமொழி பேசும் மாணவர்களுக்குத் தமிழை பேசக் கற்பித்தல்
3. தமிழ் எழுத்துகள், எளியசொற்கள், தொடர்களைக் கற்பித்தல்
4. தமிழ் மொழியின் அடிப்படை இலக்கணங்களை எடுத்துரைத்தல்
5.தமிழ் மொழியில் பிழையறப் பேசவும், எழுதவும் திறன் பெறும் வகையில் விவரித்தல்
ஆ) பயன்
1.பிறமொழி பேசும் மாணவர்களுக்குத் தமிழை எழுதக் கற்றல்
2. பிறமொழி பேசும் மாணவர்களுக்குத் தமிழைப் பேசக் கற்றல்
3. தமிழ் எழுத்துகள், எளிய சொற்கள், தொடர்களைக் கற்றல்
4. தமிழ் மொழியின் அடிப்படை இலக்கணங்களைக் கற்றல்
5.தமிழ் மொழியில் பிழையறப் பேசவும், எழுதவும் திறன்களை வளர்த்தல்
5.திறன் பயிற்சி: (Skill Training)
1. அடிப்படை இலக்கண அறிவை வளர்த்தல்
2.பிழையின்றிப் பேசப் பயிற்சி எடுத்தல்
3. பிழையின்றி எழுதப்பயிற்சி மேற்கொள்ளுதல்
4.போட்டித் தேர்வுகளுக்குத் தயாராகுதல்
5.பிறமொழிச் சொற்களை நீக்கும் திறன் பெறுதல்
6.முன் – தேவைகள்: (Pre-requisites)
1. தமிழ் மொழியைஅறிந்திருத்தல்
7.விவரக் குறிப்புகள்: (Specifications) • பாடத்தின் இயல்பு:**மொழித்திறன்பாடம்** • மதிப்பீடுகளின் எண்ணிக்கை:2+1**மதிப்புகள்** • கற்பித்தல் முறை:**விளக்கமுறை**
8.இணைப்புப் பாடங்கள்: (Bridge courses to be done) 1. நன்னூல் எழுத்ததிகாரம் 2. நன்னூல் சொல்லதிகாரம்

9.அலகுவிவரம்

அலகு எண்	அலகின் தலைப்பு	விரிவான பாடத்திட்டம்	பாடவேளை எண்ணிக்கை
I	**உயிர் எழுத்துகள்**	• தமிழ் உயிரெழுத்துகள் அறிமுகம் • குறில் நெடில் பாகுபாடு • ஆய்தம்	
II	**மெய் எழுத்துகள்**	• தமிழ் மெய்யெழுத்துகள் • ஓசை வேறுபாடு	
III	**உயிர்மெய் எழுத்துகள்**	• உயிர்மெய் எழுத்து • வல்லினம் • மெல்லினம் • இடையினம்	
IV	**தமிழ்ச் சொல்வகைகள்**	• தமிழ்ச் சொல் வகைகள் • ஒரெழுத்து • ஈரெழுத்து • மூவெழுத்துச் சொற்கள்	
V	**சொல்வகைகள்**	• பெயர்ச்சொல் • வினைச்சொல் • பெயரடை • வினையடை	

10.அலகு வாரியாக மாணாக்கர் செயல்பாடுகள்

1.எழுத்துகளின் மாத்திரை அளவுகளைக் கணக்கிடுதல்

2.ஓசை வேறுபாடுகளை உச்சரித்துக் கண்டறிதல்

3.வல்லின, மெல்லின, இடையின வேறுபாடுகளைப் பற்றி கலந்துரையாடுதல்

4.நாற்பத்தியிரண்டு ஓரெழுத்து ஒருமொழிகளை ஒப்புவித்தல்

5.சொற்களின் வேறுபாடுகள் குறித்து வகுப்பு எடுத்தல்

11.அடிப்படைப் பாடநூல்கள்

1. தமிழ், நிலை – 1, பகுதி – 1, தமிழ் இணையக் கல்விக் கழகம், சென்னை.
2. தமிழ், நிலை – 1, பகுதி – 2, தமிழ் இணையக் கல்விக் கழகம், சென்னை.

12.நோக்கு நூல்கள்

1. தமிழ், முதல் வகுப்பு, முதல் பருவம், தொகுதி 1, தமிழ் பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம், சென்னை,2018.
2. தமிழ், முதல் வகுப்பு, இரண்டாம் பருவம், தொகுதி 1, தமிழ் பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம், சென்னை,2018.
3. தமிழ், முதல் வகுப்பு, மூன்றாம் பருவம், தொகுதி 1, தமிழ் பாடநூல் மற்றும் கல்வியியல்

பணிகள் கழகம், சென்னை, 2018.

4. பரந்தாமனார்.அ.கி., நல்ல தமிழில் எழுத வேண்டுமா?, பாரி நிலையம், சென்னை.

5. பட்டாபிராமன். கா., மொழிப் பயன்பாடு, நியூ செஞ்சுரி புக் ஹவுஸ், சென்னை.

13.வலைவளங்கள்

1.http://www.ulakaththamizh.org/JOTSAArticle.aspx?id=413

2.Tamil Heritage Foundation - www.tamilheritage.org

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6.Chennai Library - www.chennailibrary.com http://www.chennailibrary.com

7.Tamil Universal Digital Library - www.ulib.prg http://www.ulib.prg

8.Tamil E-Books Downloads - tamilebooksdownloads. blogspot.com

9.Tamil Books on line-books.tamil cube.com

14.இதழ்கள்/மலர்கள்

1.ஆவணம், அரிமாநோக்கு

2.தமிழ் மொழி மற்றும் இலக்கியப் பன்னாட்டு ஆய்விதழ்

3.காலச்சுவடு, மணற்கேணி

4.உங்கள்நூலகம், பெயல்

5.தமிழியல், வரலாறு

15. மதிப்பீட்டுமுறைமை

1. பருவத்தேர்வு – விளக்க முறை

2. அகமதிப்பீட்டு முறை

(ஒப்படைப்பு/ வகுப்புத்தேர்வு / குழுவிவாதம் / களப்பணி / கருத்தரங்கம் முதலானவை)

CHEMISTRY CURRICULUM

B.Sc. (Hons.) Chemistry – 4 Years program
B.Sc. (Hons., with Research) Chemistry – 4 Years program
B.Sc. (Hons.) Chemistry (Specialization) – 4 Years program
B.Sc. (Hons., with Research) Chemistry (Specialization) – 4 Years program

DEPARTMENT OF CHEMISTRY
PONDICHERRY UNIVERSITY
2023

Major 1 **Credit: 4**

CHEM 1101 General Chemistry I: Molecular Geometry & Shapes

Learning Objectives: Molecular stereochemistry is a fundamental aspect of all areas of chemistry. To understand the nature of bonding between elements. To realize the three-dimensional structure of molecules.

Learning Outcome: This course enables the students (a) to identify and assign shapes and molecular symmetry elements (b) to visualize, identify, evaluate, 3D molecular structures and energetics of isomers (c) to understand the structural features of solids

Course Content:

Unit I – Classical Bonding:

Types of bonds, representation of electrons as dots, Lewis model of ionic, covalent structures, Electronegativity and bond polarity, Lewis structure of molecular compounds, formal charge, exception to octet rule, bond energies and bond lengths, bonding in metals – VSEPR theory, predicting molecular geometry, shapes and polarity – Valence Bond theory – Molecular orbital theory, electron delocalization.

Unit II – Bonding in Organic Molecules:

Bonding and shapes of organic molecules – hybridization, oxidation number, resonance – delocalization of electrons; inductive effect, introduction to functional groups, intermolecular forces, Brønsted–Lowry acids and bases – pKa & pKb, effect of structure on acidity, HSAB principle, Nomenclature of organic compounds.

Unit III – Basics of Stereochemistry:

Types of isomers – constitutional isomers and stereoisomers; representation of stereoisomers – Fischer projection, saw-horse projection, Newman projection formulae, configurational isomers, geometrical isomers, conformational isomers – ethane, butane, cyclohexane.

Unit IV – Stereochemistry of Inorganic Compounds:

Geometrical and optical nature of 4-, 5-, 6- coordinated p-block and transition elements compounds having mono-, di-, tri-dentate ligands; stereochemistry of 7- and above coordination compounds.

Unit V – Point Groups of Molecules:

Symmetry elements and operations, assignment of point groups for chemical molecules with examples.

Textbook:

1. Organic Chemistry, P. Y. Bruice, Pearson Education, 7th Edn, 2013
2. Inorganic Stereochemistry, D. L. Kepert, Springer Verlag, 1982.
3. Inorganic Structural Chemistry, U. Muller, 2nd Edn., Wiley, 2006.
4. Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg (Part A and B) Kluwer Academic / Plenum Publishers, 2000.
5. Organic Stereochemistry: Stereochemistry of Organic Compounds, E. L. Eliel, and S. H. Wilen, John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2003
6. F. Albert Cotton, Chemical Applications of Group Theory, 3rd Edition, Wiley, 1990.

Major 2 **Credit: 4**

CHEM 1201 General Chemistry II

Learning Objectives: This course explores the electronic structure of elements starting from hydrogen, alkali and alkaline earth metals, and the basic treatment of boron group elements. It covers the structure and bonding, and functionalization of alkanes. Basic knowledge in quantum mechanics and the solving wave equations are introduced in this course.

Learning Outcome: The student may be expected to understand the structure and bonding nature of chemical elements and learn different chemical reactions, and also learn to solve the wave equation with quantum mechanical treatment.

Course Content:

Unit I – Hydrogen and Hydrides, Alkali and Alkaline Earth Metals:

Hydrogen and Hydrides: Electronic structure, abundance, preparation and properties, isotopes, ortho- and para hydrogen; Hydrides: ionic, covalent, metallic and intermediate hydrides; Hydrogen bonding. Alkali metals: Introduction, halides, oxides and hydroxides, salts of oxo-acids, aqueous solution chemistry, complexes and organometallic compounds. Alkaline Earth metals: Introduction, halides, oxides and hydroxides, salts of oxo-acids, aqueous solution chemistry, complexes and organometallic compounds.

Unit II – Boron Group (Basic treatment):

Boron group: Boron compounds, metal borides, halides and complex halides of B, Al, Ga, In and Tl, oxides, oxo-acids, oxo-anions and hydroxides; nitrogen derivatives; Al, Ga, In and Tl salts of oxo-acids and aqueous solution chemistry, organometallic compounds.

Unit III – Basics of Organic Reaction Mechanism:

Chemical reactivity and mechanism – energetics – enthalpy, entropy, bond energy, Gibbs free energy, activation energy, kinetic and thermodynamic control, Hammond postulate, principle of microscopic reversibility, types of chemical reaction – bond cleavage, nucleophiles, electrophiles, free radicals, arrow pushing in organic chemistry.

Unit IV – Functionalization of Alkanes, Alkenes, Dienes and Alkynes:

Alkanes – source of alkanes, functionalizing alkanes - free radical halogenation and oxidations. Laboratory preparation of alkenes, dienes and alkynes. Functionalizing alkenes, dienes and alkynes - Addition reactions, substitution reactions and cycloaddition reactions.

Unit V - Basics of Quantum Mechanics:

Planck's Law – Derivation of Bohr's atom – Merits and Drawbacks – Wave-particle Duality – Uncertainty principle – Wave Equation – Particle in a box – Tunneling – Harmonic Oscillator – Power Series Solutions – Hermite Polynomials - Rigid Rotor – 3D Extensions – Legendre Polynomials and its variants –Spherical harmonics - Energy Spacing and Degeneracies - Quantum Postulates.

Textbooks:

1. Organic Chemistry, P. Y. Bruice, Pearson Education, 7th Edn, 2013
2. A. G. Sharpe, Inorganic Chemistry, 3rd Edition, Addison-Wesley, 1999.
3. J. D. Lee, A New Concise Inorganic Chemistry, 3rd Edition., ELBS, 1987.
4. D. F. Shriver, P. W. Atkins, C. H. Langford, Inorganic Chemistry, ELBS. 1990
5. D. A. McQuarrie & J. D. Simon, Physical Chemistry: A Molecular Approach, University Science Books, CA, 1997.

Major 3 **Credit: 4**

CHEM 2101 General Chemistry III

Learning Objectives: This course explores the basic treatment of carbon and oxygen group elements and functionalization of simple organic molecules, and give insights to understand the thermodynamic aspects of chemical reaction and the phase diagrams.

Learning Outcome: The students may understand and write mechanisms for various chemical reactions and able to understand the equilibrium reactions in thermodynamic perspective.

Course Content:

Unit I – Carbon Group (Basic treatment):

Introduction, Intercalation compounds of graphite, carbides and silicides, halides and complex halides; oxides and oxo-acids of carbon; oxides and oxo-acids and hydroxides of Si, Ge, Sn and Pb; Silicates; Silicones; Sulphides; Cyanogen, its derivatives and silicon nitride; aqueous solution chemistry and oxo-acid salts of Sn and Pb; Organometallic compounds.

Unit II – Oxygen Group (Basic treatment):

Introduction of Chalcogens; Hydrides; Oxides, Oxo-acids, Halides, Oxo-halides and complex halides, and their salts; Sulphides, Selenides, Tellurides; Aqueous solution chemistry; Nonaqueous SO_2.

Unit III – Chemistry of Selected Functionalization Groups:

Chemistry of alkyl halides, alcohols, aldehydes, carboxylic acids and derivatives, amines, thiols and nitro compounds.

Unit IV – Equilibrium Thermodynamics:

Laws of Thermodynamics, Thermodynamic functions (U, H, S, G, and A) - Maxwell relations-temperature and pressure effects. Chemical equilibrium – Le Chatelier's Principle - equilibrium constant.

Unit V – Phase Transformation and Phase diagram:

Phase rule, Phase stability, thermodynamics of phase transitions, simple mixtures, colligative properties, Phase diagrams: One and Two-component systems - azeotropes, eutectics, congruent and incongruent melting.

Textbook:

1. A. G. Sharpe, Inorganic Chemistry, 3rd Edition, Addison-Wesley, 1999.
2. J. D. Lee, A New Concise Inorganic Chemistry, 3rd Edition., ELBS, 1987.
3. D. F. Shriver, P. W. Atkins, C. H. Langford, Inorganic Chemistry, ELBS. 1990.
4. Organic Chemistry, P. Y. Bruice, Pearson Education, 7th Edn, 2013.
5. P. Atkins, J. de Paula, J. Keeler, Physical Chemistry, 11th Edition, Oxford University Press, Oxford, United Kingdom, 2018.
6. D. A. McQuarrie & J. D. Simon, Physical Chemistry: A Molecular Approach, University Science Books, CA, 1997.

Major 4 **Credit: 4**

CHEM 2102 General Chemistry IV

Learning Objectives: This course explores the basic treatment of halogen and noble gases, and stereochemistry and chemistry of aromatic hydrocarbons. It also covers the electrochemistry part of equilibrium thermodynamics and solve the one-electron problem quantum mechanically.

Learning Outcome: The students may understand and write mechanisms and stereochemical effects on various chemical reactions. Able to understand the electrochemical reactions in thermodynamic perspective and get insight of solving the wave equation for one-electron problem.

Course Content:

Unit I – Halogens and Noble Gases (Basic treatment):

Introduction; hydrogen halides; general considerations of halides; pseudohalogens; interhalogen compounds and polyhalogeno ions; oxides and oxyfluorides of Cl, Br and I; oxo- acids of halogens and their salts; aqueous solution chemistry; organic derivatives. Noble gases: Introduction; compounds of Xe, Kr and Rn; Chemical properties, structure and bonding.

Unit II – Stereochemistry:

Chirality – optical activity – central chirality, axial chirality, planar chirality, helicity, achiral diastereomers, prochirality, other stereochemical descriptors; configurational nomenclature (*R/S*) – CIP rule. Selectivity in organic reactions, configurational and conformational effects on reactivity. Source of chiral molecules – resolution and asymmetric synthesis (basic treatment).

Unit III – Chemistry of Aromatic Hydrocarbons:

Aromaticity, Huckel rule, annulene, benzenoid, nonbenzenoid, heteroaromatics, charged aromatics, fulvenes, fulvalenes, anti-aromatics and homoaromatics, structure and reactions of benzene, activity and orientation of substituted benzenes. Introduction to other aromatic systems.

Unit IV – Electrochemistry:

Electrochemical cells, half-cell potentials and cell potentials, determination of activities and activity coefficients of electrolytes- Debye-Hückel limiting law -Thermodynamic information from electrochemistry- Nernst equation - Electrode potentials.

Unit V – Solving One-electron Atom:

The Schrödinger equation – Atomic units – Relative coordinates - spherical polar coordinates – Separation of variables – Angular part – The Radial equation and its simplification – Asymptotic solution for ρ equation – Laguerre and associated Laguerre polynomials – Origin of quantization of solutions – Interdependency between quantum numbers.

Textbooks:

1. Organic Chemistry, P. Y. Bruice, Pearson Education, 7th Edn, 2013
2. E. L. Eliel, Stereochemistry of Carbon Compounds. John Wiley (1997)
3. A. G. Sharpe, Inorganic Chemistry, 3rd Edition, Addison-Wesley, 1999.
4. J. D. Lee, A New Concise Inorganic Chemistry, 3rd Edition., ELBS, 1987.
5. P. Atkins, J. de Paula, J. Keeler, Physical Chemistry, 11th Edition, Oxford University Press, Oxford, United Kingdom, 2018.
6. D. A. McQuarrie & J. D. Simon, Physical Chemistry: A Molecular Approach, University Science Books, CA, 1997.
7. I. N. Levine, Quantum Chemistry, 7th Edition, Pearson Education, Inc. NJ, 2014.

Major 5 **Credit: 4**

CHEM 2201 Inorganic Chemistry I

Learning Objectives: Study of p-block elements and their compounds provides a strong foundation to the understanding of periodic properties of elements and this course provides an opportunity to study periodic properties.

Learning Outcome: Students after completing will be able to predict various reactions of elements and their synthetic methodology.

Course Content:

Unit I – Acids and Bases:

Bronsted acids and bases: Bronsted acidy, periodic trends in Bronsted acidy, Lewis acids and bases: definitions, adduct formation, strengths, stability; super acids; HSAB principle and its applications.

Unit II – Solid State Chemistry:

Inorganic Solids: Ionic solids, close packing, radius ratio, ionic radii, lattice energy; crystal structure, cubic systems (SC, BCC, FCC), fluorite, antifluorite, zincblende, rutile; defects in ionic solids; insulators, semiconductors, and superconductivity.

Unit III – Early Transition Elements:

Introduction and the chemistry of Scandium group, Titanium group, Vanadium group, Chromium group and Manganese group.

Unit IV – Late Transition Elements:

Introduction and the chemistry of Iron group, Cobalt group, Nickel group, Copper group and Zinc group.

Unit V – Nuclear Chemistry- Basic Treatment:

Introduction; nuclear binding energy; radio-activity and nuclear reactions; nuclear fission and fusion; spectroscopic techniques based on nuclear properties; separation of stable isotopes and unstable isotopes; applications of isotopes.

Text Book:

1. N. N. Greenwood, A. Earnshaw, Chemistry of the Elements, 2nd Edn, BH, 1997
2. K. F. Purcell and J. C. Kotz, Inorganic Chemistry, 2nd Edn, Cengage Learning, 2012
3. F. A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 6th Edn, John Wiley, 2004.
4. D. F. Shriver, P. W. Atkins, C. H. Langford, Inorganic Chemistry, ELBS. 1990.
5. A. G. Sharpe, Inorganic Chemistry, 3rd Edn, Addison-Wesley, 1999.
6. J. D. Lee, A New Concise Inorganic Chemistry, 3rd Edn, ELBS, 1987.
7. B. Douglas, D. McDaniel, J. Alexander, Concepts and Models of Inorganic Chemistry, 3rd Edn, John Wiley, 2001.
8. L. Jolly, Modern Inorganic Chemistry, 2nd Edn, McGraw-Hill, 1991.

Major 6 **Credit: 4**

CHEM 2202 Organic Chemistry I: Functional Group Transformations

Learning Objectives: Reactions of functional groups attached with sp^3, sp^2 and sp carbons. Understaniding these processes with help of basic organic reaction mechanism.

Learning Outcome: Identify the nucleophile, electrophile and free radical and their reactivity pattern. Identify the oxidation states of carbon bearing functional groups. Transforming functional groups.

Course Content:

Unit I – Substitution and Elimination Reactions:

Identifying and generating nucleophiles and electrophiles. Types of reactions, mechanism of reactions. Substitution at saturated reaction center – S_N1, S_N2 and S_Ni mechanism - stereochemical outcome of the products; elimination reactions-generating carbon – carbon and carbon – heteroatom multiple bonds – E1, E2, E1cB.

Unit II – Electrophilic Substitution Reactions:

Aromatic electrophilic substitution reactions – o-, m-, p- directing groups, manipulation of aromatic compounds using substitution reactions, aromatic nucleophilic substitution reactions. Benzyne generation and reactivity.

Unit III – Reactions of Electrophilic Unsaturated Carbons 1:

Generation and reactions of carbon heteroatom multiple bonds (C=O, C=N, C≡N bonds), addition reactions to carbon heteroatom multiple bond, addition – elimination reactions of carbon heteroatom multiple bond. Selected reduction reactions of carbon heteroatom multiple bonds.

Unit IV – Reactions of Electrophilic Unsaturated Carbons 2:

Substitution reactions at α–carbon of carbon heteroatom multiple bonds – enolate chemistry. Reactions of α,β–unsaturated carbonyl compounds – addition reactions.

Unit V – Rearrangement Reactions:

Rearrangement reactions (anionic, cationic and free radical); examples of different kind of rearrangements.

Textbooks:

1. Organic Chemistry, P. Y. Bruice, Pearson Education, 7th Edn, 2013
2. Organic Chemistry: An Acid-Base Approach, M. B. Smith, CRC Press, 3rd Edn, 2022.
3. Organic Chemistry as Second Language, D. R Klein, 2004, John Wiley and Sons, USA.
4. Organic Chemistry, W. H. Brown, C. S. Foote, B. L. Iverson and E. V. Anslyn, Brooks/Cole Cengage Learning, 6th Edn, 2012.
5. Organic Chemistry, Clayden, Greeves, Warren, Oxford University Press, 2nd Edn, 2012.
6. Principles of Organic Synthesis, R.O.C. Norman and J. M. Coxon, 3rd Edn, 1994.
7. F. A. Carey and R. J. Sundberg (Part A and B) Kluwer Academic / Plenum Publishers (2000).

Major 7 **Credit: 4**

CHEM 2203 Physical Chemistry I

Learning Objectives: Students will learn fundamentals of group theory, molecular symmetry and its applications to the chemical systems. This physical chemistry course covers microscopic aspects of thermodynamics at molecular level in statistical perspective. The relation between the microscopic to the macroscopic systems is provided and applications aspects of electrochemistry

Learning Outcome: The student will acquire knowledge to understand the molecules in symmetry aspects and also get insights of statistical aspects of molecule and able to measure the electroanalytical parameters through electroanalytical techniques.

Course Content:

Unit I - Group Theoretic Exploration of Molecular Symmetry

Definition and Properties of Group – Subgroups – Classes - Symmetry elements and Operations – Products of symmetry Operations – Equivalence of Symmetry elements and atoms – Relationship among Symmetry elements and operations – Schoenflies Point Groups – Point groups with multiple higher-order axes – flowchart for Point group assignment- Chirality, Dipole moment and other Consequences of symmetry.

Unit II – Molecular Symmetry Groups and Matrices

Matrix representation of symmetry Operations and its Character – Classes of symmetry operations – The Great Orthogonality Theorem (without proof) – Construction and Usage of Character tables – Reducible and Irreducible representations – Symmetry Adapted Linear Combinations - Projection operators – Direct Products.

Unit III – Statistical Thermodynamics:

The Boltzmann distribution – Molecular Partition functions and thermodynamic properties – Molecular energies - translational, rotational, vibrational, electronic contributions – Ensembles – Averaging Postulates – Mean energy and its variation – Calculations for model systems.

Unit IV– Kinetic Theory of Gases:

Macroscopic and microscopic states, model system of a dilute gas, velocity probability distribution, distribution of molecular speeds, root mean speed, pressure of dilute gas, effusion and wall collisions, system with potential energy: intermolecular forces, hard sphere gas, Fick's Law, diffusion, thermal conductivity, viscosity of gases.

Unit V – Electrochemistry-Applications:

Ionic equilibrium– electrolysis – cyclic voltammetry– potentiometric titration– conductometric titration – Kohlrausch law– electrical double layer.

Textbooks:

1. F. Albert Cotton, Chemical Applications of Group Theory, 3rd Edition, Wiley, 1990.
2. P. Atkins, J. de Paula, J. Keeler, Physical Chemistry, 11th Edition, Oxford University Press, Oxford, United Kingdom, 2018.
3. T. Engel, P. Reid, W. Hehre, Physical Chemistry, 3rd Edition, 2013.
4. D. A. McQuarrie & J. D. Simon, Physical Chemistry, Ist Edition, University Science, 1997.
5. E. V. Anslyn & D. A. Dougherty, Modern Physical Organic Chemistry, University Science, 2004.

Major 8 **Credit: 4**

CHEM 3101 Inorganic Chemistry II: Chemistry of Transition Metal Complexes

Learning Objectives: Course describes the nature of coordination complexes and their structures, electronic properties.

Learning Outcome: Students undergoing this course will have working knowledge on synthetic and analysis of coordination complexes and their involvement in biological systems.

Course Content:

Unit I – Introduction to Transition Metal Complexes:

A brief review of the general characteristics of transition elements, types of ligands, nomenclature of coordination complexes, chelates, chelate effect, geometry and isomerism, Werner, Sidzwick and Valence bond theory.

Unit II – Electronic Structure of Transition Metal Complexes 1:

Crystal field theory, crystal field splitting, application of d-orbital splittings to explain magnetic properties, low spin and high spin complexes, crystal field stabilization energy, spectrochemical series, weak and strong field complexes, thermodynamic and related aspects of crystal fields, ionic radii, heats of ligation, lattice energies, site preference energies.

Unit III – Electronic Structure of Transition Metal Complexes 2:

MO theory of complexes (quantitative principles involved in complexes with no pi and with pi bonding) and ligand filed theories and molecular symmetry, angular overlap model, Jahn Teller effect, electronic spectra of transition metal complexes, Orgel and Tanabe-Sugano diagrams, charge transfer and d-d transitions, nephelauxetic series.

Unit IV – Inorganic Reaction Mechanisms:

Inert and labile compounds, substitution reactions of octahedral complexes, dissociative, associative, aquation, conjugate base mechanism; substitution reactions of square planar complexes, trans effect, trans effect series, theories of trans effect; electron transfer reactions.

Unit V – Magnetism and Inner Transition Elements:

Magnetism: Types of magnetism – dia-, para-, ferro- and antiferromagnetism, quenching of orbital angular moment, spin-orbit coupling – Faraday balance, Guoy balance, SQUID, VSM.
Chemistry of lanthanides and actinides: lanthanide contraction, oxidation states, spectral and magnetic properties, use of lanthanide compounds as shift reagents.

Textbooks:

1. D. F. Shriver, P. W. Atkins, C. H. Langford, Inorganic Chemistry, 3rd Edn. ELBS. 1999.
2. J. E. Huheey, Inorganic Chemistry, 4th Edn., Harper International.
3. F. A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 5th Edn., John Wiley.
4. B. Douglas, D. McDaniel, J. Alexander, Concepts and Models of Inorganic Chemistry, 3rd Edn., John Wiley, 2001.
5. N. N. Greenwood, A. Earnshaw, Chemistry of the Elements, 2nd Edn., BH, 1997.
6. W. L. Jolly, Modern Inorganic Chemistry, 2nd Edn., McGraw-Hill, 1991.

Major 9 **Credit: 4**

CHEM 3102 Organic Chemistry II: Synthetic Methods, Polymers and Spectroscopic Techniques

Learning Objectives: The functional group interconversions and C–C bond forming reactions. Synthesis and reactivity of aromatic heterocycles. Structural characterization of organic molecules.

Learning Outcome: Constructing organic molecules through C–C bond formation and functional group transformation. Recognize the cyclic transition states in organic reactions. Polymerization reactions. Structural characterization using spectroscopy.

Course Content:

Unit I – Name Reactions in Organic Synthesis:

Baylis-Hillman reaction, Bischler-Napieralski synthesis, Dieckmann condensation, Finkelstein reaction, Hell–Volhard–Zelinsky reaction, Kulinkovich reaction, Mannich reaction, McMurry coupling, Nef reaction, Pictet-Spengler reaction, Ugi reaction, Simmon-Smith cyclopropanation reaction, Yamaguchi macrocyclization, Wittig and related reactions.

Unit II – Pericyclic Reactions (Introductory Level):

Concerted vs non-concerted pathways, types of pericyclic reactions – electrocyclic reactions (Con and Dis rotatory processes), cycloadditions - Diels-Alder (hetero, retro variants, normal and inverse electron demand), dipolar cycloaddition, sigmatropic reactions, – *supra* and *antra* facial shifts, ene reactions, cheletropic reactions.

Unit III – Organometallics in Organic Synthesis:

Organometallic compounds - nomenclature, structure, reactivity, basicity – synthesis and applications of organolithium, organoboron, organocopper, organozinc, organomagnesium, organotin and organosilicon compounds in organic synthesis.

Unit IV – Introduction to Synthetic Polymers:

General classes of synthetic polymers, chain growth polymers – living polymers, stereochemistry of polymerization, polymerization of dienes, co-polymers, step-growth polymers, physical properties of polymers, bio-degradable polymers.

Unit V – Structural Characterization of Organic Compounds (Introductory Level):

Introductory level - UV- Visible spectroscopy, infrared spectroscopy, NMR spectroscopy and Mass spectrometry.

Textbooks:

1. Strategic Applications of Organic Named Reactions in Organic Synthesis, L. Kürti and B. Czakó, Elsevier Academic Press, 2005.
2. Organic Chemistry, Clayden, Greeves, Warren, Oxford University Press, 2nd Edn, 2012.
3. Principles of Organic Synthesis, R.O.C. Norman and J. M. Coxon, Chapman & Hall, 3rd Edn, 2001.
4. Introduction to Organic Chemistry, C. H. Heathcock, A. Streitweiser and K. M. Kosower, Medtech, 4th Edn, 2017.
5. Organic Chemistry, P. Y. Bruice, Pearson Education, 7th Edn, 2013.
6. F. W. Billmeyer, Textbook of Polymer Science, Wiley-India, 2007.

Major 10 **Credit: 4**

CHEM 3103 Physical Chemistry II – Reaction Kinetics

Learning Objectives: Knowledge about speed of the reaction and its dependence on various variables gives an insight to understand mechanisms of reactions in kinetic aspects.

Learning Outcome: After completing this course, students may understand the kinetics of different types of reactions and understands kinetics of surfaces and catalysis.

Course Content:

Unit I – Free Energy Relationships:

Review of Rate law, Rate constants and order – Free energy of activation – Linear Gibbs energy relations – Edward's Equation and alpha effect – Theories of Acids and bases – Equilibrium constant – kinetic effects – Thermodynamic and kinetic control of reactions. Hammond postulate, Curtin-Hammett principle – Hammett equation and its applications.

Unit II – Reaction Dynamics:

Collision theory – Lindemann-Hinshelwood and RRKM model – Diffusion control – Molecular Beams & collisions - Transition state theory – Eyring equation – Barrierless reactions - Activated complex – Arrhenius equation - kinetic isotope effect – Kramer's theory -Statistical approach to TS – PES of Excited states – Conical Intersections & avoided crossings – Spin-orbit coupling – branching and seam spaces.

Unit III – Photo & Fast Reactions:

Photo physics of Unimolecular processes – Delayed fluorescence – Kinetics of bimolecular processes – Collision quenching – Stern-Volmer relations – Concentration dependence of quenching – Excimers – electron transfer in Excited state – Exciplex, Twisted intramolecular charge transfer processes - proton couple electron transfer processes – Features of fast reactions – study by flow method – relaxation methods – Flash photolysis.

Unit IV – Kinetics of Surfaces and Catalysis:

Solid surfaces and its growth – Physisorption and Chemisorption – Adsorption and Desorption – Adsorption isotherms – Rate and extent of adsorption and desorption – Experimental assessment – molecular picture of adsorption and mobility – Catalysis – General Principles – Heterogenous and Homogenous catalysis – Catalysts and its types – Mechanisms – Catalytic cycles – enzyme kinetics.

Unit V – Kinetics of Electron transfer and Electrodes:

Electron transfer in homogenous systems - rate law and rate constant – tunnelling –reorganization – Markus-Hush theory - Electrical Double layer – Electrode solution interface - Butler–Volmer equation – Tafel Plots – Voltammetry – Cyclic voltammetry and its applications – Electrolysis – working Principles of Galvanic cells – Nature of Electrochemical reactions – Mechanistic elucidation of electrode reactions.

Textbook:

1. P. W Atkins & J. D. Paula, Physical Chemistry, 10th Edition, W. H. Freeman & co.
2. T. Engel, P. Reid, W. Hehre, Physical Chemistry, 3rd Edition,
3. D. A. McQuarrie & J. D. Simon, Physical Chemistry, Ist Edition, University Science.
4. E. V. Anslyn & D. A. Dougherty, Modern Physical Organic Chemistry, University Science.

Major 11 **Credit: 4**

CHEM 3100 Summer Internship and Review Writing

Learning Objectives and Outcome:	Students are encouraged to visit other research establishments to understand work culture. They are expected to learn to integrate chemistry to other domains of sciences, industrial research, and other related fields. The students acquire the skill of identifying a new research project, analyze, and submit for possible external funding.
Learning Plan and Assessment	Students submit a report in the DST-style on the knowledge gained during their summer internships. The submitted report will be validated and analyzed by group of experts and award grade

Major 12 **Credit: 4**

CHEM 3201 Inorganic Chemistry – III: Organometallics and Bioinorganic Chemistry

Learning Objectives: To learn about the nature of organometallic compounds, synthesis, characterization and catalytic applications and to learn essentials of bioinorganic chemistry.

Learning Outcome: Successful completion of this course will make students to relate organometallic based on metal systems and their applications. Additionally, student may appreciate the relevance of inorganic systems in biology with reference to their structures and electronic properties.

Course Content:

Unit I – Organometallic Chemistry 1:

Compounds with transition metal to carbon bonds: classification of ligands, nomenclature, eighteen electron rule; transition metal carbonyls: range of compounds and structure, bonding, vibrational spectra, preparation, reactions; transition metal organometallics: square planar complexes, metal alkyls, metal alkylidenes, and metal alkylidynes; Structure and bonding: metal-olefin bond and arene metal bond.

Unit II – Organometallic Chemistry 2:

Compounds with ligands having extended pi systems: bis(cyclopentadienyl) compounds, cyclopentadienyl carbonyl compounds, bis(arene) compounds, arene carbonyl compounds; isolobal analogy, metal-metal bond, transition metal clusters; clusters and catalysis; hydride and dihydrogen complexes; fluxionality.

Unit III – Organometallic Chemistry 3:

Organometallic reactions and catalysis: oxidative addition, reductive elimination, insertion, hydride elimination, abstraction; olefin hydrogenation, hydroformylation, Wacker process, Ziegler-Natta polymerisation, cyclo oligomerisation, olefin isomerisation, olefin metathesis, Monsanto acetic acid synthesis, Fischer-Tropsch process, hydrosilylation.

Unit IV – Bioinorganic Chemistry 1:

Metal ions in biological systems: heme proteins, hemoglobin, myoglobin, hemerythrin, hemocyanin, ferritin, transferrin, siderophores, cytochromes. Iron-sulphur proteins: rubredoxin, ferredoxin and model systems.

Unit V – Bioinorganic Chemistry 2:

Metalloenzymes: active sites, carboxy peptidase, carbonic anhydrase, superoxide dismutase, catalase, peroxidase, vitamin $B_{12,}$ photosynthesis, nitrogen fixation, nitrogenase; Na^+/K^+ ion pump, ionophores, metallodrugs, metal-nucleic acid interaction.

Textbooks:

1. P. Powell, Principles of Organometallic Chemistry, 2nd Edn., ELBS, 1991.
2. K. F. Purcell and J. C. Kotz, Inorganic Chemistry, 2nd Edn., Cengage learning, 2012.
3. E. Huheey, Inorganic Chemistry, 4th Edn., Harper International, 2001.
4. C. Elschenbroich, A. Salzer, 2nd Edn., VCH, 1992.
5. F. A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 5th Edn., John Wiley.
6. R. W. Hay, Bio-Inorganic Chemistry, Ellis Horwood, 1987.
7. Lehninger, Principles of Biochemistry, Van Eikeren, 1982.
8. T. M. Loehr, Iron carriers and Iron proteins, VCH, 1989.
9. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry, University Science Books, CA, 1994.

Major 13 **Credit: 4**

CHEM 3202 Organic Chemistry III: Heterocycles, Biomolecules and Drugs

Learning Objectives: Effect of replacing carbon/s by heteroatom/s on properties of aromatic hydrocarbons. The functional group transformations. Basics about drug molecules.

Learning Outcome: Application of functional group transformations in synthesis of heteroaromatics. Recognizing the structure and chemistry of biomolecules. Molecular interaction with drug target (biomolecules).

Course Content:

Unit I – Chemistry of Aromatic Heterocyclic Compounds:
Structure, synthesis and reactivity of five and six – membered aromatic heterocycles with one hetero atom and benzo-fused hetero-aromatics with one/two heteroatoms.

Unit II – Chemistry of Carbohydrates and Lipids:
Classification of carbohydrates, the D and L notation, chemistry of monosaccharides, formation of glycosides, the anomeric effect, reducing and non-reducing sugars, disaccharides, polysaccharides. Introduction to lipids – wax, fatty acids, phospholipids, prostaglandins, fat soluble vitamins, terpenes and steroids.

Unit III – Amino acids, Peptides and Proteins:
Classification and nomenclature of amino acids, acid–base properties of amino acids, peptide bonds and disulfide bonds, introduction to protein structure: primary structure, how to determine the primary structure of a polypeptide or a protein, secondary structure, tertiary structure, quaternary structure, protein denaturation. Synthesis of amino acids, resolution of racemic amino acids; peptide synthesis – protection and deprotection of amino acids.

Unit IV – Nucleosides, Nucleotides and Nucleic Acids:
Purine and pyrimidine bases, nucleosides and nucleotides, nucleic acids – DNA and RNA, helical forms of DNA.

Unit V – Introduction to Organic Chemistry of Drugs:
Pharmacophores, classification of drugs, naming drugs, lead compounds, molecular modification, random screening, serendipity in drug development, receptors, drugs as enzyme inhibitors, QSAR.

Textbooks:

1. Organic Chemistry, P. Y. Bruice, Pearson Education, 7th Edn, 2013.
2. Organic Chemistry, L. G. Wade and J. W. Simek, 9th Edn, Pearson, 2019.
3. Heterocyclic Chemistry at a Glance, J. A. Joule and K. Mills, Blackwell Publishers, 2007, USA.
4. Heterocyclic Chemistry, Thomas L. Gilchrist, Pearson Education, 3rd Edn, 2005, India.
5. Organic Chemistry, W. H. Brown, C. S. Foote, B. L. Iverson and E. V. Anslyn, Brooks/Cole Cengage Learning, 6th Edn, 2012.
6. Lehninger Principles of Biochemistry, D. L. Nelson and M. M. Cox, 7th Edn., W. H. Freeman, NY, USA.

Major 14 **Credit: 4**

CHEM 3203 Physical Chemistry III: Atomic Structure and Bonding

Learning Objectives: Predict the nature of bond and its properties through various Electronic structural methods, bonding models, and intermolecular interactions

Learning Outcome: To develop conceptual knowledge about the electronic structure of atom, ground and excited states, chemical bonding and molecular orbital theories.

Course Content:

Unit I – Approximation Methods for Many-electron Schrodinger Equation:

Atomic Hamiltonian – Independent Electron Model – Theory of Perturbation – Non-degenerate Perturbation theory – I & II Order Corrections – Perturbation Treatment of He – Degenerate Perturbation – Theory of Variation – Linear and non-linear Variation – Matrix formulation of Linear Variation – Secular Determinant – Variational treatment of He.

Unit II – Electronic Structure of Multi-electron Atoms:

Quantum Particles Indistinguishability – Electron Spin and its interpretations – Pauli's Antisymmetry principle – Excited states of Helium - Slater Determinants – Slater Type Orbitals – Mean Field approximation – Hartree and Hartree Fock SCF approximation – Aufbau principle – Spin-Orbit Coupling – Term Symbols – Hund's Rules – Deconstruction of Periodic table.

Unit III – Methods for Molecular Schrodinger Equation:

Bonn-Oppenheimer Approximation – Electronic structure of H2+ - Numerical solutions – Valence Bond Theory – Nature of Exchange - Ground and Excited states of H2 – LCAO-MO Theory of ground and excited states of H2 – Comparison of VB and MO theories - Configuration interaction - HF-SCF Theory – Correlation.

Unit IV – Theories of Chemical Bonding:

Molecular orbitals of Homo and Hetero Diatomics – Orbitals Interaction Diagrams - Bonds & Lonepairs vs MOs – Bond order - sp Mixing and Avoided Crossing - MO Configuration – Electronic States and Term Symbols – Hybridization theory of valence atomic orbitals – Isovalent hybridization – VSEPR theory – Advantages and Limitations of bonding theories.

Unit V – Orbital Interactions in Molecules:

The simple Huckel method – Assumptions – Determinant, Energies and Wave functions – LCAO approximation –Total energies – Conjugation – Aromaticity – Population Analysis – Extended Huckel Theory – Symmetry and Overlap – Principles of FMO Interactions and Walsh diagrams – Hyperconjugation – Jahn-Teller effects – Cluster Bonding.

Textbooks:

1. Ira. N. Levine, Quantum Chemistry, 7th Edition, Prentice Hall.
2. D. J. Griffiths, Introduction to Quantum mechanics, 2nd Edition.
3. J. P. Lowe & K. A. Peterson, Quantum Chemistry, 2nd Edition, Elsevier Academic.
4. P. W Atkins & R. S. Friedman: Molecular Quantum Mechanics, 4th Edition, Oxford.
5. D. A. McQuarrie, Quantum Chemistry, 2nd Edition, Pearson.

Major 15 **Credit: 4**

CHEM 3204 Topics in Analytical Chemistry

Learning Objectives: The aims are to provide a sound physical understanding of the principles of analytical chemistry and to show how these principles are applied in chemistry and related disciplines— especially in life sciences and environmental science.

Learning Outcome: Students will be able to develop analytical methods and perform chemometric analysis to understand the diverse aspects of analytical applications.

Course Content:

Unit I – Tools and Data Handling:

Balances, burettes, volumetric flasks, pipettes, calibration of tools, sampling. Errors and Statistics: significant figures, rounding off, accuracy and precision, determinate and indeterminate errors, standard deviation, propagation of errors, confidence limit, test of significance, rejection of a result.

Unit II – Separation Techniques:

Solvent Extraction: distribution Coefficient, distribution ratio, solvent extraction of metals, multiple batch extraction, counter-current distribution. - Chromatographic Techniques: classification, theory of chromatographic separation, distribution coefficient, retention, sorption, efficiency and resolution. -Column, ion exchange, paper, TLC & HPTLC: techniques and application. - Gas Chromatography: retention time or volume, capacity ratio, partition coefficient, theoretical plate and number, separation efficiency and resolution, instrumentation and application.

Unit III – Spectroscopic Techniques:

Electromagnetic radiation, absorption, and emission of radiation – instrumentation: sources, monochromators, detectors. - Flame spectrometry: flame emission, AAS, ICP, instrumentation and application. - Absorption spectrometry: UV-VIS, IR, instrumentation, techniques and applications.

Unit IV – Thermal and Radiochemical Techniques:

Thermogravimetry: instrumentation and techniques, TGA curves, DTA and DSC, applications. Radiochemical methods: decay reactions, growth of radioactivity, radiation detectors, tracer techniques.

Unit V – Electroanalytical Techniques:

Electrogravimetry, coulometry, voltammetry, polarography, conductometry, instrumentation, techniques and application.

Textbooks:

1. D. C. Harris, Quantitative Chemical Analysis, 4th Edn., W. H. Freeman, 1995.
2. G. D. Christian & J. E. O'Reily, Instrumental Analysis, 2nd Edn., Allyn & Balon, 1986.

Major 16 **Credit: 4**

CHEM 4101 Inorganic Chemistry IV: Advanced Main group Chemistry and Inorganic Spectroscopy

Learning Objectives: To understand boron and silicon compounds with their polyhedral structures and applications, inorganic ring systems. Various spectroscopic applications to inorganic compounds.

Learning Outcome: Students can resolve problems related to the structure and spectra of inorganic compounds.

Course Content:

Unit I – Boron:

Synthesis, properties, bonding and structures of B2H6, Wades rule - structural features and styx codification of B_4H_{10}, B_5H_9, B_5H_{11}, B_6H_{10}, $B_{10}H_{14}$, carboranes and their anions, metalloboranes, metallacarboranes, Borazine, Boron nitride, 11B NMR of boron compounds of this unit.

Unit II – Silicon:

Silanes, cyclosilanes, siloxanes, cyclic siloxanes, Silicon nitrides, Silyl amines, Silicates-classification, diversity of silicate minerals, synthesis and applications of silicones, zeolites and ultramarines.

Unit III – Nitrogen, Phosphorous, Sulphur:

Hydrides-N_2H_4-conformations, oxides and oxy acids of nitrogen, phosphorous, sulfur; phosphazines-synthesis, structure, reactivity, applications; comparison with borazine; ^{31}P NMR of compounds of this unit. Sulfur-nitrogen compounds-S_4N_4, S_2N_2, $(SN)_x$.

Unit IV – Spectroscopic Applications to Inorganic Compounds 1:

NMR: Principle, chemical shift, multinuclear NMR (^{11}B, ^{15}N, ^{19}F, ^{27}Al, ^{29}Si, ^{31}P) -Analysis of Selected examples: $FPO(OH)_2$, $F_2PO(OH)$, PF_3Cl_2, PF_2Cl_3, P_4S_3, TiF_4, TiF_6^{2-}, NH_3, NF_3, CO_2 in water, ClF_3, SF_4; cis-trans isomers: N_2F_2, $(PR_3)_2PtX_2$, literature examples. UV-Vis: Principle, molar extinction coefficient, types of electronic transition, isobestic point, Analysis of selected examples: differentiation of various isomers-ORD, CD, Cotton effect; $[Co(NH_3)_5ONO]^{2+}$, $[Co(NH_3)_5NO_2]^{2+}$; VO^{2+}, NiR_4Cl_2, literature examples. IR: Principle, wavenumber, Analysis of common ions, bridged complexes, hydrogen bonding systems, structural determination of NSF_3, $(CH_3)_3SnCl$, literature examples.

Unit V – Spectroscopic Applications to Inorganic Compounds 2:

EPR: Principle, Hyperfine splitting, Zero-Field splitting, Kramers' degeneracy; Analysis of Selected examples: Hydrogen and methyl radicals, AlH_3 radical, NO_2, $[Cr(H_2O)_6]^{3+}$, $[Mn(H_2O)_6]^{2+}$, $[(NH_3)_5Co\text{-}O\text{-}O\text{-}Co(NH_3)_5]^{5+}$, Bis-salicylaldimine copper(II) complex, literature examples. Mossbauer spectroscopy: Principle, Quadrupole interactions, isomer shift, recoil energy, doppler effect, applications to ^{57}Fe, ^{119}Sn, ^{127}I, ^{197}Au compounds, literature examples. Photoelectron Spectroscopy (PS): Principle, Binding energy, Ultraviolet photoelectron spectroscopy (UPS), X-ray photoelectron spectroscopy (XPS), ESCA, Identification of elements by PES, Auger peaks, Surface analysis, band structure by PES.

Textbooks:

1. N. N. Greenwood, A. Earnshaw, Chemistry of the Elements, 2ed, BH, 1997
2. J. E. Huheey, Inorganic Chemistry, 4ed, Harper International, 2002.
3. Russel S. Drago, Physical Methods in Inorganic Chemistry, Litton Educational Publishing, 2017
4. Stephan Hüfner, Tadeusz Waldemar Huber, Photoelectron Spectroscopy, Principles and Applications, Stephan Hüfner, Tadeusz Waldemar Huber, Springer Publications, 2003
5. D. F. Shriver, P. W. Atkins, C. H. Langford, 3ed, Inorganic Chemistry, ELBS. 1999.
6. F. A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 6th Edn, John Wiley, 2004.

Major 17 **Credit: 4**

CHEM 4102 Organic Chemistry IV: Spectroscopic Identification of Organic Compounds

Learning Objectives: To learn the basic principles of modern spectroscopy and characterization principles of organic molecules.

Learning Outcome: Skill to interpret the spectra of organic molecules and deduce the molecular structures.

Course Content:

Unit I –Introduction

Application of UV-Visible and IR Spectroscopy to Organic Structure Elucidation: UV – Visible Spectroscopy: Basic principles, application of UV – Visible spectroscopy to organic structure elucidation, Woodward – Fisher rules, Solubility of organic solids, isosbestic point, ORD – CD to stereochemical assignments, Octant rule. IR – Spectroscopy – Basic principles, characteristic frequencies of common functional groups.

Unit II – Application of NMR Spectroscopy:

Basic principles. Introduction to NMR techniques – CW and FT NMR techniques. ^{1}H NMR Spectral parameters – intensity, chemical shift, multiplicity, coupling constant, factors affecting. Analysis of first order and second – order spectra. Structure determination of organic compounds by ^{1}H NMR spectra.

Unit III – Multinuclear NMR (with specific emphasis on ^{13}C NMR):

Proton coupled; off–resonance decoupled; proton noise decoupled ^{13}C NMR spectra. Assignment of chemical shifts, additively effect, characteristic chemical shifts of common organic compounds and functional groups, DEPT and SEFT spectra. NMR of common heteroatoms present in organic compounds (N, F, O, P, S and D) 2D NMR techniques ^{1}H – ^{1}H COSY, ^{1}H – ^{13}C COSY, HMQC, HMBC, NOESY and INADEQUATE spectra

Unit IV – Application of Mass Spectroscopy to Organic Structure Elucidation:

Basic principles, techniques of ion production, ion and daughter ions, molecular ion and isotope abundance, nitrogen rule, energetics of fragmentation - metastable ions, common fragmentation pathways – fragmentation pattern of common chemical classes.

Unit V – Problem solving exercises involving UV, IR, NMR & MS data:

Problems involving interpretation of spectral details of organic compounds

Reference Books:

1. R. M. Silverstein and F. X. Webster, Spectrometric identification of organic compounds., John Wiley and Sons. Inc., Sixth edition (1997).
2. W. Kemp, Organic Spectroscopy, Third Edition, MacMillon (1994).
3. Pavia, Lampman and Kriz, Introduction to Spectroscopy, 3rd Edn., Brooks/Cole Pubs. Co.
4. D. H Williams and Ian Fleming, Spectroscopic methods in organic chemistry, Tata McGraw Hill, (1998).
5. William Kemp, Introduction to multinuclear NMR.

Major 18 **Credit: 4**

CHEM 4103 Physical Chemistry IV: Principles of Spectroscopy

Learning Objectives: To develop a working knowledge in the theory of absorption and emission spectroscopy from classical and quantum sciences.

Learning Outcome: Familiar with probability of transition, selection rule. Simulate electromagnetic spectrum of simple molecules.

Course Content:

Unit I – Electronic Spectra:

Electromagnetic radiation – Interaction with matter – Electronic energy levels and CI - SALC – Absorption and Emission – Transition moments and probability – Selection rules – Intensities - Broadening – Vibronic transitions – Frank-Condon Principle – Vibrational progressions and excited state geometry – Radiative and Non-radiative decay - XPS & Auger electron spectra.

Unit II – Rotational and Vibrational Spectra:

Pure Vibrational and Rotational spectra - Spectra of Di and Polyatomics - Normal Modes - Selection rules – Fermi Resonance – Anharmonicity and Isotope effect – Bond-lengths and strengths – Vibrational Localization of Functional groups – Polarizability and Raman effect - Rotational and Vib-Rotational Raman spectra – Fourier Transform - Exclusion Rule.

Unit III – Magnetism and Magnetic Resonance:

Electrons and nuclei in magnetic field – Magnetic resonance spectroscopy – Nuclear magnetic resonance – Chemical shifts – Fine Structure – Conformational conversion and Exchange – Pulse Techniques – magnetization vector – spin relaxation and decoupling – NOE effect – 2D NMR – Electron paramagnetic resonance – g value – fine structure.

Unit IV – Photochemistry:

Photochemical Processes – Time-dependent Schrodinger equation & perturbation theory - Grothus-Draper and Stark-Einstein Laws – Jablonski Diagram for Excited States – Qualitative description of fluorescence, phosphorescence, and non-radiative processes – Quantum yield – Photosensitized processes – Energy Transfer processes – Two-photon absorption.

Unit V – Solids and Diffraction methods:

Close packing – FCC and HCP – Unit cells types – Bravais Lattices – Crystallographic Point and Space Groups – Miller Indices – Reciprocal lattice – Brillouin zone — XRD and Bragg's law – Lau, Debye-Scherrer, Bragg methods – Systematic Absences – Structure and Form Factors – Phase problem – Absolute configuration - Electron Diffraction and LEED.

Textbook:

1. Max Diem, Quantum Mechanical Foundations of Molecular Spectroscopy, Wiley-VCH, 2021.
2. Jeanne L. McHale, Molecular Spectroscopy, 2nd Edition, CRC Press, 2017
3. Hans Kuzmany, Solid State Spectroscopy. An Introduction, Springer, 2009
4. Ramakrishna V. Hosur, and Veera Mohana Rao Kakita, A Graduate course in NMR Spectroscopy, Springer, 2021

Major 19 **Credit: 4**

CHEM 4201 Computational Chemistry

Learning Objectives: Students learn how to use various computational software to find the equilibrium geometry of molecular systems and find various properties through simulations.

Learning Outcome: Student will be able to draw molecular structure, analyze eigen values, correlate eigen values with physical properties.

Course Content:

Unit I – Ab-initio Implementation of HF-SCF-MO theory:

Molecular Hamiltonian and Schrodinger equation – LCAO approximation – Effective Potential and Mean-Field Approximation – Antisymmetry and Slater determinant – Fock operator - Self-Consistent Field approximation – Roothan's equations - Density Matrix – Total energies – Koopman's theorem – Unrestricted and Restricted open shell HF – Spin contamination.

Unit II – Basis Sets:

Atomic Basis sets – Slater type orbitals – Split-valence – Gaussian Type Orbitals – Basis set Contraction – Polarization functions – Diffuse Functions – Popular Basis sets - Basis-Set superposition Error – Counterpoise correction – Basis set Extrapolation – Effective core potential – Computational issues.

Unit III – Electron Correlation:

Electron correlation – Static and Dynamic Origins – Density functional theory - Configuration Interaction (CI) – Configuration State Functions - CI matrix – Time complexity – Brillouin's theorem - Slater-Condon rules - Truncated CI – MRCI – MC SCF – CAS SCF — Moller-Plesset perturbation theory – Coupled Cluster Methods - Size Consistency and Extensivity.

Unit IV – Characterization of Molecules:

Equilibrium geometry – Potential energy Surface – Forces in Molecules – Hellmann-Feynmann Theorem – Characterization of Stationary points - Normal modes - Vibrational Analysis – Thermodynamic properties - Zero-point energy – Flowchart for Obtaining equilibrium geometry – Molecular Properties – Beyond Bonn-Oppenheimer approximation.

Unit V – Practical Issues:

Popular Electronic structure programs – Preparing the input - Choosing Methods and Basis sets – Interpreting the output file – Solving Convergence problems –- Interpreting the imaginary frequencies – Use of direct products and Symmetry - Visualization of the Output - Illustrative examples – Population Analysis.

Recommended Books:

1. F. Jensen, Introduction to computational chemistry, Wiley, NY, 2007.
2. D. C. Young, Computational Chemistry, John-Wiley and Sons, NY, 2001.
3. C. J. Cramer, Essentials of Computational Chemistry, John-Wiley & Sons, 2004.
4. I. N. Levine, Quantum Chemistry, 7th edition, Prentice Hall.

Major 20 **Credit: 4**

CHEM 4202 Manipulations of Organic Molecules

Learning Objectives: To learn non-polar mechanism, constructing cyclic compounds, use of light and organometallic compounds in organic synthesis, functional group interconversions etc.

Learning Outcome: An integrated approach to manipulate any organic compound by observing and identifying their geometrical and electronic properties, participating functional groups, related theory, properties of reagents and catalysts, and other external variables.

Course Content:

Unit I – Concerted Reactions:

Cycloaddition, electrocyclic and sigmatropic and related pericyclic reactions - Explanations based on frontier orbital, Woodward-Hoffman and Huckel-Mobius theories - Application of concerted reactions in organic synthesis.

Unit II – Organic Photochemistry:

Introduction to organic photochemistry - energetics of excitation - photochemistry of alkene, diene, aromatic, carbonyl and conjugated systems - Application of photochemical reactions in organic synthesis.

Unit III – Modern Reagents in Organic Synthesis:

Introductory treatment to the application of silicon, phosphorus, selenium, palladium, ruthenium, rhodium, indium, titanium and samarium reagents in organic synthesis.

Unit IV – Rearrangement reactions in Organic Synthesis:

Review of rearrangement reactions and their application in organic synthesis (emphasis on reactions rather than reactivity)

Unit V – Oxidation and Reduction Reactions in Organic Synthesis:

Oxidation of organic compounds with reagents based on peroxides, peracids, ozone, osmium, chromium, ruthenium, silver, dimethyl sulfoxide, iodine, and selenium dioxide. Reduction of organic compounds with reagents based on alkali and alkaline earth metals, boron, aluminum, hydrogen, hydrazine, formic acid and dissolving metals.

Textbooks:

1. I. Fleming, Molecular Orbitals and Organic Chemical Reactions, John Wiley & Sons Ltd, 2009
2. R.O.C. Norman and J. Coxon, Principles of Organic Synthesis - ELBS, 1994.
3. Smith, Organic Synthesis - McGraw-Hill, 1996.
4. J. D. Coyle, Organic Photochemistry - Wiley, 1985.
5. Carruthers, Modern Methods in Organic Synthesis, Academic Press, 1989.
6. F. A. Carey and R. J. Sundberg (Part A and B) Kluwer Academic / Plenum Publishers (2000).

Major 21 **Credit: 4**

CHEM 4203 Crystal Engineering and Solid-State Properties of Molecular Materials

Learning Objectives: Understanding some solid-state properties, such as polymorphism, pharmaceutical co-crystals, and mechanical, electrical, and magnetic properties of molecular crystals, that are some of the hot areas of current-day research.

Learning Outcome: Learners will be able to design crystals with desired properties using the crystal engineering approach.

Course Content:

Unit I – Crystal engineering and pharmaceutical co-crystals:
Crystal systems, space groups, point groups, supramolecular synthons - hetero synthons and homo synthons, co-crystals - pharmaceutical co-crystals, polymorphism.

Unit II – Mechanical Properties of Molecular Crystals:
Elastic bending, plastic bending, shearing, thermo-salient effect, photo-salient effect

Unit III– Thermal Expansion of Molecular Materials:
Thermal expansion coefficients, Principal axes of thermal expansion, symmetry and thermal expansion, parameters influencing the thermal expansions

Unit IV–Introduction to Electrical Properties of Molecular Materials:
Electrical conductivity in solids, dielectric materials, paraelectric materials, piezoelectric materials, pyroelectric materials, ferroelectric materials, relaxation

Unit V–Introduction to Magnetic Properties of Molecular Materials:
Diamagnetic materials, paramagnetic materials, ferromagnetic materials, ferrimagnetic materials, antiferromagnetic materials

Suggested Readings:

1. G. R. Desiraju, J. J. Vittal and A. Ramanan, Crystal Engineering a Textbook, World Scientific Publishing Co. Pte. Ltd., 2011.
2. W. D. Callister, Jr. and D. G. Rethwisch, Fundamentals of Materials Science and Engineering an Integrated Approach, 5th edition, John Wiley & Sons, Inc., 2015.
3. K. Rissanen, Hot Topics in Crystal Engineering, Elsevier Inc, 2021.
4. R. Hilfiker, Polymorphism: in the Pharmaceutical Industry, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2006.
5. Crystal Engineering of Pharmaceutical Cocrystals in the Discovery and Development of Improved Drugs, Geetha Bolla, Bipul Sarma, and Ashwini K. Nangia, *Chem. Rev.* **2022**, *122*, 11514–11603.
6. From Molecules to Interactions to Crystal Engineering: Mechanical Properties of Organic Solids, Subhankar Saha, Manish Kumar Mishra, C. Malla Reddy, and Gautam R. Desiraju, *Acc. Chem. Res.* **2018**, *51*, 2957–2967.

Major 22 **Credit: 4**

CHEM 4204 Asymmetric Synthesis

Learning Objectives: To learn the methods for making chiral molecules.

Learning Outcome: Able to explain the need for synthesizing biologically active compounds in optically pure form, the principles and strategies of making and analyzing enantio-enriched compounds.

Course Content:

Unit I – Introduction to Asymmetric Synthesis and Resolution:

Asymmetric synthesis importance and basic principles - stereoselective and stereospecific – enantioselective and diastereoselective. Energetic considerations, strategies for asymmetric synthesis – advantages and limitations of each strategy, analytical methods for determining enantiomeric excess. Resolution – resolving agents and resolution of racemic compounds having functional groups for eg. alcohol, amine, and acid. Resolution of chiral ligands – BINOL, trans-1,2-diaminocyclohexane. Kinetic resolution of racemic mixtures. Dynamic Kinetic resolution, enzymatic resolution.

Unit II – Asymmetric Synthesis on Chiral Substrate:

Nucleophilic addition to α–chiral carbonyl compounds; Prediction of stereochemistry – Cram's rule and related modifications. Double stereo differentiation; matched pair and mismatched pair; examples from aldol condensation and hydroboration reactions. Electrophilic addition to α–chiral olefins – epoxidation, cyclopropanation, hydroboration – oxidation, alkylation of enolates of β-chiral carbonyl compounds.

Unit III – Asymmetric Synthesis using Chiral Auxiliary:

Chiral auxilary mediated reactions using various chiral auxiliaries. Chiral auxiliaries derived from proline, champhor, menthol and other chiral pool sources. SAMP/RAMP hydrazines and other pyrrolidines, oxithiane, oxazolidine-2-one, thiazolidine-2-one, phenylethylamine, 2-phenylcyclohexanol etc. Remote chiral Induction.

Unit IV – Asymmetric Synthesis using Chiral Reagents:

Chiral organoboranes – Application of chiral organoboranes, reduction (Ipc2BCl) and allylation and crotylation reactions. Chiral modification of lithium aluminum hydride, BINAL-H – application in reduction of prochiral ketones; oxazaborolidines.

Unit V – Asymmetric Synthesis using Chiral Catalysts:

Asymmetric alkylation and allylation of carbonyl compounds, reduction of ketones, imines. Asymmetric hydrogenation: early advances DIPAMP, DIOP and Noyori's BINAP selected reactions/examples. Sharpless epoxidation, dihydroxylation, aminohydroxylation of alkenes; Jacobson catalysts – Evans catalyst–aziridination. Nucleophilic addition, conjugate addition and cycloaddition reactions. Organocatalysis–proline mediated aldol reactions and further expansion in the field of organocatalysis. Organocascade reactions. Asymmetric Michael addition to α, β–unsaturated carbonyl compounds.

Textbooks:

1. Asymmetric Synthesis, R. A. Aitken and S. N. Kilenyi, Springer Science Business Media, 1994.
2. Principles of Asymmetric Synthesis (Tetrahedron series in Organic Chemistry), R. E. Gawley, J Aube, Pergman, 1996.
3. Asymmetric Synthesis, G. Proctor, Oxford University Press, USA, 1997.

Major 23 **Credit: 4**

CHEM 4205 Polymer Science: Synthesis and Characterization

Learning Objectives: To describe the type of bond in a polymer and rationally design the monomers for a given polymer. To describe various methods used for synthesizing polymers. To use analytical methods to characterize a polymer. To study the properties of polymers.

Learning Outcome: The learners will be able to design the monomers for the preparation of polymers of interest. The learners will be able to characterize and understand the properties polemers.

Course Content:

Unit I – Chain Polymerization:

Free radical polymerization, Role of inihibitors and retarders, controlled radical polymerization – iniferters - atom transfer radical polymerization (ATRP) – nitroxy radical mediated (NMP) polymerization – reversible addition-fragmentation chain transfer (RAFT) polymerization. Anionic polymerization, co-ordination polymerization, Zieglar–Natta catalysts, single site catalysts, copolymerization, kinetics of polymerization and copolymerization.

Unit II – Step and Miscellaneous Polymerization:

Polycondensation – role of functionality – cyclic vs. linear polymers, kinetics of polycondensation, different types of polymers made through step polymerization including Nylon 6,6. Electrochemical polymerization – metathesis polymerization – group transfer polymerization – enzyme-catalyzed polymerization.

Unit III – Polymerization Techniques and Polymer Processing:

Bulk polymerization, solution polymerization, suspension polymerization, emulsion polymerization, interfacial polycondensation, solid and gas phase polymerization. Comparison of polymerization techniques. Compounding, calendaring, die casting, rotational casting, film casting, compression moulding, injection moulding, blow moulding, extrusion moulding, thermoforming, foaming, reinforcing, fiber spinning, electrospinning.

Unit IV – Molecular Weight of Polymers:

Role of molecular weight on the properties of polymers, degree of polymerization, number average, weight average, sedimentation average and viscosity average molecular weights, polydispersity index and its significance, determination of molecular weight of polymers using cryoscopy, ebulliometry, membrane osmometry, vapor phase osmometry, end group analysis, viscometry, light scattering, ultracentrifugation, and gel permeation chromatography.

Unit V – Thermal Properties and Application of Polymers:

Glass transition temperature (Tg) – factors influencing Tg – plasticizers – dilatometry, differential scanning calorimetry (DSC), thermomechanical analysis, dynamic mechanical analysis (DMA). Thermal stability of polymers – thermogravimetric analysis (TGA), differential thermal analysis (DTA). Conducting polymers – doping – synthesis and characterization of conducting polymers. Polymeric membranes for fuel cell applications, polymeric adhesives and sealants, rubbers vulcanization, use of rheometer in rubber industry, different types of synthetic rubber and their applications.

Reference Books:

1. Fred W. Billmeyer, Textbook of Polymer Science, Wiley-India, 2007.
2. George G. Odian, Principles of polymerization, John Wiley and Sons, 2004.
3. Paul J. Flory, Principles of polymer chemistry, Cornell University Press, 1953.
4. V R Gowariker, N V Viswanathan, J. Sreedhar, Polymer Science, New Age International, 2003.

Major 24 **Credit: 4**

CHEM 4206 Natural Products Chemistry

Learning Objectives: To create awareness about the various classes of natural products. To describe the structural features of representative examples of each class of natural product.

Learning Outcome: Can appreciate the chemical and biosynthetic way of synthesizing representative examples of each class of natural product.

Course Content:

Unit I – Chemistry of Terpenes:

Biosynthesis of terpenoids – monoterpenes – sesquiterpenes – diterpenes (structure of terpenoids such as pinene, camphor, hirsutene, abietic acid, squalene etc).

Unit II – Steroids:

Biosynthesis of Steroids - Structure of common steroids such as cholesterol, ergosterol, stegmasterol, cholic acid – steroidal hormones; estrone, progesterone – testosterone – synthetic strategies towards steroids

Unit III – Polyphenolics and other Plant Coloring Molecules:

Chemistry of flavones; isoflavones and aurones, biosynthesis and role of polyphenolics.

Unit IV – Alkaloids and Antibiotics:

Biosynthesis and structure determination of representative examples of pyrrolidine, piperidine, indole, quinoline, and isoquinoline alkaloids; Structure of β-lactam antibiotics (penicillin)

Unit V – Marine Natural Products:

Introduction to marine natural products.

Textbooks:

1. K. Nakanishi, Natural Product Chemistry Blackie Publications, 3 Vols.
2. R.H. Thomson, Chemistry of Natural Products - Wiley, New York, 1996.
3. I.L. Finar, Advanced Organic Chemistry, ELBS, New Delhi, 1975.

Major 25 **Credit: 4**

CHEM 4207 Supramolecular Chemistry

Learning Objectives: Stabilization of chemical systems with non-conventional interactions and synthesis of materials with desired structures are challenging. This course aims to deal with these aspects.

Learning Outcome: Students after completing this course may be able to design and synthesize new molecules with different shapes and geometry and explore their applications.

Course Content:

Unit I – Concepts of Supramolecular Chemistry:
Definition, Nature of supramolecular interactions, Host-guest interaction, Molecular recognition, Types of recognition, Self-assembly.

Unit II – Cation-binding Hosts:
Concepts, Cation receptors, Crown ethers, Cryptands, Spherands, Calixarenes, Selectivity of cation complexation, Macrocyclic and template effects.

Unit III – Binding of Anions and Neutral molecules:
Concepts, Anion host design, Anion receptors, Shape and selectivity, Neutral receptors, clathrates, cavitands, cyclodextrins, cyclophanes.

Unit IV – Applications of Supramolecular Chemistry:
Rational Design, Molecular Paneling, Supramolecular reactivity and catalysis, Supramolecular devices, Nanoscience applications.

Unit V – Supramolecular Chemistry in Biology:
Membranes, Macrocyclic systems, Photosynthesis, Oxygen transport, biological mimics, Enzymes, Metallobiosites, Heme analogues.

Recommended Books:

1. J. M. Lehn, Supramolecular Chemistry, Concepts and Perspectives, VCH, 1995.
2. H. Dodziuk, Introduction to Supramolecular Chemistry, Kluwer Academic, 2002.
3. F. Vogtle, Supramolecular Chemistry, An Introduction, John Wiley and Sons, 1991.
4. J. W. Steed, J. L. Atwood, Supramolecular Chemistry, A Concise Introduction, John Wiley, 2000.

Major 26 **Credit: 4**

CHEM 4208 Bioinorganic Chemistry

Learning Objectives: The course explains the role of metal ions in various biological processes and systems.

Learning Outcome: After completing this course, students will understand the structural features of biological systems involving metal ions and their activities and mechanisms.

Course Content:

Unit I – Introduction to Bioinorganic Chemistry:

Introduction-Periodic survey of essential and trace elements- Biodistribution of metal ions-Biomolecules recap: sugars, amino acids, bioligands, peptides, proteins, enzymes, nucleosides, nucleotides, nucleic acids, cofactors, phospholipids-cell membrane and transport-active & passive transport-symport, antiport, uniport, an ion pump, valinomycin, Gramicidin, enterobactin.

Unit II – Principles of Coordination Chemistry linked to Bio-inorganic Chemistry:

The link between Bio-inorganic and coordination chemistry- Thermodynamic aspects-hard-soft acid base concept-chelate effect-pKa value of ligands-tuning of redox potential-kinetic aspect-ligand exchange rate.

Unit III – Metal-Protein Interaction, Metalloenzymes, and Biomimics:

Metalloproteins, transport and storage proteins, Metalloenzymes- Classifications, metallohydrolases, Metallo oxidoreductases, Metallo isomerases, Metallo synthases, Metallolyases, Ligases, the role of metal ions in structural context - selected examples-Heme vs non-heme centers. Biomimetics: Bioinorganic side of nucleic acid chemistry - Interactions with Metal Ions- Nuclease and Peptidase Models; Bioinspired metal complexes from recent literature.

Unit IV – Physical Methods in Bioinorganic Chemistry:

Applications of spectroscopy for understanding biologically important molecules- Electronic spectra, vibrational spectroscopy, NMR, EPR, mossbauer spectroscopy, ORD, CD and MCD-Magnetic measurements-practical kinetics to biological systems.

Unit V– Metallodrugs and applications:

Metallodrugs – chelation in medicine-natural detoxification-Therapeutic Agents -cis-platin-Biochemical mechanisms of DNA damage-DNA repair-cancer treatment & cytotoxicity studies-Radiodiagnostic Agents- MRI Contrast Enhancement- insight into recent literature.

Textbook:

1. S.J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry, University Science Books, CA, 1994.
2. A. K. Das, Bioinorganic Chemistry, Arunabha Sen Publishers, 2016
3. Lehninger, Principles of Biochemistry, Van Eikeren, 1982.
4. K. D. Karlin and Z. Tyeklar, Bioinorganic chemistry of Copper, Chapman and Hall, Newyork, 1993.
5. W. P. Jencks, Catalysis in Chemistry and Enzymology, McGraw-Hill book company, 1969.
6. Robert A. Scott, Charles M. Lukehart, Applications of Physical Methods to Inorganic and Bioinorganic Chemistry, Wiley Publishers, 2007.

Major 27 **Credit:4**

CHEM 4209 Catalysis Concepts and Applications

Learning Objectives: To enable to students to understand the structure and properties and their relations of metal complexes-based catalysts. The course also aims to give knowledge on various reaction mechanisms involving these types of catalysts.

Learning Outcome: Students after completing this course are equipped with designing metal complexes with catalytic reactivity for various organic transformations.

Course Content:

Unit I – Homogeneous Catalysis:

Metal complex catalysis in the liquid phase –structure/activity relationships in homogeneous catalysis – steric effects– electronic effects of ligands, substrates, and solvents - catalyst recovery and recycling.

Unit II – Heterogeneous Catalysis:

Classic gas/solid systems – the concept of the active site – model catalyst systems – real catalysts: promoters, modifiers, and poisons – surface organometallic chemistry – liquid/solid and liquid/liquid catalytic systems – aqueous biphasic catalysis – fluorous biphasic catalysis – biphasic catalysis using ionic liquids – phase-transfer catalysis – advanced process solutions using heterogeneous catalysis – the BP AVADA ethyl acetate process – the IFP and yellow diesel processes for biodiesel production.

Unit III – Industrial Process:

Industrial process-ammonia synthesis (Haber-Bosch Technology), epoxidation catalysts, hydrogenation catalysts, the Shell Higher Olefins Process (SHOP), the Du Pont synthesis of adiponitrile, the Ciba–Geigy Metolachlor process. High- Fructose-Corn Syrup, the Mitsubishi Rayon acrylamide process, the BMS paclitaxel process, the Tosoh/DSM aspartame process.

Unit IV – Enzyme Catalysis:

The basics of enzymatic catalysis, active site and substrate binding models, common mechanisms in enzymatic catalysis, factors affect enzyme action-pH and enzyme function, temperature and enzyme function, applications of enzyme catalysis, binding enzymes to solid supports, replacing conventional routes with biocatalysis, developing new biocatalysts, abzymes, catalytic RNA.

Unit V– Computer Applications in Catalysis Research:

Computers as research tools in catalysis – modeling of catalysts and catalytic cycles – a short overview of modeling methods – simplified model systems versus real reactions – modeling large catalyst systems using classical mechanics In-depth reaction modeling using quantum mechanics – predictive modeling and rational catalyst design.

Textbooks and References:

1. G. Rothenberg, Catalysis: Concepts and Green Applications, Wiley-VCH, Weinheim.
2. Boy Cor, Wolfgang A. Hermann, Applied Homogeneous Catalysis with Organometallic Compounds, Vol.2, Wiley-VCH.
3. J. E. Huheey, E. A. Keiter R. L. Keiter and O. K. Medhi, Inorganic Chemistry: Principles of Structure and Reactivity, 4th Edn. Pearson Education Inc.
4. F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Advanced Inorganic Chemistry,5th Edn. John Wiley and Sons.
5. Warshel, A.; Sharma, P.K.; Kato, M.; Xiang, Y.; Liu, H.; Olsson, M.H.M. (2006). "Electrostatic Basis of Enzyme Catalysis". Chem. Rev. 106 (8): 3210-3235.

Major 28 **Credit: 4**

CHEM 4210 Inorganic Photochemistry

Learning Objectives: Course explains the reactions of coordination complexes in their photo-excited states.

Learning Outcome: Students will be aware of various photo-physical and photo-chemical processes involved in coordination complexes.

Course Content:

Unit I – Basic principles:
Absorption of light –photochemical laws – photo stationary states – rate law – photolysis – quantum yields – actinometry – scavenging of reaction intermediates – flash photolysis – single photon techniques – flow techniques – picosecond transient kinetics**.**

Unit II – Kinetics of photoluminescence:
Thermal effects of photoluminescence – luminescence yield – time resolved detection of excited states – radiative and non-radiative transitions – energy transfer.

Unit III – Photoredox reactions:
Charge transfer complex – theory of electron transfer reactions – reactivity of CTTM, CTTL excited states – medium effects.

Unit IV – Ligand field photochemistry:
General features of ligand field photochemistry – reaction of excited states of dn metal complexes.

Unit V – Organometallic photochemistry:
Excited states in organometallic compounds – metal carbonyls – compounds with or without M– C bonds – hydride complexes.

Recommended Books:

1. K.K. Rohatgi-Mukherjee, Fundamentals of Photochemistry, Tata-McGraw Hill, 1981.
2. Collected readings in inorganic photochemistry, J. Chem. Edn. 1983
3. G. J. Ferraudi, Inorganic photochemistry, 1973
4. A.W. Adamson, E.D. Fleishcer, Concepts in inorganic photochemistry, 1963

Major 29 **Credit: 4**

CHEM 4211 Ligand Field Theory

Learning Objectives: Understanding the bonding of coordination compounds will enable to develop materials with important properties. This course deals with this aspect and students will understand the nature to the bonding of ligands with metal ions.

Learning Outcome: Students, after completing this course, shall understand and interpret the electronic properties of metal complexes.

Course Content:

Unit I – Introduction:
Qualitative basis of crystal fields, atomic spectroscopy (free ion, free ion terms, term wave functions, spin-orbit coupling), Thermodynamic aspects of crystal fields.

Unit II – Ions in Crystal Field:
Free ions in weak crystal fields (effect of a cubic crystal field on S, P, D, F, G, H, and I terms), Free ions in Medium and strong crystal fields.

Unit III – MO theory of complex ions:
Bonding in O_h/T_d complexes, qualitative calculations of 10Dq, Electronic spectra of complex ions.

Unit IV – Magnetic properties of complex ions:
Complexes of non-cube stereochemistry, Actinide element compounds

Unit V – ESR of complex ions:
Theory and evaluation of spin Hamiltonian parameters for systems with *s* 1/2 and > 1/2.

Textbooks:

1. B. N. Figgis, Introduction to Ligand Fields, Wiley Eastern Ltd., New Delhi/Bangalore, 1976.
2. A. B. P. Lever, Inorganic Electronic Spectroscopy, Elsevier, 1986.

Major 30 **Credit: 4**

CHEM 4212 Miscellaneous Topics in Inorganic Chemistry

Learning Objectives: This course aims to comprehend the main group organometallic compounds, structure, and their properties. This course has an extensive view of the solid-state structures of inorganic systems including isopoly and heteropoly anions, spectral/magnetic properties of lanthanides and actinides and advanced levels of nuclear chemistry.

Learning Outcome: Students after completing this course will understand the main group organometallics and compare it with d-block organometallics. They can correlate various structures and may have knowledge in synthesizing materials with desired properties.

Course Content:

Unit I – Main group Organometallics:

Classification and structure, ionic and electron deficient compounds of groups 1, 2 and 12; Electron deficient compounds of the boron group; Electron-precise compounds of the carbon group. Electron-rich compounds of the nitrogen group.

Unit II – Interhalogens, isopoly, and heteropoly compounds:

Pseudohalogens, Interhalogens, Xenon Compounds-Fluorides, oxides, oxyhalides- Poly oxo metallates-isopoly anions of Chromium, Vanadium, Phosphorous, Molybdenum and Tungsten, heteropoly anions of Molybdenum and Tungsten.

Unit III – Lanthanides and Actinides:

Chemistry of lanthanides and actinides: lanthanide contraction, oxidation states, spectral and magnetic properties, use of lanthanide compounds as shift reagents.

Unit IV – Inorganic Solids:

Types of solids, covalent, ionic, molecular and metallic solids, Intermolecular forces in solids, close packed structures, CCP, HCP, Unit – cell, crystal lattices, radius ratio, lattice energy, Born-Lande equation, Born-Haber cycle for Lattice energy, Important examples for Perovskite-spinel-inverse spinel-rutile-Ilmenite structures- Imperfections in crystals- point defects, metal excess defect-F centers, metal deficiency defect.

Unit V – Nuclear Chemistry:

Stability of nuclide, Radioactive decay and equilibrium, nuclear reactions, fission and fusion, nuclear reactor-basic component, Q value, cross sections, radioactive tracer techniques, neutron activation analysis, counting techniques such as G. M. ionization and proportional counter, Problems in nuclear chemistry.

Text books:

1. B. Douglas, D. McDaniel, J. Alexander, Concepts and Models of Inorganic Chemistry, 3ed, John Wiley, 2001.
2. H.J. Arnikar, Essentials of Nuclear Chemistry, 4ed, New Age Int. P. Ltd, 1995.
3. K. F. Purcell and J. C. Kotz, Inorganic Chemistry, 2ed, Cengage learning, 2012
4. F. A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 6ed, John Wiley, 2004.
5. J. E. Huheey, Inorganic Chemistry, 4ed, Harper International, 2002.
6. N. N. Greenwood, A. Earnshaw, Chemistry of the Elements, 2ed, BH, 1997S.K. Mehra, Advanced Nuclear Chemistry, Campus Books Internationals, 2009.

Major 31 **Credit: 4**

CHEM 4213 Electroanalytical Techniques

Learning Objectives: To enable students to use various electroanalytical methods to study and understand corrosion and its mitigation, preparing energy storing materials, chemical reactivity

Learning Outcome: Learners will be able to understand the fundamentals of electrochemistry and recognise the electrochemical processes, and various electroanalytical techniques.

Course Content:

Unit I – Kinetics of Electrode Reactions:

Mass transfer by Diffusion and Migration – models of electrode reactions – current potential characteristics – general mass transfer equation, migration and diffusion

Unit II – Potential Step Methods:

Types of techniques, step under diffusion control, Ilkovic equation – polarographic analysis – sampled current voltammetry: reversible, irreversible processes, multicomponent systems

Unit III – Chrono Methods:

Chronoamperometry, chronocoulometry – pulse polarographic methods: Tast pulse, normal pulse, differential pulse

Unit IV – Potential Sweep Methods:

Cyclic Voltammetry: Nernstian reversible, totally irreversible, quasi-reversible processes, multicomponent systems – convolute or semi-integral techniques

Unit V – Corrosion and Inhibition:

Fundamentals: Corrosion Electrochemistry, electrochemical and local cell model of corrosion, Classification of corrosion, corrosion protection, measurement of wet corrosion, estimation of corrosion rate, Tafel plot, Linear polarization resistance, AC Impedance.

Textbooks:

1. J. Bard and L. R. Faulkner, Electrochemical Methods, Fundamentals and applications, John Wiley, 1980.
2. Bockris and Reddy, Electrochemistry, vol 1 and 2, Plenum, 1973.
3. H. Kissinger, Electroanalytical Techniques, John wiley, 1998

Major 32 **Credit: 4**

CHEM 4214 Molecular Reaction Dynamics

Learning Objectives: Molecular reaction dynamics unfolds the history of change on the molecular level. It asks what happens on the atomic length and time scales as the chemical change occurs. The intention of this course is to describe why a particular experiment was carried out, what we have learned, what concepts are necessary to describe and understand the experiment, and how we move forward.

Learning Outcome: Students can understand the bimolecular chemical reaction in gas phase and get insides into dynamic and mechanical aspects.

Course Content:

Unit I – Macroscopic and Microscopic Processes:

Introduction to molecular collisions – Collision parameters - From reaction cross-sections to rate coefficients – From microscopic dynamics to macroscopic kinetics

Unit II – Potential Energy Surfaces:

Two-body and three-body potentials energy functions – Reaction Path – Harpoon Mechanism – Steric Effect – Kinematic effect – Energy requirement for reactions with a barrier – Activated complex theory for rate coefficient - Transition state resonances - Activated complex theory for rate coefficient

Unit III – Molecular Energy Transfer:

Simple models of energy transfer – State-to-state collisions – Bimolecular spectroscopy – Laser-assisted collision processes

Unit IV – Reaction dynamics and Chemical reactivity:

Case studies: Bimolecular collisions – RRKM unimolecular reaction rate - Molecular dynamics of gas- surface reactions - van der Waals interactions on collisions

Unit V – Simulations:

Introduction to Molecular dynamics simulation package (classical and quantum mechanical treatment) – Case studies

Textbooks:

1. Molecular Reaction Dynamics and Chemical Reactivity, R.D. Levine, R.B. Bernstein (Oxford, New York).
2. Theories of Molecular Reaction Dynamics the Microscopic Foundation of Chemical Kinetics, Niels Engholm Henriksen and Flemming Yssing Hansen, Oxford University Press, 2008

Major 33 **Credit: 4**

CHEM 4215 Organic Synthesis for Chemical Biology – Principles and Practices

Learning Objectives: Interdisciplinary approach in learning chemistry, application of organic chemistry in the study of biological phenomenon. To equip the students with the principles and strategies of contemporary organic synthesis relevant to chemical biology applications.

Learning Outcome: To be able to utilize the structure and function of organic molecules in biological system.

Course Content:

Unit I – Chemical Biology:

Chemical biology, origin, scope, academic and industrial perspectives, descriptors for biological relevance of an organic molecule, Lipinski rule, selected examples, challenges to synthetic chemists.

Unit II – Bioisosterism:

Introduction – role of bioisosterism in drug development programs, classification of bioisostrism, effects of bioisosterism on biological activity, classical examples.

Unit III – Diversity Oriented Synthesis:

Introduction - Diversity oriented synthesis – Principles and practices of DOS, substrate-based approach, reagent-based approach, Build / Couple / Pair strategy/sigma element, folding pathways / Classical examples from literature**.**

Unit IV – Multicomponent Reactions:

Introduction — history of MCR, Classical MCRs Stecker, Mannich, Passereni, UGI, Hantsch/ Bignelli/ Tietze/ Asigner / A3 coupling and other named MCRs, critical analysis of classical MCRs, Relevance of MCR to DOS, Examples from literature

Unit V – Introduction to Bio-conjugation:

principles and practices: Meaning, Scope and principles of bio-conjugation. Concept of bio-orthogonality, common bio-orthogonal functionalities and organic reactions used in bio-conjugation reactions examples from literature**.**

Textbooks:

1. Essentials of Chemical Biology - Andrew Miller and Julian Tanner
2. Multicomponent Reactions – Jieping Zhu, Hugues Bienaym
3. Bioisosteres in Medicinal Chemistry Volume 54 - R. Manhold, H. Kubinyi, G. Folkers
4. Diversity Oriented Synthesis-producing chemical tools for dissecting biology–David R.Spring
5. Diversity Oriented Synthesis - Exploring the intersections between chemistry and biology – Derek S Tan

Major 34 **Credit: 4**

CHEM 4216 Drug Design and Discovery

Learning Objectives: To create awareness and emphasize the need for interdisciplinary approach in learning chemistry. To recognize the relevance and application of organic chemistry in the study of biological phenomenon. To equip the students with the principles and strategies of contemporary organic synthesis relevant to chemical biology applications.

Learning Outcome: Learners will be able to recognize and appreciate the role of organic synthesis in drug discovery.

Course Content:

Unit I – Drug design, discovery, and development
Past and present.

Unit II – Bioisosterism:
Introduction – role of bioisosterism in drug development programs, classification of bioisostrism, effects of bioisosterism on biological activity, classical examples.

Unit III – Pharmacokinetics of drug action
Metabolism of drugs, and the role of metabolism in PK and drug safety – ADME, Toxicity, therapeutic index

Unit IV – The strategies
Molecular design of new drugs for receptors or enzymes

Unit V – Self-study Unit
Latest development in drug discovery of selected diseases (self-study and a submission of a term paper).

Textbooks:

1. An Introduction to Medicinal Chemistry, G. L. Patrick, 5th Edn, Oxford University Press, 2013.
2. Fundamentals of Medicinal Chemistry, G. Thomas, John Wiley and Sons Ltd, 2003.

Major 35 **Credit: 4**

CHEM 4217 Statistical Thermodynamics

Learning Objectives: This course aims to provide fundamentals of statistical thermodynamics.

Learning Outcome: On completion of the course, the student should be able to: (a) account for the physical interpretation of partition functions and be able to calculate thermodynamic properties of model systems with using Boltzmann -, Fermi- Dirac and Bose-Einstein statistics. (b) account for the physical interpretation of distribution functions and discuss and show how these can be used in calculations of basic thermodynamic properties. (c) calculate physical characteristics of non-ideal gases and liquids using the most common models for fluids.

Course Content:

Unit I – Fundamentals:

Probability and statistics: Binomial, Poisson, Gaussian Distributions, Bose-Einstein, Fermi-Dirac, Maxwell-Boltzmann statistics, and distribution; Macrostate, microstate, Entropy and equilibrium particle distribution; Thermodynamics Properties - Molecular partition function, internal energy and entropy at dilute limit, thermodynamic properties of ideal gas

Unit II – Partition Function and Application:

Partition function and thermodynamic properties – monoatomic, diatomic, and polyatomic systems; Ideal gas mixtures – non-reacting and reacting ideal gas mixtures, Equilibrium constant; Spectroscopy – Temperature, radiative transitions, Einstein coefficients, absorption and emission spectroscopy.

Unit III – Beyond Dilute Limit:

Crystalline solid, Einstein and Debye theory of crystalline solid, band theory of metals, Photon gas, Planck's distribution law, black body radiation

Unit IV – Canonical Ensembles:

Canonical, Grand Canonical, Micro Canonical ensembles, methods, Equilibrium properties and fluctuations; Real gases – partition function of real gases, Virial equation of gases, Rigid sphere, square well, Lennard-Jones Potentials.

Textbooks:

1. Statistical Thermodynamics: Fundamentals and Applications, Normand M. Laurendeau, Cambridge University Press, 2005.
2. Statistical Mechanics, Donald A McQuarrie, Viva Books, 2011.
3. Perspectives on Statistical Thermodynamics, Yoshitsugu Oono, Cambridge University Press, 2017.

Major 36 **Credit: 4**

CHEM 4218 Analytical Techniques in Chemistry

Learning Objectives: The aims are to provide a sound physical understanding of the principles of analytical chemistry and to show how these principles are applied in chemistry and related disciplines - especially in life sciences and environmental science.

Learning Outcome: Students will be able to develop analytical methods and perform chemometric analysis to understand the diverse aspects of analytical applications.

Course Content:

Unit I – Tools and Data Handling:

Balances, burettes, volumetric flasks, pipettes, calibration of tools, sampling. Errors and Statistics: significant figures, rounding off, accuracy and precision, errors and error analysis, test for significance – t-test, ANOVA test, chi-squared; Calibration methods: regression and correlation

Unit II – Separation Techniques:

Solvent Extraction: distribution Coefficient, distribution ratio, solvent extraction of metals, multiple batch extraction, counter current distribution. – Chromatographic Techniques: classification, theory of chromatographic separation, distribution coefficient, retention, sorption, efficiency and resolution. Column, ion exchange, paper, TLC and HPTLC: techniques and application. – Gas Chromatography: retention time or volume, capacity ratio, partition coefficient, theoretical plate and number, separation efficiency and resolution, instrumentation and application.

Unit III – Spectroscopic Techniques:

Electromagnetic radiation, absorption, and emission of radiation Instrumentation: sources, monochromators, detectors. - Flame spectrometry: flame emission, AAS, ICP, instrumentation and application. - Absorption spectrometry: UV-VIS, IR, instrumentation, techniques and applications.

Unit IV – Titration, gravimetric and Thermal Techniques:

Acid-base titrations, EDTA titrations, Redox titrations, pH titrations, electrogravimetry, voltammetry - Thermogravimetry: instrumentation and techniques, TGA curves, DTA and DSC, applications. Radiochemical methods: decay reactions, growth of radioactivity, radiation detectors, and tracer techniques.

Unit V – Analytical techniques in Biology, Archeology and Environmental Science:

Process involved in various application domains, sample preparations for specific domain application, analyzing results from various techniques toward qualitative and quantitative analysis.

Textbooks:

1. D. C. Harris, Quantitative Chemical Analysis, 8ed, W. H. Freeman, 2010.
2. G. D. Christian and J. E. O'Reily, Instrumental Analysis, 2nd Ed., Allyn and Balon, 1986
3. Encyclopedia of Analytical Chemistry, R A Meyers (editor) Wiley, 2006.

Major 37 **Credit: 4**

CHEM 4219 Organic Synthesis and Approaches

Learning Objectives: This course aims to provide the different principles of retro-synthetic analysis to plan the synthesis of a given target molecule using different reagents, reactants, and reactions.

Learning Outcome: On successful completion of this course, learners will be able to analyse a given target molecule, identify simple reactants and reactions to make various bonds and write a synthetic protocol to synthesise the given target molecule.

Course Content:

Unit I – Review of C-C and C-heteroatom bond forming reactions:
Reviewing different methods used in making carbon-carbon (C-C), carbon-nitrogen (C-N), carbon-oxygen (C-O), carbon-sulfur (C-S), carbon-halogen (C-X), etc. bonds using different reagents, reactants, and reactions.

Unit II – Retrosynthetic analysis:
Retrosynthetic analysis, disconnection approach, Synthesis of target molecules based on synthon approach.

Unit III– Strategies in Synthesis
Concept of Umpolung – Functional Group Interconversions. Use of directing groups. Protection and deprotection of common functional groups.

Unit IV– Total Synthesis
Synthesis of target molecules through linear and convergent synthesis (Selected examples)

Unit V– Problem solving exercise based on synthetic approaches
Practicing the synthesis of complex organic molecules using different strategies (Selected examples)

Textbooks:

1. Organic Synthesis: The Science Behind the Art, W. A. Smit, A. F. Bochkov and R. Caple, The Royal Society of Chemistry, 1998.
2. Modern Organic Synthesis - An Introduction, George s. Zweifel and Michael H. Nantz, W. H. Freeman and Company, NY, 2007.
3. Organic Synthesis, Disconnection Approach, S. Warren, John Wiley, 1985.
4. Organic synthesis: strategy and control, P. Wyatt and S. Warren, John Wiley and Sons Inc., USA, 2007.
5. Greene's Protective Groups in Organic Synthesis, T. W. Greene and P. G. M. Wuts, John Wiley and Sons Inc, 4th Edn, 2007.

Major 38 **Credit: 12**

CHEM 4200 Research Project and Dissertation

Research across disciplines is the systematic production of new knowledge. The process often includes the following:

- Developing a research question(s).
- Identifying where the research question(s) fits within existing knowledge, often accomplished through a literature review.
- Designing the method of investigating the question and securing the appropriate permissions to conduct your research.
- Collecting and analyzing data/materials, drawing conclusions from that analysis.
- Writing about, presenting, and publishing your findings.

In keeping with NEP 2020 objectives department of Chemistry defines undergraduate research as follows:

Undergraduate research is a scholarly or creative investigation that contributes to the systematic production of new knowledge; it is a meaningful activity undertaken with the guidance of a faculty member or other research mentor(s) and is used to enrich the College academic curriculum and student experience through enhanced critical thinking skills and a greater understanding of a chosen discipline(s) and its methodologies.

Contact program coordinator, faculty advisor about choosing your mentor

23. Syllabus for Minor Courses

Minor 1 **Credit: 4**

CHEM 1102 Essentials of Chemistry – I

Learning Objectives: This course aims to provide the basic concepts about atoms and molecules, intermolecular forces, thermodynamics, chemical kinetics, and electrochemistry.

Learning Outcome: After completion of this course, the students will have a basic understanding of various aspects of general chemistry.

Course Content:

Unit I – Atoms and Molecules:

Atomic and molecular masses: molecular formula determination, stoichiometry and chemical change, quantitative analysis; thermochemistry: enthalpy and its consequences; atoms: structure and spectra, introduction to quantum theory; the periodic table: electron configuration and general properties. (Chapters 3, 4, and 5 of Robinson)

Unit II – Intermolecular Forces, Liquids and Solids; Solutions and Colloids:

Intermolecular forces – properties of liquids and solids: forces between molecules, properties of liquids and solids, structure of crystal and solids. The nature of solutions: the formation of solutions, dissolutions of ionic compounds, dissolution of molecular electrolytes. Macroscopic properties of solutions: solutions of gases in lipids, solutions of liquids in lipids, the effect of temperature on the solubility of solids in water, solid solutions. Expressing concentration: percent composition, molarity, molality, mole fraction. Colligative properties of solutions, colloids chemistry. (Chapters 10, 11, and 12 of Robinson)

Unit III – Chemical Thermodynamics; Electrochemistry; Oxidation – Reduction:

The first law of thermodynamics, state functions. Work and heat. Galvanic cells and cell potentials: Galvanic cells, cell potentials, standard electrode potentials, circulation of cell potentials, relationship of the cell potential and the equilibrium constant. Batteries: primary cells, secondary cells, fuel cells, corrosion. Electrolytic cells: the electrolysis of molten sodium chloride, the electrolysis of aqueous solutions, electrolytic disposition of metals, Faraday's law of electrolysis. (Chapters 18 and 19 of Robinson)

Unit IV – Chemical Kinetics:

Rate of reaction and rate laws. The microscopic explanation of reaction rates: introduction to collision theory of reaction rates, activation energy and the Arrhenius equation, elementary reaction, reaction mechanisms, catalysis. (Chapters 13 of Robinson)

Unit V – Chemical Equilibrium:

An introduction to equilibrium: the state of equilibrium, reaction quotients and equilibrium constants, Le Chatelier`s principle, predicting the direction of a reversible reaction, calculation of equilibrium constants. Kinetics and equilibrium: the relationship of reaction rates and equilibrium, reaction mechanisms involving equilibrium. Ionic equilibrium: monoprotic, diprotic, and triprotic acids; properties of Bronsted bases in aqueous solutions, pH, pOH: measurements and significance, solubility products. The Lewis concept of acids and bases. Precipitation and dissolution. (Chapters 14, 15, 16, and 17 of Robinson)

Text Book:

1. General Chemistry, W. R. Robinson, J. D. Odom, H. F. Holtzclaw, Jr., 10th Edition, AITBS Publishers, New Delhi.
2. General Chemistry, D. D. Ebbing, 7th Edition, AITBS Publishers, New Delhi.

Minor 2 **Credit: 4**

CHEM 1202 Essentials of Chemistry – II

Learning Objectives: This course aims to provide the basic concepts about structure and bonding, organic reactions, metals, and metal complexes.

Learning Outcome: After completion of this course, the students will have a basic understanding of various aspects of organic and inorganic chemistry.

Course Content:

Unit I – Chemical Bonding; Molecular Structures and Models of Covalent Bonds:

Ionic bonding, covalent bonding: oxidation states and Lewis symbol, valence bond theory: Hybridization of atomic orbitals: sp hybridization, sp^2 hybridization, sp^3 hybridization, sp^3d and sp^3d^2 hybridization, assignment of hybrid orbital to central atoms, hybridization involving double and triple bonds. Molecular orbital theory: Molecular orbitals, molecular orbital energy diagrams, bond order, H_2 and He_2 molecules, diatomic molecules of the second period. (Chapters 6, 7 of Robinson)

Unit II – Introductory Organic Chemistry: Structure and Bonding at Carbon:

Elemental carbons and compounds. Organic compounds of carbon: alkanes, nomenclature, hydrocarbons. Derivatives of aromatic and non-aromatic hydrocarbons. Polymers: Factors that affect properties of polymers, polymer properties, kinds of polymers. (Chapters 9 and 24 of Robinson)

Unit III – Organic Reaction Mechanisms:

Types of organic reactions – addition, substitution, elimination reactions – interpretation of reaction profiles – introductory treatment. (Chapter 6, 9 and 15 of Solomons)

Unit IV – Chemistry of Representative Metals and Semi-Metals:

The elemental representative metals: Periodic relationships among groups, representative metals, chemical compounds. The semi-metals: The chemical behaviour and structures of the semi-metals, occurrence of boron and silicon hydrides, boron and silicon halides, boron and silicon oxides and derivatives. (Chapter 21 and 22 of Robinson)

Unit V – Transition Elements and Coordination Compounds:

The transition elements, properties of the transition elements, compounds of the transition elements, superconductors. Coordination compounds: Basic concepts, the naming of the complexes, the structures of complexes, isomerism in complexes, uses of complexes. Introduction to bonding: Valence bond theory, properties and bonding. (Chapter 23 of Robinson)

Text Book:

1. General Chemistry, W. R. Robinson, J. D. Odom, H. F. Holtzclaw, Jr., 10^{th} Edition, AITBS Publishers, New Delhi.
2. General Chemistry, D. D. Ebbing, 7^{th} Edition, AITBS Publishers, New Delhi.
3. Organic Chemistry, T. W. G. Solomons, 5^{th} Edition, John Wiley and Sons, Inc.

Minor 3 **(Vocational)** **Credit: 4**

CHEM 2104 Practice of Chemistry – I

Learning Objectives: This course aims to provide hands-on experience in handling chemicals, laboratory wares, and laboratory equipment.

Learning Outcome: After completion of this course, the students will be able to handle the chemicals and glassware with proper safety measurements.

Course Content:

The following experiments will be practiced in this semester.

1. Preparation of exactly 0.10 N HCl
2. Comparison of the melting point of impure and recrystallized benzoic acid
3. Qualitative visualization of exothermic and endothermic reactions
4. Estimation of antacid tablet
5. Estimation of water of crystallization of a hydrated salt

Text Book:

1. Vogel's Text Book of Quantitative Chemical Analysis, Mendham et. al., 6^{th} Edn., Pearson Education Ltd., Singapore, 2002.
2. Vogel's Text Book of Practical Organic Chemistry, Furniss et. al., 5^{th} Edn., Pearson Education Ltd., Singapore, 2004.

Minor 4 **(Vocational)** **Credit: 4**

CHEM 2204 Practice of Chemistry – II

Learning Objectives: This course aims to provide hands-on experience in basic measuring methods for various physical and chemical properties.

Learning Outcome: After completion of this course, the students will be aware of various methods used for the estimation, identification, and preparation of chemical compounds.

Course Content:

The following experiments will be practiced in this semester.

1. Estimation of molecular formula of oxide of magnesium
2. Density measurement of irregular objects using liquid displacement method
3. Preparation of soap from vegetable oils
4. Identification of anions by chemical tests
5. Identification of cations by chemical tests

Text Book:

1. Vogel's Text Book of Quantitative Chemical Analysis, Mendham et. al., 6th Edn., Pearson Education Ltd., Singapore, 2002.
2. Vogel's Text Book of Practical Organic Chemistry, Furniss et. al., 5th Edn., Pearson Education Ltd., Singapore, 2004.

Minor 5 **(Vocational)** **Credit: 4**

CHEM 3104 Practice of Chemistry – III

Learning Objectives: This course aims to provide hands-on experience in basic measuring methods for various physical and chemical properties.

Learning Outcome: After completion of this course, the students will be aware of various methods used for estimation, identification, and preparation.

Course Content:

The following experiments will be practiced in this semester.

1. Identification of simple organic functional groups by chemical tests
2. Preparation of a simple polymer
3. Paper chromatographic separation of mixture of coloured inks
4. Qualitative analysis of hardness of water by micellar effect – comparison of soaping effect of various commercial soaps/detergents
5. Qualitative identification of non-electrolyte, strong electrolytes, and weak electrolytes by electrical conductance

Text Book:

1. Vogel's Text Book of Quantitative Chemical Analysis, Mendham et. al., 6^{th} Edn., Pearson Education Ltd., Singapore, 2002.
   Vogel's Text Book of Practical Organic Chemistry, Furniss et. al., 5^{th} Edn., Pearson Education Ltd., Singapore, 2004.

Minor 6 **Credit: 4**

CHEM 3205 Selected Topics in Inorganic Chemistry

Learning Objectives: This course aims to provide the basics of various aspects of inorganic chemistry.

Learning Outcome: On successful completion of this course, the students will be able to correlate transition metal chemistry, coordination chemistry and organometallic chemistry and their importance. Students may appreciate the relevance of inorganic systems in biology.

Course Content:

Unit I – Transition Metal Chemistry:
Early Transition Elements: Introduction and the chemistry of Scandium group, Titanium group, Vanadium group, Chromium group and Manganese group. Late Transition Elements: Introduction and the chemistry of Iron group, Cobalt group, Nickel group, Copper group and Zinc group.

Unit II – Coordination Chemistry:
A brief review of the general characteristics of transition elements, types of ligands, nomenclature of coordination complexes, chelates, chelate effect, geometry and isomerism, Werner, Sidgwick and Valence bond theory.

Unit III – Organometallic Chemistry:
Compounds with transition metal to carbon bonds: classification of ligands, nomenclature, eighteen electron rule; transition metal carbonyls: range of compounds, structure, bonding, vibrational spectra, preparation, reactions.

Unit IV – Bioinorganic Chemistry:
Metal ions in biological systems: heme proteins, hemoglobin, myoglobin, ferritin, transferrin cytochromes; Iron-sulphur proteins: rubredoxin, ferredoxin.

Unit V – Solid State Chemistry:
Inorganic Solids: Ionic solids, close packing, radius ratio, ionic radii, lattice energy; crystal structure, cubic systems (SC, BCC, FCC), fluorite, antifluorite, zincblende, rutile; defects in ionic solids; insulators, semiconductors, and superconductivity.

Text Book:

1. J. D. Lee, Concise Inorganic Chemistry, 3rd ed., ELBS, 1987.
2. N. N. Greenwood, A. Earnshaw, Chemistry of the Elements, 2nd ed, BH, 1997
3. G. L. Miessler Donald and A. Tarr, Inorganic Chemistry, 3rd ed, Pearson, 2003
4. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry, University Science Books, CA, 1994.
5. E. Huheey, Inorganic Chemistry, 4th ed., Harper International, 2001.
6. A G. Sharpe, Inorganic Chemistry, 3rd ed, Addison-Wesley, 1999.
7. B. Douglas, D. McDaniel, J. Alexander, Concepts and Models of Inorganic Chemistry, 3rd Edn., John Wiley, 2001.

Minor 7 **Credit: 4**

CHEM 4104: Selected Topics in Organic Chemistry

Learning Objectives: This course aims to provide a basic understanding of organic chemistry, reaction mechanisms, and applications.

Learning Outcome: Successful completion of this course, the students will become aware of the organic reactions and importance of organic chemistry in biology.

Course Content:

Unit I – Substitution, Elimination and Addition Reactions:

S_N1, S_N2 and S_Ni reactions, factors affecting substitution reactions, E_1 and E_2 elimination reactions, factors affecting elimination reactions, electrophilic addition reactions.

Unit II – Oxidation and Reduction Reactions:

Oxidation of alcohols using metals and metal-free reagents, oxidation of olefins, sulphides, amines, carbonyl compounds, etc. Catalytic and stoichiometric methods of reduction of organic functional groups.

Unit III – Stereochemistry:

Constitutional isomers and stereoisomers, configurational isomers and conformational isomers of ethane, butane, cyclohexane. *R*, *S* configurations, stereochemical outcome of substitution and elimination reactions.

Unit IV – Heterocyclic Chemistry:

Synthesis and reactions of five- and six-membered heterocyclic molecules-furan, pyrrole, thiophene, pyridine, indole, quinolone, isoquinoline, etc.

Unit V – Chemistry of Biomolecules and Drugs:

Structures and function of aminoacids, carbohydrates, nucleic acids, peptides, proteins, etc., and commonly used modern drugs.

Text Book:

1. Clayden, Greeves, Warten, Organic Chemistry, Oxford University Press, 2012.
2. P.Y. Bruice, Organic Chemistry 7th Edition, Pearson Education, India, 2013.
3. Thomas L. Gilchrist, Heterocyclic Chemistry 3rd Edition, Pearson Education, India, 2005.
4. J. A. Joule and K. Mills, Heterocyclic Chemistry at a Glance, Blackwell Publishers, USA, 2007.
5. D. L. Nelson and M. M. Cox, Lehninger Principles of Biochemistry 7th Edition, W.H. Freeman, USA.

Minor 8 **Credit: 4**

CHEM 4105: Selected Topics in Physical Chemistry

Learning Objectives: This course aims to provide basic of chemistry through thermodynamics, chemical kinetics electrochemistry and photochemistry.

Learning Outcome: After completion of this course, the students will have a basic understanding of various aspects of physical chemistry.

Course Content:

Unit I – Thermodynamics:

Laws of Thermodynamics, Thermodynamic functions (U, H, S, G, and A), Maxwell relations-temperature and pressure effects.

Unit II – Chemical Kinetics:

Rates of the chemical reactions, Arrhenius equation, Linear Gibbs energy relations, Hammond postulate, Curtin-Hammett principle - Hammett equation and its Applications-Examples of reaction mechanism.

Unit III – Electrochemistry:

Electrochemical cells, half-cell potentials and cell potentials, determination of activities and activity coefficients of electrolytes- Debye-Huckel Theory-Thermodynamic information from electrochemistry- Nernst equation.

Unit IV – Phase Transformations and Stability:

Phase rule, thermodynamics of phase transitions, simple mixtures, colligative properties-phase diagrams-two-component systems- azeotropes, eutectics.

Unit V – Photochemistry:

Electronic excited states, singlet and triplet states, Jablonski diagram, rate of excited state processes, primary quantum yield, quenching, resonance energy transfer (RET).

Text Book:

1. P. Atkins, J. de Paula, J. Keeler, Physical Chemistry, 11th Edition, Oxford University Press, Oxford, United Kingdom, 2018.
2. R. G. Mortimer, Physical Chemistry, 3rd Edition, Elsevier Academic Press, United Kingdom, 2008.
3. K. J. Laidler, Chemical Kinetics, 3rd Edition, Pearson, India. 2003.
4. D. A. McQuarrie and J. D. Simon, Physical Chemistry- A Molecular Approach, Viva Books Limited, 1998.

24. Syllabus for Multi-disciplinary Courses

Multi-disciplinary – 1 **Credit: 3**

CHEM 1103 Introduction to Chemistry – I

Learning Objectives: This course aims to provide basic chemistry knowledge to the arts/social science major students.

Learning Outcome: After completion of this course, the students will have a basic understanding of various aspects of chemistry.

Course Content:

Unit I – Atomic Structure:

Subatomic particles in an atom, the nucleus, electrons, Bohr model, quantum mechanical model, electron configurations, energy level diagram, valence electrons, isotopes and ions.

Unit II – Periodic Properties:

Repeating patterns of periodicity, understanding how elements are arranged in the periodic table, metals, nonmetals, and metalloids, families and periods.

Unit III – Chemical Bonding:

The ionic bond, positive and negative ions, polyatomic ions, ionic compounds, naming ionic compounds. Covalent bond, understanding multiple bonds, naming binary covalent compounds, empirical formula, molecular formula, structural formula, electronegativity, polar covalent bond, water, VSEPR theory.

Unit IV – Air:

Earth's atmosphere: divisions and composition, chemistry of the atmosphere, pollution through the ages, automobile emissions, photochemical smog, acid rain, air pollution, water pollution, indoor air pollution, stratospheric ozone: earth's vital shield, carbon dioxide and climate change.

Unit V – Water:

Water: some unique properties, water in nature, chemical and biological contamination, groundwater contamination, usage of water, making water fit to drink, wastewater treatment.

Textbook:

1. Chemistry for Dummies, J. T. Moore, Wiley Publishing, Inc., 2003.
2. Chemistry for Changing Times, J. W. Hill and T. W. McCreary, 14th Edn., Pearson Education Ltd., 2016

Multi-disciplinary – 2 **Credit: 3**

CHEM 1203 Introduction to Chemistry – II

Learning Objectives: This course aims to provide the basics of chemistry in day-to-day life to the arts/social science major students.

Learning Outcome: After completion of this course, the students will have a basic understanding of chemistry involved in day-to-day life.

Course Content:

Unit I – Chemistry in Everyday Life:

The chemistry of carbon – organic chemistry, hydrocarbons – alkanes, alkenes, alkynes, aromatic compounds. Functional groups – alcohols, carboxylic acids, esters, aldehydes and ketones, ethers, amines and amides.

Unit II – Chemistry of Earth:

Spaceship earth – structure and Composition, silicates and the shapes of things, metals and ores, earth's dwindling resources.

Unit III – Polymers:

Polymerization – making big ones out of little ones, polyethylene, addition polymerization, rubber and other elastomers, condensation polymers, properties of polymers, plastics and the environment.

Unit IV – Some Serendipitous Discoveries in Chemistry:

Archimedes, vulcanization of rubber, right- and left-handed molecules, William Perkin and a mauve dye, Kekule, discovering radioactivity, Teflon, stick 'em up!! sticky notes, growing hair, sweeter than sugar.

Unit V – Nobel Prize in Chemistry:

Sugar and purine synthesis, discovery of the inert gases, radioactive substance, discovery of radium and polonium, Grignard reagent, coordination complex, synthesis of ammonia, synthesis of haemin, carbohydrates and vitamin C, fission of heavy nuclei, alkaloids, transuranium elements.

Textbook:

1. Chemistry for Dummies, J. T. Moore, Wiley Publishing, Inc., 2003.
2. Chemistry for Changing Times, J. W. Hill and T. W. McCreary, 14th Edn., Pearson Education Ltd., 2016

Multi-disciplinary – 3 **Credit: 3**

CHEM 2103 Introduction to Chemistry – III

Learning Objectives: This course aims to provide the basics of chemistry in day-to-day life to the arts/social science major students.

Learning Outcome: After completion of this course, the students will understand the chemistry involved in day-to-day life.

Course Content:

Unit I – Foods:

Carbohydrates in the diet, fats and cholesterol, proteins – muscle and much more, minerals, vitamins, and other essentials, starvation, fasting and malnutrition, flavourings – spicy and sweet, food additives – beneficial or dangerous? problems with our food.

Unit II – Fitness and Health:

Calories – quantity and quality, vitamins, minerals, fluids, and electrolytes, weight loss – diets and exercise, measuring fitness – some muscular chemistry, drugs, athletic performance, and the brain.

Unit III – Drugs:

Scientific drug design: pain relievers – from aspirin to oxycodone, drugs and infectious diseases, chemicals against cancer, hormones – the regulators, drugs for the heart, drugs and the mind, drugs and society.

Unit IV – Household Chemicals:

Cleaning with soap – synthetic detergents, laundry auxiliaries – softeners and bleaches, all-purpose and special-purpose cleaning products, solvents, paints, and waxes, cosmetics – personal care chemicals.

Unit V – Chemistry Down on the Farm:

Farming with chemicals – fertilizers, the war against pests – herbicides and defoliants, sustainable agriculture, looking to the future – feeding a growing, hungry world.

Textbook:

1. Chemistry for Changing Times, J. W. Hill and T. W. McCreary, 14th Edn., Pearson Education Ltd., 2016.
2. Chemistry for Dummies, J. T. Moore, Wiley Publishing, Inc., 2003.

25. Syllabus for Skill Enhancement Courses

SEC – 1 **Credit: 3**

CHEM 1100 Chemistry Laboratory – I

Learning Objectives: This course aims to provide hands-on experience in handling chemicals, laboratory wares, and laboratory equipment.

Learning Outcome: After completion of this course, the students will be able to handle the chemicals and glassware with proper safety measurements.

Course Content:

The following experiments will be carried out in this semester.

1. Preparation of Exactly 0.10 N HCl
2. Comparison of melting point of impure and recrystallized benzoic acid
3. Qualitative visualization of exothermic and endothermic reactions
4. Estimation of anta-acid tablet
5. Estimation of water of crystallization of a hydrated salt
6. Estimation of molecular formula of oxide of magnesium
7. Density measurement of irregular objects using liquid displacement method
8. Preparation of soap from vegetable oils

Reference Books:

1. Vogel's Text Book of Quantitative Chemical Analysis, Mendham et. al., 6th Edn., Pearson Education Ltd., Singapore, 2002.
2. Vogel's Text Book of Practical Organic Chemistry, Furniss et. al., 5th Edn., Pearson Education Ltd., Singapore, 2004.

SEC – 2 **Credit: 3**

CHEM 1200 Chemistry Laboratory – II

Learning Objectives: This course aims to provide hands-on experience in basic measuring methods for various physical and chemical properties.

Learning Outcome: After completion of this course, the students will be aware of various methods used for the estimation, identification, and preparation of chemical compounds.

Course Content:

The following experiments will be carried out in this semester.

1. Identification of anions by chemical tests
2. Identification of cations by chemical tests
3. Identification of simple organic functional groups by chemical tests
4. Preparation of a simple polymer
5. Paper chromatographic separation of mixture of coloured inks
6. Qualitative analysis of hardness of water by micellar effect – comparison of soaping effect of various commercial soaps/detergents
7. Qualitative identification of non-electrolyte, strong electrolytes, and weak electrolytes by electrical conductance

Reference Books:

1. Vogel's Text Book of Quantitative Chemical Analysis, Mendham et. al., 6th Edn., Pearson Education Ltd., Singapore, 2002.
2. Vogel's Text Book of Practical Organic Chemistry, Furniss et. al., 5th Edn., Pearson Education Ltd., Singapore, 2004.

SEC – 3 **Credit: 3**

CHEM 2100 Chemistry Laboratory – III

Learning Objectives: This course aims to provide practical experience for the purification, separation, and quantification of various organic and inorganic compounds.

Learning Outcome: After completion of this course, the students will be able to do purification, separation, and quantification of various organic and inorganic compounds.

Course Content:

The following experiments will be carried out in this semester.

1. Purification of solvent and compounds: crystallization, sublimation, distillation, Soxhlet extraction,
2. Separation methods: solvent extraction, paper, TLC, column, ion-exchange chromatography, demonstration of chromatography instrumentation
3. Physical Chemistry: density, viscosity, melting point, boiling point, refractive index, conductivity, and others
4. Quantitative analysis: Titrimetry, potentiometry, conductometry
5. Computational chemistry

Reference Books:

1. Vogel's Text Book of Quantitative Chemical Analysis, Mendham et. al., 6th Edn., Pearson Education Ltd., Singapore, 2002.
2. Vogel's Text Book of Practical Organic Chemistry, Furniss et. al., 5th Edn., Pearson Education Ltd., Singapore, 2004.
3. D. C. Young, Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems, John Wiley & Sons, 2001.
4. D. Rogers, Computational Chemistry using the PC, 3rd Edition, John Wiley & Sons, 2001.

INTEGRATED TEACHER EDUCATION PROGRAM

(ITEP: 4-YEAR DURATION)

B.Sc., B.Ed. PROGRAMME (SEMESTER)

Regulations and Syllabus

(2023-24 Onwards)

School of Education

Pondicherry University

(As per NCTE Regulation-2019 & NEP-2020)

2.0 FOUNDATIONS OF EDUCATION

2.1 Evolution of Indian Education

Credit: 4
Semester: S-1

2.1.1 About the Course

The course seeks to develop an understanding among student teachers of the evolution of education in India that would allow student teachers to locate themselves within the larger system of education. The course aims at orienting student teachers to the historical perspective of Indian education including the development and features of education in ancient India such as the Gurukuls, post-Vedic period, during Mauryan and Gupta empires, during colonial era and post-independence period, and future perspectives about education development in India, and progression from Education 1.0 to Education 4.0 etc. This course also provides an overview of the contribution of Indian thinkers to evolve Indian Education system – Savitribai and Jyotiba Phule, Rabindranath Tagore, Swami Vivekananda, Mahatma Gandhi, Sri Aurobindo, Gijubhai Badheka, Pt. Madanmohan Malaviya, Jiddu Krishnamurti, Dr. Bhima Rao Ambedkar and others.

2.1.2 Learning Outcomes

After completion of this course, student teachers will be able to:

- discuss genesis, vision, and evolution of education in ancient India to the contemporary India,
- enable themselves to shape their educational perspective to act as an effective teacher.

UNIT - I

Ancient Indian Education: Vedic Period

A. Vision, objectives and salient features of Vedic Education System.
B. Teaching and Learning Process.
C. Development of educational institutions: Finances and Management.
D. Famous Educational institutions and Guru-Shishya.
E. Education at the time of Epics: Ramayana and Mahabharata.

UNIT - II

Ancient Indian Education: Buddhist and Jain Period

A. Vision, objectives and salient features of Buddhist and Jain Education System.
B. Teaching and Learning Process.
C. Finance and Management of Educational Institutions.
D. Educational Institutions: Nalanda, Taxila, Vikramshila, Vallabhi, Nadia.
E. Famous Guru-Shishya.

UNIT - III

Post-Gupta Period to Colonial Period

A. Vision, objectives, brief historical development perspective as well as salient features of Education in India.
B. Teaching and Learning Process.
C. Finance and Management of educational institutions.

UNIT - IV

Modern Indian Education

A. Colonial Education in India

- Woods Despatch, Macaulay Minutes and Westernization of Indian Education

B. Shiksha ka Bhartiyakaran (Indigenous Interventions in Education)

(Bird's eye view of their contribution)

- Swadeshi and Nationalist attempts of educational reforms with special reference to general contribution of Indian thinkers –

Savitribai and Jyotiba Phule, Rabindranath Tagore, Swami Vivekananda, Mahatma Gandhi, Sri Aurobindo, Gijubhai Badheka, Pt. Madanmohan Malaviya, Jiddu Krishnamurti and Dr. Bhima Rao Ambedkar others – to the education systems of India.

C. Education in Independent India

- Overview of Constitutional values and educational provisions.
- Citizenship Education:
  - Qualities of a good citizen.
  - Education for fundamental rights and duties.
- Overview of 20th Century Committees, Commissions and Policies.
- UEE, RMSA, RTE Act 2009: Overview and impact.
- NEP 2020: vision and implementation for a vibrant India.

2.1.3 Suggestive Practicum

1. Prepare a report highlighting educational reforms with special reference to school education in the light of NEP 2020.
2. Critically analyze the concept of good citizen from the perspective of education for democratic citizenship.
3. Compare vision, objectives, and salient features of education during different periods.
4. Working out a plan to develop awareness, attitude and practices related to Fundamental Rights or fundamental duties or democratic citizenship qualities, execute it in the class and write the details in form of a report.
5. Sharing of student experiences (in groups) related to Indian constitutional values, help them to reshape their concept and enable them to develop vision, mission and objectives for a school and their plan to accomplish the objectives in form of a group report.
6. Analyses of current educational strengths and weaknesses of one's own locality and work out a critical report.
7. Visit to places of educational significance and value centers and develop a project report.
8. Observation of unity and diversity in a social locality and matching it with unity and diversity in the class and work out a plan for awareness for national-emotional integration for class to develop awareness, attitudes, skills, and participatory values, execute it in the class and report the details.

2.1.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field

engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.

- Hands on experience of engaging with diverse communities, children, and schools.

2.1.5 Suggestive Mode of Assessment

The assessment will be based on the tests and assignments.

2.1.6 Suggestive Reading Materials

Teachers may suggest books/readings as per the need of the learners and learning content.

MAJOR SUBJECTS: PHYSICS

3.1 MECHANICS

Credit: 4
Semester: S-1

3.1.1. About the course

This course is intended to review the concepts of Newtonian mechanics. The students will be introduced the formalisms of force laws. They are exposed to angular momentum in real life situation.

3.1.2. Learning outcomes:

On successful completion of the course, the student will be able to

- understand the principles of various force laws and the concept of energy and momentum
- apply linear momentum conservation principles to different physical systems
- relate linear and rotational motion
- apply conservation of angular momentum to real life situations

UNIT– I: NEWTON'S LAWS AND ITS APPLICATIONS

Classical mechanics – Newton's first law – force – mass – Newton's second law – Newton's third law – weight and mass – applications of Newton's laws in one dimension – force laws – tension and normal forces – frictional forces – dynamics of uniform circular motion

UNIT-II: CONSERVATION OF MOMENTUM AND COLLISIONS

Collisions – linear momentum – impulse and momentum – conservation of momentum – two body collisions – motion of a complex object – two particle systems – many particle systems – center of mass of solid objects – conservation of momentum in a system of particles

UNIT–III: ROTATIONAL KINEMATICS AND DYNAMICS

Rotational motion – rotational variables – rotation with constant angular acceleration – rotational quantities as vectors – relationships between linear and angular variables: scalar form – vector relationships between linear and angular variables – torque – rotational inertia and Newton's second law – rotational inertia of solid bodies – combined rotational and translational motion

UNIT–IV: ANGULAR MOMENTUM

Angular momentum of a particle – systems of particles – angular momentum and angular velocity – conservation of angular momentum – spinning top – quantization of angular momentum – rotational dynamics: a review

UNIT–V: WORK AND ENERGY

Work and energy – work done by a constant force – work done by a variable force: one dimensional case – work done by a variable force: two dimensional – kinetic energy and work energy theorem – power – conservative forces – potential energy – conservation of mechanical energy

3.1.3. Suggestive mode of transaction:

Lectures, Presentation, Demonstration, Group discussion

3.1.4. Suggestive mode of assessment:

Assignments, Class tests, Problem solving, Semester examinations

3.1.5. Suggestive readings:

1. Resnick, Halliday, Krane, (2002). *Physics,* (5th ed.). *Vol.1,* New Delhi: John Wiley & Sons (ASIA) Pvt Ltd., Print Chapters: 3,5,6,7,8,9.1–9.3, 9.7,10,11.1– 11.6, 12.1– 12.3.
2. Atam P. Arya, (1979). *Introductory College Physics,* (3rd ed.). New Delhi, Macmillian Publications, Print. George Gamove & John M. Cleveland, (1978). *Physics: Foundations & Frontiers,* New Delhi: Prentice Hall, India, Pvt. Ltd. Print. 3. Jerold Touger, (2006). *Physics,* New Delhi: Wiley India (P) Ltd. Print.
4. Neil Chatterjee, (2009). *Enjoyable Physics, Vol.1,* New Delhi: Macmillan Publishers India Ltd. Print.

3.2 PHYSICS PRACTICAL – A

Credit: 4

Semester: S-1

3.2.1. About the course:

On successful completion of the course, the student will be able to

- use basic measuring instruments
- infer the basic concepts in Mechanics, Optics and Electrical circuits
- develop the skill of observation and make meaningful conclusions.

3.2.2. Experiments/Lab

1. Handling basic laboratory instruments (screw gauge, travelling microscope, spectrometer, spherometer)
2. Study of Collisions
3. Study of rigid body oscillations (Torsional/bifilar/compound pendula)
4. Study of refraction (Lenses / Prisms)
5. Study of frictional forces
6. Study of lens system (simple and compound microscope)
7. Comparing EMF of two batteries using potentiometer
8. Melde's string – standing waves
9. Coefficient of viscosity by flow method
10. Surface tension by capillary rise method

3.2.3. Suggestive mode of transaction:

Experimentation, Demonstration

3.2.4. Suggestive mode of assessment:

In lab- experimentation, Semester examinations

3.2.5. Suggestive readings:

1. Arora C.L., (2011). B.Sc. Practical Physics, New Delhi: S. Chand & company Ltd. Print.
2. Bhattacharya C.K., (1984). University Practical Physics with Viva-Voce, New Delhi: CBS publishers and distributors. Print.
3. Chattapadhyay D. and Rakshit P.C., (2005). An Advanced course in Practical Physics, (7th ed.), Kolkatta: New Central Book Agency Pvt., Ltd. Print.
4. Gupta S.L., and Kumar V., (2002). Practical Physics, (25th ed.), Meerut: Pragatiprakashan Publication. Print. Ouseph C.C., Rao U.J. and Viyayendran V., (2010). Practical Physics and Electronics, Chennai: S. Viswanathan Printers and Publishers Pvt., Ltd., Print.
5. Palanisamy P K, (2002). Physics Laboratory Manual, Chennai: Scitech Publications (India) Pvt. Ltd., Print.

MAJOR SUBJECTS: CHEMISTRY
3.1 PRINCIPLES OF GENERAL CHEMISTRY - I

Credit: 4
Semester: S-1

3.1.1. About the course:

This course deals with atomic structure, periodic table, chemical bonding, properties of gases, liquids, solids and solutions.

3.1.2. Learning outcome:

On successful completion of this course learners will be able to:
• Comprehend the evolution of electronic structure of atom
• Use quantum numbers and atomic orbital wave function equations to visualize the shapes of orbitals
• Recognize the relationship between position of an element in periodic table and its atomic properties and the periodic trend in properties
• Explain the concept of chemical bonding
• Analyze the properties of gases, liquids, solids and solutions

UNIT I : ATOMIC STRUCTURE

Blackbody emission and temperature, Photoelectric effect, Double slit experiment, Line spectrum of elements, Rutherford's experiment, Bohr's atomic model, Heisenberg's Uncertainty, Quantum atomic model, hydrogen atomic orbitals and quantum numbers, atomic orbital equations (no derivation required), hybrid atomic orbitals, Electronic configuration of atoms, Madelung rule, atomic mass, synthetic elements, isotopes and stability of isotopes (qualitative description).

UNIT II: PERIODIC TABLE AND PERIODICITY

Periodic trends in atomic properties, reactivity and compound formation, types of compounds, mole concept and composition, oxidation states - Chemical reactions, stoichiometry, chemical reactions in solutions, limiting reagent - Reactions in aqueous medium, precipitation, acid-base, redox, balancing redox reactions, oxidizing and reducing agents, stoichiometry and titration.

UNIT III : CHEMICAL BONDING

Types of bonds, representation of electrons as dots, Lewis model of ionic, covalent structures, Electronegativity and bond polarity, Lewis structure of molecular compounds, resonance and formal charge, exception to octet rule, bond energies and bond lengths, bonding in metals - VSEPR theory, predicting molecular geometry, shapes and polarity - Valence Bond theory - Molecular orbital theory, electron delocalization.

UNIT IV: GASES, LIQUIDS, SOLIDS AND SOLUTIONS

Gas equations, van der Waals gas, virial gas equation, real gases, intermolecular forces - Properties of liquids, properties of solids, phase diagrams, nature of bonding in solids, crystal structures.

UNIT V: SOLUTIONS

Types of solutions, solution concentration, solubilities of gases, vapour pressure, osmotic pressure, colligative properties of non-electrolyte solutions, electrolyte solutions, colloidal mixtures.

3.1.3. Suggestive mode of transaction:
Lectures, presentations, group discussions and demonstration method.

3.1.4. Suggestive mode of Assessment:
Assignments, class test, problem solving, Semester examination.

3.1.5. Suggestive Readings:

1. Lee. J.D. concise inorganic chemistry ELBS,1991.
2. Chemistry A Molecular approach, Nivaldo J Tro, 4ed, Pearson, 2017
3. Chemistry: The Central Science, Theodore L. Brown, H. Eugene LeMay, Jr.,Bruce E. Bursten, Catherine J. Murphy, Patrick M. Woodward, Matthew W.Stoltzfus, 13ed, Pearson, 2015
4. J.E.Huheey,E.A.KeiterandR.L.Keiter,InorganicChemistry:PrinciplesofStructureandReactivity,ISBN-13:9788177581300, HarperCollinCollegePublishers,4thEd.,1993.
5. F.A.CottonandG.Wilkinson,AdvancedInorganicChemistry,ISBN:9789354245701,WileyInterscience, 4th& 5thEd., 1998
6. Neil Winterton, Jeff Leigh Modern Coordination Chemistry, ISBN: 9780854044696, RSC,1960
7. D. F. Shriver, P. W. Atkins and C. H.Langford InorganicChemistry.ISBN:9780195685237, Oxford UniversityPress,l994

3.2 PRACTICAL – A

Credit: 4

Semester: S-1

3.2.1. About the course:

This course deals with estimation process, comparison of melting point, crystallization.

3.2.2. Learning outcome:

On successful completion of this course learners will be able to:

- Estimate the anta acid tablet
- Compare the melting point of compounds.
- Find molecular formula of a compound.

These experiments are indicative only and are not restricted only to these. Course tutor may extend, innovate, extrapolate as per the requirements.

1. Preparation of Exactly 0.10 N HCl
2. Comparison of melting point of impure and recrystallized benzoic acid
3. Qualitative visualization of exothermic and endothermic reactions
4. Estimation of anta-acid tablet
5. Estimation of water of crystallization of a hydrated salt
6. Estimation of molecular formula of oxide of magnesium
7. Density measurement of irregular objects using liquid displacement method
8. Preparation of soap from vegetable oils
9. Identification of simple organic functional groups by chemical tests
10. Preparation of a simple polymer.

3.2.3. Suggestive mode of transaction:

Demonstration, experimentation.

3.2.4. Suggestive mode of Assessment:

In lab-experimentation and semester examination.

3.2.5. Suggestive Readings:

1. V.Venkateswaran,R.Veeraswamy,A.R.Kulandaivelu,Basicprinciplesofpracticalchemistry,SultanChand&Sons,ISBN:81-8054-776-8.
2. V.V. Ramanujam, *Inorganic Semi-micro Qualitative Analysis*, 3rd Ed., ISBN:196500ENGGPCX,National PublishingCompany,l990.
3. A.I.Vogel,*TextBookofQuantitativeInorganicAnalysis*,5thEd.,ISBN-10:047020608X,ISBN-13:978-0470206089,Longman, 1989
4. Brauer,*HandbookofPreparativeInorganicChemistry(Vol.IandII)*,ISBN:9780323161275,ISBN:9780323161299, AcademicPress, 1963.

MAJOR SUBJECTS: MATHEMATICS

CORE 1: THEORY OF EQUATIONS AND TRIGONOMETRY

Credit: 4
Semester: S-1

About the Course:

In algebra, the study of algebraic equations, which are equations defined by a polynomial, is called the theory of equations. A polynomial is an expression consisting of one or more terms. The main difficulty of the theory of equations was to know when an algebraic equation has an algebraic solution. Trigonometry" basically deals with the study of the relationship between the sides and angles of the right-angle triangle. Hence, it helps to find the missing or unknown angles or sides of a right triangle using the trigonometric formulas, functions or trigonometric identities.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT- I: Relations between the roots and the coefficients of a general polynomial equations in one variable – Transformation of equations – Descarte's rule of signs.

UNIT-II: Solution of cubic equations: Cardon's Method - Trigonometrical method– Horner's Method, Bi-quadratic equation– Ferrari method.

UNIT- III: De Moivre's theorem and its applications – Direct and Inverse circular andhyperbolic functions.

UNIT- IV: Logarithm of a complex quantity- Expansion of Trigonometrical functions.

UNIT- V: Gregory's series- Summation of series.

Suggestive practicum:

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related
- Case studies of the children in different areas of interest of the above title / content and submit the report

Suggestive mode of transaction

Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment

Suggestive Reading Materials

Prescribed Text (specify sections clearly):

1. Algebra Volume-1, T.K. Manicavachagom Pillay , T.Natarajan and K.S. Ganapathy,. Viswanathan (Printers & Publishers) Pvt. Lid, (1999)

2. Trigonometry, S. Narayanan and T.K. Manicavachagom Pillai, S. Viswanathan (Printers & Publishers) Pvt. Ltd, (1997)

Recommendedbooks:

1. *Plane Trigonometry-Part-I&II(6th Edition), S.L.Loney, ArihantPublications, 2016.*

e-LearningSource

http://ndl.iitkgp.ac.inhttp://ocw.mit.edu http://mathforum.org

CORE 2: DIFFERENTIAL CALCULUS

Credit: 4
Semester: S-1

About the Course:

A differential is a study of a rate of change. In math, this term is most often associated with differential equations which are equations containing derivatives. Derivatives are an algebraic method for generalizing the instantaneous rate of change of a function. Differential calculus studies the rate of change of the slope of a function. Using differential calculus to study a function makes it possible to analyze minute behaviours in the function. calculus is an in-depth study of functions, and differential calculus studies how fast or slow a function changes. A function's rate of change can be found by analysing the slope of the graph of a function.

Learning Outcomes: After completion of this course, student teacher will be able to discuss and develop the understanding and solving the skills of the theory & equations and applications of theories.

UNIT I: n^{th} derivative – Standard results – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula.

UNIT II: Total differential coefficients – Euler's theorem - Partial derivatives ofa function of two functions -Equations of tangent and normal - Taylor expansions of single and double variables.

UNIT III: Maxima and Minima of two variables – Lagrange's method ofundetermined multipliers - Angle of intersection of curves– Sub tangent and Sub Normal. -

UNIT IV: Angle between the radius vector and tangent – Angle between theintersection of two curves – Polar sub tangent and sub normal.

UNIT V: Circle, radius and Centre of curvature – Cartesian formula for radius of curvature – envelope.

Suggestive practicum

- Solve / workout any one Chapter's Exercise Problems at Secondary/ Higher Secondary level and submit on the above content/ text.
- Review of Indian and western Mathematicians and their invention and discovery in the above content / subject.
- Organizing Group discussion and presentation in mathematics of the above content related Case studies of the children in different areas of interest of the above title / content and submit the report.

Suggestive mode of transaction

Lecture, problem solving, exercise, cooperative teaching, Team teaching, suggestive project work in school mathematics at secondary level.

Suggestive mode of assessment

Assessment will be based on the Test / Examination and Assignment

Suggestive Reading Materials

Pres. Text Book (section):

- Calculus Vol.-I,

T. K. Manickavachagom Pillai, Printers and Pub. (May1992 Edition)

Unit 1 : Chapter 3, Unit 2: Chapter 8, Unit 3: Chapter 8, 9, Unit 4, Chapter- 9, Unit 5 : Chapter 10 (Section 1)

Reference Books

- Calculus (2nd Edition), Lipman Bers and Frank Karal, HoltMcDougal, 1976.
- Thomas' Calculus 12th Edition, George B.Thomas, Maurice D.Weirand Joel Hass, Pearson Education, 2015.

e-Learning Sources

http://ndl.iitkgp.ac.inhttp://ocw.mit.edu
http://mathforum.org

ABILITY ENHANCEMENT & VALUE-ADDED COURSES

TAMIL LANGUAGE

Ist SEMESTER

தாள்: தமிழ் - I

Title of the Paper: TAMIL I

பாடத்திட்டம் (Syllabus)

கவிதை இலக்கியம்

1. தமிழ்	-	மகாகவி பாரதியார்
2. கோவில் வழிபாடு	-	கவிமணி தேசிக விநாயகம் பிள்ளை
3. நீங்களே சொல்லுங்கள்	-	பாவேந்தர் பாரதிதாசன்
4. ஆக்கம் சேர்ப்போம்	-	கவிஞரேறு வாணிதாசன்
5. கழைக் கூத்தாடி	-	கவிஞர் தமிழொளி
6. தமிழக நிலை	-	கவிஞர் புதுவைச்சிவம்
7. தமிழில் பெயரிடுங்கள்	-	உவமைக் கவிஞர் சுரதா
8. பெரியார்	-	கவிஞர் வாலி
9. ஒரு வண்டி சென்றியூ	-	ஈரோடு தமிழன்பன்
10. ஒவ்வொரு புல்லையும்	-	இன்குலாப்

சிறுகதை இலக்கியம்

1. பாதுகை - பிரபஞ்சன்
2. பூ - பாவண்ணன்
3. அன்பளிப்பு - கு. அழகிரிசாமி
4. அற்றது பற்றெனில் - இந்திரா பார்த்தசாரதி
5. நிலை நிறுத்தல் - கி. ராஜநாராயணன்

நாடக இலக்கியம்

1. அனார்கலி - கவிஞர் கண்ணதாசன்
2. ஒநாயும் வீட்டு நாயும் - பாரதியார்

இலக்கிய வரலாறு

மரபுகவிதை, புதுக்கவிதை, ஹைக்கூ, சிறுகதை, நாடகம் ஆகியவற்றின் தோற்றம் வளர்ச்சி குறித்த வரலாறு

பாடத்திட்டத் தொகுப்பு நூல்:

பொதுத் தமிழ் - முதலாண்டு - தமிழ் (முதல் மற்றும் இரண்டாம் பருவப் பாடங்கள்)
புதுவைப் பல்கலைக்கழகம், புதுச்சேரி - 2015

Language French – I :

Prescribed Textbook : ***FESTIVAL 1*** - Méthode de Français

Authors : Sylvie POISSON-QUINTON

Michèle MAHEO-LE COADIC

Anne VERGNE-SIRIEYS

Edition : CLE International, Nouvelle Édition révisée : 2009.

Portions : Unités : 1, 2, 3.

MALAYALAM LANGUAGE

Semester-1

മലയാളകവിത

കാല്പനികത മുതൽ ആധുനികതെവര മലയാളകവിതയിൽ ഉണ്ടായ ഭാവുകത്വപരിണാമം പരിചയ പ്പെടുക. കവിതയുടെ രൂപപരവും ഭാവപരവുമായ വൈവിദ്ധ്യം തിരിച്ചറിയുവാനും ആസ്വദിക്കുവാനുമുള്ള ശേഷി കൈവരിക്കുകയാണ് പഠനത്തിന്റെ ഉദ്ദേശ്യം

പാഠഭാഗങ്ങൾ വിശദപഠനത്തിനുള്ളവയാണ്. ഒരു ഖണ്ഡകാവ്യവും തെരഞ്ഞെടുത്ത പത്ത് കവിത കളുമാണ് വിശദപഠനത്തിനായി നിർദ്ദേശിക്കുന്നത്. പാഠ്യഭാഗം അഞ്ച് യൂനിറ്റുകളായി തിരിച്ചിരി ക്കുന്നു. എല്ലാ യൂനിറ്റുകളിൽനിന്നും ചോദ്യങ്ങൾ ചോദിക്കണം.

യൂനിറ്റ് 1. ഖണ്ഡകാവ്യം. കുമാരനാശാൻ - ചിന്താവിഷ്ടയായ സീത

യൂനിറ്റ് 2. പി. കുഞ്ഞിരാമൻനായർ - സൌന്ദര്യപൂജ
ഇടേശ്ശരി ഗോവിന്ദൻനായർ - വിവാഹസമ്മാനം
വൈലോപ്പിള്ളി ശ്രീധരമേനോൻ - യുഗപരിവർത്തനം

യൂനിറ്റ് 3. എൻ.വി.കൃഷ്ണവാര്യർ - എലികൾ
അക്കിത്തം അച്യുതൻനമ്പൂതിരി – പണ്ടത്തെ മേശാന്തി
സുഗതകുമാരി – ബീഹാർ

യൂനിറ്റ് 4. കടമ്മനിട്ട രാമകൃഷ്ണൻ - ശാന്ത
വിജയലക്ഷ്മി – മൃഗശിക്ഷകൻ

യൂനിറ്റ് 5. പി. പി. രാമചന്ദ്രൻ - ലളിതം
കെ.ആർ. ടോണി – അന്ധകാണ്ഡം

അധികവായനയ്ക്ക് നിർദ്ദേശിക്കുന്ന പുസ്തകങ്ങൾ:

മലയാളകവിതാസാഹിത്യചരിത്രം- ഡോ എം.ലീലാവതി.

മലയാളകവിതാപഠനങ്ങൾ- സച്ചിദാനന്ദൻ

TELUGU LANGUAGE

I Semester

TELUGU - I
Old Poetry, Modern Poetry, Short Stories & Grammar

ప్రాచీన కవిత్వం (Old Poetry)

1. గంగా శంతనుల కథ – నన్నయ

   (ఆంధ్ర మహాభారతం – ఆదిపర్వం – చతుర్థాశ్వాసం 121వ పద్యం నుండి 125 వ పద్యం వరకు)

2. ద్రౌపది పరిదేవనం – తిక్కన

   (ఆంధ్ర మహాభారతం – ఉద్యోగ పర్వం – తృతీయాశ్వాసం 100వ పద్యం నుండి 125వ పద్యం వరకు)

ఆధునిక కవిత్వం (Modern Poetry)

3. కన్యక – గురజాడ అప్పారావు
4. దేశచరిత్రలు – శ్రీశ్రీ

కథానికలు

5. చింతల తోపు – పాపినేని శివశంకర్
6. సావుకూడు – బండి నారాయణస్వామి

వ్యాకరణం

7. సంధులు

   సవర్ణదీర్ఘ, గుణ, వృద్ధి, యణాదేశ, త్రిక, గసడదవాదేశ, రుగాగమ టుగాగమ,

   ఆమ్రేడిత, అత్వ, ఇత్వసంధులు

8. సమాసాలు

   తత్పురుష, కర్మధారయ, ద్వంద్వ, ద్విగు, బహువ్రీహి

9. అక్షర దోషాలు

   దోషాలు సరిదిద్ది సాధు రూపాలు రాయాలి.

HINDI LANGUAGE

1st Semester

Paper-I सामान्य हिन्दी-I

पाठ्य विषय

- उपन्यास
  'निर्मला' - प्रेमचन्द, राजकमल प्रकाशन, दरियागंज दिल्ली
- हिन्दी अपठित
  पल्लवन
  पत्राचार
  अनुवाद : अनुवाद की परिभाषा, अनुवाद का महत्व, अनुवादक की योग्यताएँ, अनुवाद के प्रकार और प्रक्रिया
  पारिभाषिक शब्दावली (कार्यालयी शब्दावली)
  हिन्दी में पदनाम
  कंप्यूटर में हिन्दी का अनुप्रयोग : प्रारम्भिक परिचय

अंकविभाजन : पूर्णांक 100

व्याख्याएँ (निर्मला उपन्यास)	4 में से 2	2 x 7 ½ = 15 अंक
आलोचनात्मक प्रश्न (निर्मला उपन्यास)	2 में से 1	1 x 15 = 15 अंक
लघुत्तरी प्रश्न (निर्मला उपन्यास)	4 में से 2	2 x 5 = 10 अंक
पल्लवन	2 में से 1	1 x 10 = 10 अंक
पत्रालेखन	2 में से 1	1 x 15 = 15 अंक
लघूत्तरी प्रश्न (अनुवाद)	5 में से 3	3 x 5 = 15 अंक
लघूत्तरी प्रश्न (कंप्यूटर)	4 में से 2	2 x 5 = 10 अंक
पारिभाषिक शब्दावली	15 में से 10	10 x 1 = 10 अंक

अध्ययन के लिए सहायक पुस्तकें

- सामान्य हिन्दी, डॉ. विजयपाल सिंह, हिन्दी प्रचार संस्थान, वाराणसी
- व्यावहारिक हिन्दी, डॉ. महेन्द्र मित्तल, शबरी संस्थान, दिल्ली
- हिन्दी संक्षेपण, पल्लवन और पाठ बोधन, डॉ. हरदेव बाहरी, अभिव्यक्ति प्रकाशन, इलाहाबाद
- प्रयोजन मूलक हिन्दी, विनोद गोदरे, वाणी प्रकाशन, दिल्ली
- प्रेमचन्द और उनका युग, रामविलास शर्मा, राजकमल प्रकाशन, दिल्ली
- प्रेमचन्द के उपन्यासों का शिल्प विधान, कमलकिशेर गोयनका, सरस्वती प्रेस, दिल्ली
- संक्षेपण कैसे करें, डॉ. शैलेन्द्रनाथ श्रीवास्तव, भारतीभवन, पटना

5.3 Art Education (Performing and Visual) and Creative Expressions

Exemplar 1 - Puppetry

Credit:2
Semester:S-1 and S-7

5.3.1 About the Course

Engagement with various forms of art as self-expression and need to develop sensibility to appreciate them has been an important concern in educational theory and practice. This concern is premised on the claim that forms of self-expression contribute immensely to the development of cognitive, affective, and psycho-motor dimensions among children, as well as that through one or another art form, children come to explore ways of expressing themselves. Further, it is also the case that critical appreciation of art enables children to form judgments of a very special kind, namely, aesthetic judgment. This enables students as they grow into adults to have focused attention on making sense of and appreciating cultural productions.

Children enjoy artwork a lot. They explore and find meaning in artwork. Their psycho-motor skills get developed through art. The huge element of socialization is acquired through different forms of art. They get to know each other and understand each other and make friends through art. They develop their peer group through getting involved in art forms. Learning to work with others is also achieved through art. It gives them space to think independently, create and reflect. It is one space where all the three are involved- hand, head, and heart.

Therefore, educational practitioners that the students of MA Education aim to be, will need to bring an element of art in practices that they engage in. To be able to do this, they need an appreciation of art in general, familiarity with one art form, and basic skills and capabilities to be creative and artful. Additionally, they should be familiar with some critical debates in art education, even if their work is in other subject areas.

To this end in the first semester students will do one course that aims to help them recognize and appreciate the importance of aesthetic judgment, develop familiarity with an art form and basic skills to be creative and artful in their expressions. Skills develop from practice, therefore hands-on training in doing art will be emphasized in this course. This course aims to help students develop a habit of performing skillful activities that are essentially aesthetic and artful which is expected to contribute to other educational practices that they develop in other courses in the programme. Therefore, this course will explicitly relate this skill to activities that practitioners ofeducation engage in, like teaching, development of teaching-learning material, and content of other subject areas wherever possible.

Puppetry

Puppetry is an integrated art form, which takes into its fold everything from fine arts to performance. Puppetry is one of the oldest forms of performing art. Puppetry has evolved over the years into a sophisticated form of art. The journey was very interesting with a lot of ups and downs. There are thousands of forms of puppetry from simple finger puppets to highly complex puppets played by more than 3 people. Each country has a puppet form, why country, each area in a country has a puppet form. Hence, in India you will find many, many forms of puppetry.

In puppetry there are two main aspects. One the designing and creating of puppets and the other playing or performing puppetry. These two skills are different. Designing will need a lot of

thnking, visualization, and technical skills while performance will need high level communication skills. Hence, together they make a consolidated a high range of skills. In this course, students are exposed to different forms of puppets and puppetry. There will be a discussion around the forms and the aesthetic sense of puppetry. Later the students are encouraged to prepare, design and create puppets. They then prepare script and play the puppets. This creation of the puppets together in small groups with a lot of discussions and give and take helps the students develop working together skills and conceptual understanding.

Learning Outcomes

After completion of this course, student teachers will be able to:

- articulate the importance of aesthetics and art in elementary education,
- demonstrate their familiarity with and appreciation of puppetry,
- design puppets,
- practice and create a short puppetry show.

UNIT - I

Importance of Aesthetics and Art education (2 Sessions)

In this unit the basic idea of aesthetics and art, and ways in which the aesthetic dimension manifests itself in human life will be discussed. Using various examples of art, students will engage in identifying aesthetic aspects of daily life, develop aesthetic judgment, and gain familiarity with the role of art in education. Students will also be introduced to three aspects ofart in education: The value of art itself and its use as an instrument in education; moral dimensions of works of art and the controversial distinction between the value of Popular art and High art.

UNIT - II

Designing Puppets (6 Sessions)

In this unit, students will learn about puppetry, its history and specifically about how puppets work. This unit will also discuss the imagination required to design puppets, visualize how puppets will be used and the technicalities of designing puppets. These will be learnt by designing puppets. Students will start with constructing finger puppets and move towards small shapes through papers, like Fish, birds, rat - then they will design masks, flat masks, and masks with dimensions. At the end they will design puppets with old newspaper. The puppets are designed with old newspapers and colour papers. They decorate it and design it in such a waythat it can be played, performed. They prepare costumes and all other accessories.

UNIT - III

Performing the puppets (4 Sessions)

This unit will engage in performance of puppetry and the level of communication skills required to create a good engaging story and perform it with the help of puppets they have created. The performance will be expected to relate to some activity in the educational context. Students will perform the puppets they have designed. Initially each member will play their own puppets. Later they will play in pairs, later they will be formed into a small group and asked to prepare their own

M.Tech. (ECE) with Specialization in (Intelligent Communication Systems)

Regulations, Curriculum and Syllabus

(with effect from academic year 2023-2024)

Submitted by

DEPARTMENT OF ELECTRONICS ENGINEERING

SCHOOL OF ENGINEERING AND TECHNOLOGY

PONDICHERRY UNIVERSITY

PONDICHERRY -14

March 2023

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 511	ADVANCED DIGITAL COMMUNICATION	3	1	0	4	60

Prerequisite: Basics of analog and digital communication systems.

Objective : To make the students to understand the various advanced concepts of digital communication techniques.

Outcome : Students will be able to imply the concepts of advanced digital communication techniques to various applications.

Module I: Digital Modulation Techniques **12 Hours**

Elements of Digital Communication system - Factors influencing digital modulation techniques; Linear Modulation Techniques: BPSK - QPSK - DPSK; Constant envelope modulation techniques: MSK- GMSK; Linear and constant envelope modulation techniques: M- ary PSK and M- ary QAM.

Module II: Additive White Gaussian Noise Channel **12 Hours**

Optimum receiver for signals corrupted by AWGN - performance of the optimum receiver for memory less modulation; optimum receiver for CPM signals - optimum receiver for signals with random phase in AWGN channel.

Module III: Equalization Techniques and Synchronization **12 Hours**

Optimum receiver for channels with ISI and AWGN – Nyquist criterion for zero ISI - linear equalization and its variations - Decision Feedback Equalization - Predictive Decision Feedback Equalization -Turbo equalization- Signal Parameter Estimation: Carrier phase estimation - symbol timing estimation.

Module IV: Multiple Carrier Modulation **12 Hours**

Physical modelling for wireless channels – Fading and diversity – OFDM – CDMA – MIMO- Beam-steering – MIMO-OFDM – Spatial Multiplexing.

Module V: Instructional Activity **12 Hours**

Simulation: Different digital modulation - AWGN channel - equalization techniques and synchronization using any related platforms

Reference Books:

1. George R. C & Clare D M, “Modern Communications and Spread Spectrum,” McGraw Hill Book Company, 1986.
2. John G P, Masoud S, “Digital Communications,” 5th Edition, McGraw Hill Book Company, 2014.
3. Kamilo Feher, “Wireless Digital Communications Modulation & Spread Spectrum Applications,” PHI, 1995.
4. Bernard S, “Digital Communication fundamentals and applications,” 2nd Edition, Pearson education, 2009.
5. Theodire S R, “Wireless Communications,” 2nd Edition Pearson Education, 2010.

Hyperlinks:

1. http://nptel.iitm.ac.in/courses/117101051.html
2. http://nptel.ac.in

ECEICS 511

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 512	ADVANCED DIGITAL SIGNAL PROCESSING	3	1	0	4	60

Prerequisite : Knowledge in Signal and Systems, and Digital Signal Processing

Objective : To make the students to understand the concepts in signal processing mechanisms and power spectrum estimation methods

Outcome : Students will be able to analyze and implement advanced signal processing techniques for various applications.

Module I: Fundamentals of Signal Processing **12 Hours**

Introduction: Basic elements of Digital Signal Processing System- advantages of digital over analog signal processing; Classification of signals: Deterministic vs random signals - multi channel and multi-dimensional signals; Down Sampling-decimation-up sampling- interpolation.

Module II: Power spectrum estimation **12 Hours**

Estimation of spectra using the DFT from finite duration signals - non– parametric methods for power spectrum estimation: Welch- Bartlett methods; Parametric methods for power spectrum estimation: Yule-Walker method- Burg method for the ARM parameters.

Module III: Adaptive Signal processing **12 Hours**

FIR adaptive filters- steepest descent adaptive filter - LMS algorithm - convergence of LMS algorithms; Applications: Noise cancellation - channel equalization.

Module IV: Wavelet Transform **12 Hours**

Introduction: Continuous Wavelet Transform - basic properties of wavelet transforms - Discrete Wavelet Transform: Haar scaling functions and function spaces - nested spaces - Haar wavelet function - orthogonality of $\phi(t)$ and $\psi(t)$ - normalization of Haar bases at different scales.

Module V: Instructional Activity **12 Hours**

EEG/ECG signal analysis for the real time environment; Echo cancellation using adaptive filters; Voice recognition and speech-to-text conversion using related tools.

Reference Books:

1. Proakis J G and Manolkis D G, “Digital Signal Processing: Principles, Algorithms and Applications”, 4th Edition, Prentice Hall of India, 2007.
2. Monson H H, “Statistical Digital Signal Processing and Modeling”, Wiley, 2002.
3. Cristi R, “Modern Digital Signal Processing”, Thomson Brooks/ Cole, 2004.
4. Lokenath D and Firdous A S, “Wavelet Transforms and Their Applications”, 2nd Edition, Birkhauser, Springer, 2014.
5. Raghuveer R M, and Ajit S B, “Wavelet Transforms: Introduction to Theory and Applications”, Pearson Education, New Delhi, 1998.

Hyperlink:

1. www.ece.umd.edu/class/enee630.F2012.html
2. http://ar.book.org/s/?q=DSP+PROAKIS&yearFrom=&yearTo=&language=&extension=&t=0

ECEICS 512

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 513	HIGH SPEED SEMICONDUCTOR DEVICES	3	1	0	4	60

Prerequisite : Fundamental knowledge in Semiconductor Devices and Circuits

Objective : The course aims to give exposure on the band diagram, structure, characteristics of hetero-junction devices and their fabrication techniques.

Outcome : Students will be able to understand the behavior of semiconductor materials and be aware of the structure of advanced devices and their fabrication techniques.

Module I: Semiconductor Materials Characteristics **12 Hours**

Review of Crystal Structure: Crystal structure of important semiconductors (Si, GaAs, InP) - energy band diagram - carrier concentration and carrier transport phenomenon – electrical – optical - thermal and high field properties of semiconductors.

Module II: Fabrication Techniques **12 Hours**

Crystal Growth and Wafer Preparation - epitaxy - dielectric film deposition and oxidization techniques - masking and lithography techniques (optical, e-beam and other advanced lithography techniques) - diffusion - ion implantation - metallization - bipolar and CMOS integration techniques .

Module III: MOS Devices **12 Hours**

M-S Junction: Structure – operation - characteristics; MOS Diode: Structure - band diagram - operation - C–V characteristics - effects of oxide charges - high field effects and breakdown; MOSFET: Band diagram - structure – operation - I–V characteristics (analytical expressions) ; Advanced MOSFET: MOSFET breakdown and punch through - sub- threshold current - scaling down - High k-dielectric materials - SOI MOSFET - buried channel MOSFET - charge coupled devices.

Module IV: High Speed Semiconductor Devices **12 Hours**

HBT and HEMT Devices: AlGaAs/ GaAs and Si/SiGe based HBT and HEMT structure - band diagram - operation - I–V characteristics (analytical expressions) - small signal switching models - benefits of hetero-junction transistor for high speed applications; Nano devices: Resonant tunneling diode - SET - FinFET - nanowire FET.

Module V: Instructional Activity **12 Hours**

Simulation study: MOSFET - HBT /HEMT- FinFET – SET using related tools.

Reference Books:

1. Nandita Das Gupta and Amitava Das Gupta, “Semiconductor Devices: Modeling and Technology”, Prentice Hall of India, 2004.
2. M. S. Tyagi, “Introduction to Semiconductor Materials and Devices”, John Wiley and Sons, 2008.
3. S. M. Sze, “Physics of Semiconductor Devices”, 3rd Edition, John Wiley and Sons, 2008.
4. J. Singh, “Semiconductor Devices: Basic Principles”, John Wiley and Sons, 2007.
5. Waser R, “Nanoelectronics and Information Technology” 2nd Edition, Wiley, 2012.

Hyperlinks:

1. http://nptel.iitm.ac.in/courses/Webcoursecontents/IITDelhi/Semiconductor%20Devices/index.html
2. http://nptel.iitm.ac.in/video.php/subjectId/117106093
3. http://nptel.iitk.ac.in/courses/Webcoursecontents/IITKANPUR/HighSpeed_SemiconductorDevices/ ui/Course_home-32.html.

ECEICS 513

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 514	VLSI DESIGN AND EMBEDDED SYSTEMS	3	1	0	4	60

Prerequisite : Knowledge of digital electronics, microprocessor architecture and assembly language, C programming language

Objective : To make the students to understand the basics of embedded system and also the VLSI design using CMOS.

Outcome : Students will be aware of principles and design issues of various embedded processors and VLSI circuits.

Module I: Digital VLSI Design using CMOS **12 Hours**

Principles of circuit design using pass transistors and transmission gates - combinational logic circuit design - sequential logic circuit design - Flip Flops - synchronous sequential circuits.

Module II: Layout Analysis **12 Hours**

Resistive and inductive interconnect delays - network delay - layouts - simulation - switch logic networks - gate and network testing - memory cells and arrays - clocking disciplines - power optimization.

Module III: Embedded System **12 Hours**

Overview, embedded hardware units - embedded software - embedded System on Chip (SoC) - design process - classification of embedded system - bus - memory devices - component interfacing - networks for embedded systems; Communication interfacings: RS232/UART-RS422/RS485 - IEEE 488 bus.

Module IV: Embedded Processors **12 Hours**

Architecture of the Kernel- types of Kernal - PIC Processor - ARM processor - SHARC processor - design methodologies- specifications - architecture design and system analysis.

Module V: Instructional Activity **12 Hours**

Study on embedded system design: Telephone PBX - ink jet printer - water tank monitoring system- GPRS - Personal Digital Assistants; Simulation of VLSI Circuits: Basic gates using logic families - CMOS inverter layout.

Reference Books:

1. Marilyn W, “Computers as components: principles of embedded computing system design”, 4th Edition, Morgan Kaufmann, 2016.
2. David E S,“An embedded software premier”, Addison-Wesley, 1999.
3. Prasad K V K K, “Embedded / real time systems: Concepts, Design and Programming”, Dreamtech press, 2003.
4. Kamran E, Douglas A P, Sholeh E, “Essentials of VLSI Circuits and Systems”, 1st Edition, PH Learning, 2009.
5. Wayne W, “Modern VLSI Design: IP Based Design”, 4th Edition, Prentice Hall, 2008.
6. Jacob R B, “CMOS Circuit Design, Layout and Simulation”, 3rd Edition, Wiley-IEEE Press, 2010.
7. Douglas A P, Kamran E, “Basic VLS I Design”, 3rd Edition, Pearson College Division, 1995.
8. Sung Mo K, Yosuf L, ChulwooK, “CMOS Digital Integrated Circuits: Analysis and Design”, 4th Edition, McGraw-Hill, 2014.
9. John P U, “Introduction to VLSI Circuits and Systems”, 1st Edition, Wiley, 2001.

Hyperlinks:

1. http://ecee.colorado.edu/~mcclurel/index.html
2. http://mysite.du.edu/~rvoyles/
3. http://courses.cs.washington.edu/courses/cse477/01sp/admin/schedule.html
4. http://codesign.cs.tamu.edu/teaching/csce617/labs-projects-s13
5. http://www.onlinevideolecture.com/electrical-engineering/nptel-iit-delhi/embedded-systems
6. http://web.ewu.edu
7. http://ic.sjtu.edu
8. http://nptel.iitm.ac.in

ECEICS 514

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 520	Intelligent Communication Systems Laboratory	0	0	4	2	60

Objective : Hands on experience on various simulation tools to design and analyze the various Intelligent Communication Technologies.

LIST OF EXPERIMENTS: (Given the list is minimal, however, the course teacher can decide the level of experiments)

1. **Optical Experiments (Optisim):**
   a. Measurement of Coupling Loss
   b. Measurement of Bending Loss
   c. Measurement of Attenuation Loss
   d. Measurement of Numerical Aperture
2. **Microwave Experiments**
   a. Microwave IC – Power Divider
   b. Microwave IC – Directional Coupler
   c. Microwave IC -
   d. Microwave IC – Filter Characterization
3. **Communication Experiments (MATLAB & NETSim)**
   a. Frequency Hopping Spread Spectrum (FHSS) Modulation and Demodulation Techniques
   b. Simulation of WIFI Network
   c. Simulation of IOT
   d. Simulation of 5G
   e. Simulation of SDR
   f. Simulation of OFDM
4. **Artificial Intelligence Experiments (Python)**
   a. Implementation of Breadth First Search
   b. Implementation of Depth First Search
   c. Implementation of Travelling Salesman problem
   d. Implementation of N-Queens Problem

ECEICS 520

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 521	5G TECHNOLOGIES	3	1	0	4	60

Prerequisite: Wireless communication

Objective : To develop an understanding of the basic concepts , accessing technologies and mobility management of 5G

Outcome : Students will be able to understand the importance and in-depth functioning of 5G Technology

Module I : Overview of 5G Wireless Communications **12 Hours**

Evaluation of mobile technologies 1G to 4G; D2D: From 4G to 5G; An overview of 5G requirements, Regulations for 5G, Radio Resource Management and its techniques for 5G; Propagation Channels: Channel modeling requirements, propagation scenarios (Relaying and Co-operative Communication and challenges in the 5G modeling, Channel Models for mmWave MIMO Systems.

Module II : 5G Architecture **12 Hours**

Introduction, NFV and SDN, Basics about RAN architecture, High-level requirements for the 5G architecture, Functional architecture and 5G flexibility, Functional split criteria, Functional split alternatives, Functional optimization for specific applications; Integration of LTE and new air interface to fulfill 5G Requirements, Enhanced Multi-RAT coordination features, Physical architecture and 5G deployment.

Module III : 5G Radio-Access Technologies **12 Hours**

Access design principles for multi-user communications, Orthogonal multiple-access systems, Spread spectrum multiple access systems, Capacity limits of multiple-access methods, SCMA, IDMA, Radio access for dense deployments, OFDM numerology for small-cell deployments, Radio access for V2X communication, Radio access for massive MIMO.

Module IV : Interference And Mobility Management **12 Hours**

Network deployment types, UDN, Moving networks, Heterogeneous networks, Interference management in 5G and UDN moving relay nodes, Interference cancelation; Mobility management in 5G and heterogeneous networks, User equipment controlled versus network-controlled handover.

Module V: Instructional Activity **12 Hours**

Simulation of 5G Communications Link Analysis with Ray Tracing/ Wireless Connectivity in the 5G Era for WLAN/ Factors affecting deployment of 5G on Indian Scenario using open source software tool

Reference Books:

1. Afif Osseiran, Jose F.Monserrat, Patrick Marsch, “5G Mobile and Wireless Communications Technology”, Cambridge University Press Second Edition 2011.
2. Erik Dahlman, Stefan Parkvall, Johan Sko¨ld , “5G NR: The Next Generation Wireless Access Technology” Elsevier First Edition 2016.
3. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, Wiley, First Edition,2010

Hyperlinks:

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2. https://www.cisco.com/c/en/us/solutions/what-is-5g.html

ECEICS 521

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 522	COMPUTATIONAL METHODS FOR INTELLIGENT COMMUNICATION SYSTEMS	3	1	0	4	60

Prerequisite : Knowledge in Engineering Mathematics

Objective : To familiarize the student with the different computational methods for communication systems

Outcome : Students will be able to apply the mathematics concepts to intelligent communication systems and subsystems.

Module I: Probability and Stochastic Process **12 Hours**

Random variables: conditional probability - discrete and continuous random variables, Cumulative Distribution Function (CDF) - Probability Mass Function (PMF) - Probability Density Function (PDF) - conditional PMF/PDF - classification of stochastic process - stationary process (SSS and WSS).

Module II: Integral Equations **12 Hours**

Formulation of typical problems in terms of integral equations: wire antennas – scattering - apertures in conducting screens and waveguides - discontinuities in waveguides and microstrip lines; Solution of Integral equations: General Method of Moments (MoM) for the solution of integral-differential equations - choice of expansion and weighting functions - application of MoM to typical electromagnetic problems.

Module III: Finite Element Method **12 Hours**

Typical finite elements - Solution of two-dimensional Laplace and Poisson's equations - solution of scalar Helmholtz equation and applications of FEM in typical electromagnetic problems.

Module IV: Finite-difference Time-domain Method **12 Hours**

Finite differences - finite difference representation of Maxwell's equations and wave equation - numerical dispersion - Yee's finite difference algorithm - stability conditions - programming aspects - absorbing boundary conditions- applications of FDTD in patch antenna.

Module V: Instructional Activity **12 Hours**

Modeling - simulation and analysis of applications of different computational methods with related tools.

Reference Books:

1. Michel K.O, “Applied Probability and Stochastic Processes”, John Wiley and Sons, 2008.
2. Paboulis A, Unnikrishna P S, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill, 2002.
3. Harrington, R.F., "Field Computation by Moment Methods", Wiley- IEEE Press. 1993
4. Y. M. Desai , T. I. Eldho, “Finite Element Method with Applications in Communication Engineering”, Pearson Education, 2011.
5. Stephen D. Gedney, “Introduction to Finite Difference Time Domain Method”, Springer, 2011.
6. L. M. Delves, J. L. Mohamed, “Computational Methods for Integral Equations”, Cambridge University Press, 2011.
7. Peterson, A.F, Ray, S.L. and Mittra, R., "Computational Methods”, Wiley-IEEE Press. 1998

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ECEICS 522

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 523	INTELLIGENT COMMUNICATION SYSTEMS	3	1	0	4	60

Prerequisite : Basics of analog and digital communication systems and elementary knowledge of all communication systems.

Objective : To impart the new concepts of different intelligent communication systems.

Outcome : Students will aware of the principles and techniques used in intelligent communication systems

Module I: Microwave and Satellite Communication Systems **12 Hours**

Microwave communication systems - transmitters - receivers - line of sight propagation; Orbits of satellite - orbital effects on communication system's performance - satellite earth stations - satellite antennas and earth coverage - system noise temperature and G/T ratio - design of downlinks - uplink design - link design for specified C/N - VSAT systems.

Module II: Optical Communication System **12 Hours**

Prologue: Historical perspective - light sources - photodiodes - fiber losses - signal dispersion - pulse propagation - multichannel propagation - signal propagation - modulation schemes; OFDM for optical communications - MIMO optical communications - Detection Schemes; Coherent optical OFDM detection - optical MIMO detection.

Module III: Cellular Communication System **12 Hours**

Uniqueness of mobile radio environment - basic cellular system - analog and digital cellular systems - cell coverage - frequency reuse - channel interferences - cell splitting and handoffs - mobile antennas.

Module IV: Computer Communication **12 Hours**

Transmission modes - serial and parallel transmission - asynchronous – synchronous – simplex - half duplex - full duplex communication. Switching: circuit switching and packet switching - Networks: Network criteria - physical structures - network models - categories of networks - Interconnection of Networks: Internetwork - Network models: Layered tasks - OSI model - Layers in OSI model - TCP/IP protocol suite.

Module V: Instructional Activity **12 Hours**

Performance analysis of minimum of four communication systems through simulation using related platforms.

Reference Books:

1. Rappaport T S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson India, 2010.
2. Keiser G, "Optical Fiber Communication", 3rd Edition, Mc Graw Hill, 2003.
3. Pratt T, Bostian C W and Allnut J E, "Satellite Communications", 2nd Edition, John Willey and Sons, 2003.
4. Andrew S.Taneubauw and David J. Wethrall, "Computer Networks" , 5th edition, Prentice Hall, 2011.

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ECEICS 523

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 524	MULTIMEDIA TECHNOLOGIES	3	1	0	4	60

Prerequisite : Advanced Digital Signal Processing

Objective : Students will be able to acquire knowledge about multimedia techniques and the methods to enhance quality of service in the multimedia systems.

Outcome : Develop effective strategies to deliver quality-of-experience in multimedia applications.

Module I: Introduction to Multimedia **12 Hours**

Introduction - Characteristics of multimedia presentation - Multimedia Components - Digital representation - media and data stream- Multimedia documents-task-production-sharing and distribution- Properties of a Multimedia system.

Module II: Multimedia Architectures **12 Hours**

User Interfaces - OS Multimedia Support - Multimedia Extensions - Hardware Support - Distributed Multimedia Applications - Real Time Protocols - Play Back Architectures - Synchronization - Document architecture - Hypermedia Concepts - Hypermedia Design - Digital Copyrights - Digital Library - Multimedia Archives.

Module III: Multimedia Compression Techniques **12 Hours**

Compression types and techniques - CODEC ;Text Compression - GIF coding standards; Audio Compression - ADPCM ; JPEG standards - JPEG 2000 compression - H.261 ; MPEG- MPEG 3- MPEG 7- MPEG 21 .

Module IV: Multimedia Communication & Applications **12 Hours**

Tele Services - Implementation of Conversational Services - Messaging Services - Retrieval Services - Tele Action Services - Tele Operation Services - Media Consumption - Media Entertainment - Virtual Reality.

Module V: Instructional Activity **12 Hours**

Simulation Using: Editing Tools - Image - sound- video; Painting and drawing Tools - 3D Modeling and animation Tools.

Reference Books:

1. Ralf Steinmetz, Klara Nahrstedt, “Multimedia Computing, Communications, and Applications”, Pearson India, 2009.
2. Ranjan Parekh, “Principles of Multimedia”, Second Edition, McGraw Hill Education, 2017.
3. Ralf Steinmetz, Klara Nahrstedt, “Multimedia Systems”, Springer, 2004.
4. Tay Vaughan, “Multimedia: Making it Work”, McGraw – Hill Education, Ninth Edition, 2014.
5. Jerry D. Gibson, Toby Berger, Tom Lookabaugh, Dave Lindergh, Richard L. “Baker Digital Compression for Multimedia: Principles and Standards”, Elsevier, 2006.

Hyperlinks:

1. https://www.tutorialspoint.com/multimedia/multimedia_introduction.htm
2. https://nptel.ac.in/courses/117105083

ECEICS 524

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 531	ADVANCED WIRELESS COMMUNICATIONS	3	1	0	4	60

Prerequisite : Basics of analog, digital and wireless communication.

Objective : To impart the new concepts in Advanced Wireless Communications.

Outcome : Students will able to understand the latest technologies used in advanced wireless communication systems.

Module I: Introduction **12 Hours**

Introduction about wireless communication : technical challenges of wireless communication - Structure of a wireless communication link - applications; Cellular architecture - frequency reuse - channel assignment - handoff - coverage and capacity improvement; Multiple access : FDMA/CDMA/TDMA/SDMA.

Module II: Propagation Principles **12 Hours**

Propagation principles: Propagation mechanisms - Path Loss Models ; Mobile Radio Propagation : Large Scale Path Loss - Ground Reflection Model – Shadowing - Outdoor Propagation Models - Indoor Propagation Models; Small Scale fading - types of small scale fading - parameters of mobile multipath channels - small scale multipath measurements - statistical models for multipath fading channels

Module III: Modulation and Detection **12 Hours**

Digital modulation: linear and constant envelope modulation techniques for wireless communication - error performance in fading channel; Detection: Equalization - different detection techniques used in wireless communication.

Module IV: MIMO Systems **12 Hours**

Types of MIMO Systems: Beam forming - spatial multiplexing - basic space time code: design principles - Alamouti scheme – STBC - STTC - representation of space - comparison of space - time block and trellis codes.

Module V: Instructional Activity **12 Hours**

Simulation of minimum of (two) modulation - multiple access technique and MIMO schemes for wireless communication using related tools.

Reference Books:

1. Andreas Molisch F, “Wireless Communications”, John Wiley and Sons Ltd., 2011.
2. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
3. Theodore S. Rappaport, “Wireless Communications: Principles and Practice”, 2nd Edition, Prentice Hall of India, 2005.
4. Guillaume De La Roche, Andres Alayon Glazunov and Ben Allen, “LTE – Advanced and Next Generation Wireless Networks: Channel Modelling and Propagation”, John Wiley and Sons Ltd., 2013
5. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.
6. Michel DaoudYacoub, “Wireless Technology: Protocols, Standards, and Techniques”, CRC Press, 2002.
7. Jafarkhani H, “Space-Time Coding: Theory & Practice”, Cambridge University Press, 2005.

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5. http://ee.sharif.edu/~pr.wireless.comm/references/Goldsmith.pdf

ECEICS 531

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 532	ANALOG AND DIGITAL IC DESIGN	2	1	0	3	45

Prerequisite : VLSI systems and design

Objective : Students will be able to understand the basic concepts of Analog and Digital IC design.

Outcome : Students will be able to build, design and analyze the Combinational and Sequential circuit.

Module I: Analog Integrated Circuit **9 Hours**

Introduction to Analog Integrated Circuits: Analog Integrated Circuit design- Notation - Symbols and Terminology - CMOS Technology: Basic MOS semiconductor fabrication process -The MOS Transistor- Integrated Circuit Layout - CMOS Device Modeling- Simple MOS Large Signal Model- Small Signal Model for the MOS Transistor.

Module II: CMOS Operational Amplifier **9 Hours**

CMOS Operational Amplifier: Introduction and analysis of Cascode Amplifier and Telescopic Cascode Amplifier - Design of CMOS op-amps - Compensation of Op-amps -Design of Two stage op-amps, Cascode op-amps.

Module III: Combinational MOS Logic Circuits **9 Hours**

Introduction - MOS logic circuits with depletion NMOS loads: two - input NOR gate, generalized NOR structure with multiple inputs - transient analysis of NOR gate - two-input NAND gate - generalized NAND structure with multiple inputs - transient analysis of NAND gate - CMOS logic circuits.

Module: Sequential MOS Logic Circuits **9 Hours**

Introduction -SR latch circuit - clocked SR latch - clocked JK latch - master-slave flip-flop - CMOS D-latch and Edge- triggered flip-flop - Schmitt trigger circuit.

Module V: Instructional Activity **9 Hours**

Simulation: CMOS operational Amplifier- MOS: Combinational and Sequential Circuits.

Reference Books:

1. P. Allen and D. Holberg, “CMOS Analog Circuit Design”, Oxford University Press, Second Edition, 2012.
2. B. Razavi, “Design of Analog CMOS Integrated Circuits”, McGraw Hill, 2003.
3. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, “Analysis and Design of Analog Integrated Circuits”, Wiley Publishers, Fifth Edition, 2009.

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ECEICS 532

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 533	ANTENNA ENGINEERING	2	1	0	3	45

Prerequisite : Electromagnetics and antenna theory.

Objective : To learn the antenna radiation concepts, different types of antenna and their design methodology.

Outcome : Students will be able to design different types of antenna for various applications.

Module I: Concepts of Radiation and Antenna Fundamentals **9 Hours**

Physical concept of Radiation: Radiation from surface and line current distributions - fundamental parameters of antennas - Friss Transmission Equation - radiation integrals and auxiliary potential functions - Near and Far Field regions - Reciprocity and reaction theorems - radiation hazards and solutions

Module II: Aperture and Reflector Antennas **9 Hours**

Huygens's principle - radiation from rectangular and circular apertures - design considerations - Babinets principle - radiation from sectoral - pyramidal - conical and corrugated Horns - design concepts of parabolic reflectors and cassegrain antennas.

Module III: Broadband Antennas **9 Hours**

Principles - frequency independent antennas - design and properties of log periodic - Yagi-Uda antennas - loop antennas - helical antennas - biconical antennas - broadcast antenna - spiral antenna and slot antennas.

Module IV: Microstrip Antennas **9 Hours**

Microstrip Antennas: Radiation mechanism - parameters and applications - feeding methods - design of rectangular and circular patch - impedance matching of microstrip antennas - broadband - compact and tunable microstrip antennas.

Module V: Instructional Activity **9 Hours**

Design, simulation and analysis of different antennas for wireless applications using related simulation tools.

Reference Books:

1. Jordan E C and Balmain K G, “Electromagnetic Waves and Radiating Systems”, 2nd Edition, Pearson Education, 2015.
2. Balanis C A, “Antenna Theory: Analysis and Design”, 4th Edition, John Wiley and Sons, New Jersey, 2016.
3. Kraus J D and Marhefka R J, “Antennas for All Applications”, 3rd Edition, Tata McGraw Hill, 2002.
4. Elliot R S, “Antenna Theory and Design”, Revised Edition, John Wiley and Sons, India, 2006.
5. Girish Kumar and Ray K P, “Broadband Microstrip Antennas”, Artech House, 2003.

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ECEICS 533

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 534	ARTIFICAL INTELLIGENCE	2	1	0	3	45

Prerequisite : Digital Signal processing and Pattern Recognition

Objective : To understand the basic concepts and algorithms of Artificial Intelligence.

Outcome : Students will be able to design and implement Artificial Intelligent techniques for various applications

Module I: Introduction and Problem Solving **9 Hours**

Artificial Intelligence -Introduction - Problem-solving - Solving Problems by Searching - Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Local Search - Search in Partially Observable Environments.

Module II: Adversarial Search and Constraint Satisfaction Problems **9 Hours**

Game Theory - Optimal Decisions in Games - Heuristic Alpha-Beta Tree Search - Monte Carlo Tree Search - Stochastic Games - Partially Observable Games - Limitations of Game Search Algorithms Constraint Satisfaction Problems (CSP) - Examples - Constraint Propagation -Backtracking Search for CSPs - Local Search for CSPs

Module III: Knowledge, Reasoning and Planning **9 Hours**

First Order Logic - Inference in First Order Logic - Using Predicate Logic - Knowledge Representation - Issues - Categories and Objects - Reasoning Systems for Categories - Planning - Definition - Algorithms - Heuristics for Planning - Hierarchical Planning

Module IV: Uncertain Knowledge and Reasoning **9 Hours**

Quantifying Uncertainty - Probabilistic Reasoning - Probabilistic Reasoning over Time Probabilistic Programming - Making Simple Decisions - Making Complex Decisions - Case Based Reasoning - Evolutionary Computation

Module V: Instructional Activity **9 Hours**

Solve puzzles with uninformed and informed searches - Reasoning methods through puzzles and real life scenarios - Give example scenarios where probabilistic reasoning and case based reasoning can be applied-Discuss some case studies and their ethical issue

Reference Books:

1. Stuart Russell, Peter Norvig, “Artificial Intelligence: A Modern Approach”, Pearson, 4th Edition, 2020.
2. Zhong zhi Shi “Advanced Artificial Intelligence”, World Scientific; 2019.
3. Kevin Knight, Elaine Rich, Shiva Shankar B. Nair, “Artificial Intelligence”, McGraw Hill Education; 3rd edition, 2017
4. Richard E. Neapolitan, Xia Jiang, “Artificial Intelligence with an Introduction to Machine Learning”, Chapman and Hall/CRC; 2nd edition, 2018
5. Deepak Khemani, “A first course in Artificial Intelligence”, McGraw Hill Education Pvt Ltd., New Delhi, 2013.
6. Nils J. Nilsson, “Artificial Intelligence: A New Synthesis”, Morgan Kaufmann Publishers Inc; Second Edition, 2003.

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ECEICS 534

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 535	BIOSENSORS	2	1	0	3	45

Prerequisite: Semiconductor Devices and MEMS

Objective : To make the students to understand the usage of different sensors for various biomedical applications.

Outcome : Students will able to analyze different bio sensors and its effective usage for the real time applications.

Module I: Introduction to Biosensors **9 Hours**

Basic principle of bio sensor- components of bio sensor- classification of biosensors - applications.

Module II: Semiconductors substrates **9 Hours**

Semiconductor substrates for bio electronics - silicon - diamond - chemical functionalization - covalent attachment of biomolecules to silicon surfaces - DNA modified silicon and diamond surfaces.

Module III: Immune sensors **9 Hours**

Anti body as bio recognition element: Types of anti-bodies and anti-body fragments; Types of immune sensors - labeled and label-free sensors - immune sensor applications.

Module IV: Transducers in Biosensors **9 Hours**

Piezoelectric semiconductor - impedimetric - mechanical and molecular electronics based transducers - Chemi - luminescence based bio sensors.

Module V: Instructional Activity **9 Hours**

Simulation of biosensors for various applications: clinical chemistry-medicine and health care-veterinary - industrial processes - environmental monitoring using related tools.

Reference Books:

1. Itamar W and Eugenii K, “Bio electronics: From Theory to Applications”, Wiley VCH, 2005.
2. Chandran K, Kalpana B and Robson B, “Bio sensors and Bio electronics”, Elsevier, 2015.
3. Brian R E, “Biosensors an Introduction”, 1st Edition, Wiley, 1996.
4. Loic J B and Pierre R C, “Biosensors Principles and Applications”, 1st Edition, Marcel Dekker Inc, New York, 1991.
5. Donald G B, “Biosensors Theory and Applications”, 1st Edition, Technomic Co. Inc, Lancaster, 1993.

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2. http://biomedikal.in/2011/02/lecture-notes-on-mems-technology/
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ECEICS 535

Course Code	Name of the Course	Periods			Credits	Total Hours
ECEICS 536	DIGITAL IMAGE PROCESSING AND PATTERN RECOGINTION	L	T	P	3	45
		2	1	0		

Prerequisite: Digital Image Processing

Objective : To understand the basic concepts and algorithms of Digital Image processing and Pattern Recognition

Outcome : Explore the possibility of applying image processing and pattern recognition concepts in various domains

Module I: Introduction to Digital Image Processing **9 Hours**

Introduction - Elements of visual perception - Digital Imaging System - Image Acquisition - Sampling and Quantization - Pixel Relationships - File Formats - Colour images and models - Image Operations - Arithmetic, logical, statistical and spatial operations.

Module II: Image Enhancement and Segmentation **9 Hours**

Spatial Domain - Gray level Transformations -Histogram Processing- Spatial Filtering - Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain - Smoothing and Sharpening filters - Homomorphic Filtering; Segmentation: Detection of Discontinuities - Edge Operators - Edge Linking and Boundary Detection - Thresholding - Region Based Segmentation

Module III: Introduction to Pattern Recognition **9 Hours**

Learning paradigms - Supervised and unsupervised learning - Bayesian decision theory: Minimum error rate classifier; Parameter estimation: Maximum likelihood and Bayesian Estimation - Hidden Markov models - Nonparametric techniques: Nearest neighbor rules, Parzen windows; Decision trees: Axis-parallel, Oblique, Impurity measures.

Module IV: Statistical Pattern Recognition **9 Hours**

Introduction- Classification and Regression - Features - Feature vectors and Classifiers - Pre-processing and feature extraction - The curse of dimensionality - Polynomial curve fitting- Clustering-Hierarchical Clustering -K-means- Support Vector Machine.

Module V: Instructional Activity **9 Hours**

Simulation of preprocessing techniques - Implementation of image processing techniques for real time applications - Feature extraction techniques - Clustering techniques.

Reference Books:

1. Anil J Jain, “Fundamentals of Digital Image Processing”, PHI, 2011.
2. Rafael Gonzalez and Richard E.Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2008, New Delhi.
3. R. O. Duda, P. E. Hart and D. G. Stork, Pattern classification, John Wiley & Sons, 2002.
4. Theodoridis S and Koutroumbas K, “Pattern Recognition”, 4th edition, Academic Press,2009.

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ECEICS 536

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 537	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	2	1	0	3	45

Prerequisite : Electromagnetic theory.

Objective : To expose the students on the fundamentals of electromagnetic interference and compatibility in the electronic system design.

Outcome : Students will able to know the EMI environment, coupling principles, specifications, standards and limits, measurements and control techniques, and EMC design of PCBs.

Module I: EMI Environment **9 Hours**

EMI/ EMC concepts and definitions: Sources of EMI - conducted and radiated EMI- transient EMI - time domain vs frequency domain EMI - units of measurement parameters.

Module II: EMI Coupling Principles and Standards **9 Hours**

Principles: Conducted, radiated and transient coupling - common impedance ground coupling- radiated common mode and ground loop coupling - radiated differential mode coupling - Near and Far Field cable to cable coupling - power mains and power supply coupling - units of specifications; Civilian Standards: FCC - CISPR - IEC - EN; Military Standards: MIL STD461D/ 462.

Module III: EMI Measurements **9 Hours**

EMI test instruments/ systems: EMI shielded chamber - open area test site - TEM cell - sensors/ Injectors/ Couplers - test beds for ESD and EFT.

Module IV: EMI Control Techniques **9 Hours**

Techniques: Shielding - filtering - grounding - bonding - isolation transformer - transient suppressors - cable routing - signal control - component selection and mounting.

Module V: Instructional Activity **9 Hours**

Simulation of minimum of (two) EMI coupling methods and controlling techniques with their performance analysis using related tools.

Reference Books:

1. V. P. Kodali, “Engineering EMC Principles, Measurements and Technologies”, IEEE Press, 2001.
2. Henry W. Ott, “Noise Reduction Techniques in Electronic Systems”, Wiley, 1988.
3. C. R. Paul, “Introduction to Electromagnetic Compatibility”, Wiley, 2006.
4. Bernhard Keiser, “Principles of Electromagnetic Compatibility”, 3rd Edition, Artech house, 1986.

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1. http://www.nptel.iitm.ac.in/syllabus/syllabus.php?subjectId=117108043.
2. http://www.ieee.li/emc/

ECEICS 537

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 538	EMBEDDED SYSTEMS FOR NETWORKING	2	1	0	3	45

Prerequisite : Basics of Embedded Systems and Networking

Objective : To impart the Embedded Systems for Communication designs

Outcome : Students will be able to analyze the advanced technical design details behind the Embedded Systems and Networking.

Module I: Embedded Communication Protocols **9 Hours**

Embedded Networking: Introduction–Serial / Parallel Communication–Serial communication protocols -RS232 standard – RS485 – Synchronous Serial Protocols - Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – PC Parallel port programming -ISA/PCI Bus protocols – Firewire

Module II : USB and CAN Bus USB Bus **9 Hours**

Introduction – Speed Identification on the bus – USB States – USB bus communication: Packets – Data flow types –Enumeration –Descriptors –PIC 18 Microcontroller USB Interface – C Programs – CAN Bus – Introduction - Frames –Bit stuffing –Types of errors – Nominal Bit Timing – PIC microcontroller CAN Interface –A simple application with CAN

Module III: Controller Area Network **9 Hours**

Controller Area Network – Underlying Technology, CAN Overview – Selecting a CAN Controller – CAN development tools. Implementing CAN open Communication layout and requirements – Comparison of implementation methods – Micro CAN open – CAN open source code – Conformance test – Entire design life cycle.

Module IV: Wireless Embedded Networking **9 Hours**

Wireless sensor networks – Introduction – Applications – Network Topology – Localization – Time Synchronization - Energy efficient MAC protocols –SMAC – Energy Efficient and robust routing – Data Centric routing.

Module V: Instructional Activity **9 Hours**

Design 8051, PIC and 16 bit processors for I/O programming, serial port programming for PWM generation, motor control, LCD, RTC and Sensor interfacing and to design and analyse wired/wireless networks using NS2 simulator.

Reference Books

1. Frank Vahid, Givargis 'Embedded Systems Design: A Unified Hardware/Software Introduction', Wiley Publications
2. Jan Axelson, 'Parallel Port Complete', Penram publications
3. Dogan Ibrahim, 'Advanced PIC microcontroller projects in C', Elsevier 2008
4. Jan Axelson 'Embedded Ethernet and Internet Complete', Penram publications
5. Bhaskar Krishnamachari, 'Networking wireless sensors', Cambridge press 2005

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1. http://advancedengineering.umd.edu/node/2320
2. http://ece564web.groups.et.byu.net
3. http://personal.stevens.edu/~yyao/syllabus-674.html
4. http://staff.um.edu.mt/carl.debono/lectures.html

ECEICS 538

Course Code	Name of the Course	Periods			Credits	Total Hours
ECEICS 539	HIGH PERFORMANCE COMMUNICATION NETWORKS	L	T	P	3	45
		2	1	0		

Prerequisite : Fundamentals of computer networks and wireless networks.

Objective : To learn the architecture and uniqueness of high performance networks.

Outcome : Students will be able to understand the various topologies, services offered by broadband, WiMAX, UWB and LTE networks.

Module I: Introduction **9 HOURS**

Communication Networks: Telephone and Computer Networks - Cable Television Networks - Wireless Networks; Networking principles : Network Mechanisms - Network Elements - digitalization - network externalities - traffic characterization and QoS - service integration - Network bottle Necks; Layered architecture: OSI/ISO - TCP/IP - BISDN architecture

Module II: Flow Control And Traffic Management **9 Hours**

Link-level flow and error control: Main objectives of flow and error control - Window flow control - Rate control schemes - FEC and ARQ Schemes; Traffic Management: Traffic and Congestion control in high speed networks; Queuing models

Module III: Internet And TCP / IP Networks **9 Hours**

Internet Protocol (IP): Technology trends in IP networks - IP packet communications in mobile communication networks; TCP and UDP: performance of TCP/ IP networks; Circuit switched networks: SONET - DWDM - fiber to the home - DSL; Intelligent Network (IN) scheme : comparison with conventional systems - merits of the IN scheme; CATV network: System and Layered Architecture - services over CATV.

Module IV: Enabling Networks **9 Hours**

WiMAX overview : system architecture - frame structure - PMP mode - mesh mode - multihop relay mode; UWB : overview - time hopping UWB - direct sequence UWB - multiband UWB; LTE and LTE- A overview - system model - frame structure - comparison with broadband technologies.

Module V: Instructional Activity **9 Hours**

Simulation study: WiMAX network in mesh mode and multihop relay mode - integration of LTE - and WiMAX network with single IP network.

Reference Books:

1. Jean Warland and Pravin Varaiya, “High Performance Communication Networks”, 2nd Edition, Harcourt and Morgan Kanffman Publishers, London, 2008.
2. Leon Gracia and Widjaja, “Communication Networks”, Tata Mc Graw Hill, 2008.
3. Jeffrey G. Andrews, Arunabha Ghosh and Rias Muhamed, “Fundamentals of WiMAX Understanding Broadband Wireless Networking”, Prentice Hall of India, 2008.
4. AmitabhaGhosh and Rapeepat Ratasuk, “Essentials of LTE and LTE-A”, Cambridge University, 2011.
5. David Tung Chong Wong, Peng-Yong Kong, Ying-Chang Liang, Kee Chaing Chua and Jon W. Mark, “Wireless Broadband Networks”, John Wiley and Sons, 2009.
6. Ada Gavrilovska, “Attaining High Performance Communications: A Vertical Approach”, CRC Press, 2016.
7. Dimitris N. Chorafas, “High-Performance Networks, Personal Communications and Mobile Computing”, Springer, 2016.

Hyperlinks:

1. http:// www.ece.gmu.edu/.../high performance communication networks_1.pdf
2. http://www.amazon.com/dp/1558605746/ref=rdr_ext_tmb

ECEICS 539

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 540	INFORMATION SECURITY	2	1	0	3	45

Prerequisite : Digital Image Processing

Objective : To understand the basic security algorithms required by any computing system.

Outcome : The students may be now aware of the security challenges and issues that may arise in any digital system.

Module I: Basics of Digital Cryptography **9 Hours**

Classical Cryptography-The Shift Cipher, The Substitution Cipher, The Affine Cipher Cryptanalysis Techniques - Encryption Evaluation metrics.

Module II: Introduction To Digital Steganography **9 Hours**

Types of Steganography - Applications of Steganography - Embedding Security and Imperceptibility -The Visual Steganalytic System - IQM-Based Steganalytic System - Learning Strategies -The Frequency-Domain Steganalytic System.

Module III: Digital Watermarking **9 Hours**

Digital Watermarking - Differences between Watermarking and Steganography - A Brief History of Watermarking – Classification in Digital Watermarking – Least Significant-Bit Substitution - Discrete Fourier Transform (DFT) - Discrete Cosine Transform – Discrete Wavelet Transform - Random Sequence Generation - The Chaotic Map - Error Correction Code – Set Partitioning in Hierarchical Tree

Module IV: Cyber Security Attack **9 Hours**

Attacks and Tools - Image Processing Attacks – Cryptographic Attack Protocol Attacks - Steganographic Attack.

Module V: Instructional Activity **9 Hours**

Simulation: Cryptographic techniques – Steganographic techniques – Role of digital watermarking in real time applications.

Reference Books:

1. Frank Shih, “Digital Watermarking and Steganography: Fundamentals and Techniques, CRC Press, 2014.
2. Douglas R. Stinson, “Cryptography Theory and Practice”, Third Edition, Chapman &Hall/CRC, 2006
3. Fathi E. Abd El-Samie, HossamEldin H. Ahmed, Ibrahim F. Elashry, Mai H. Shahieen, Osama S. Faragallah, El-Sayed M. El-Rabaie, “Image Encryption: A Communication Perspective”, CRC Press, 2013.
4. Wenbo Mao, “Modern Cryptography – Theory and Practice”, Pearson Education, First Edition, 2006.

Hyperlinks:

1. https://nptel.ac.in/courses/106105031
2. https://freevideolectures.com/course/4070/nptel-ethical-hacking/36

ECEICS 540

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 541	LOW POWER DIGITAL VLSI DESIGN	2	1	0	3	45

Prerequisite : Fundamentals of VLSI design.

Objective : To discuss low power design methodologies at various design levels from the circuit level to the system level and also power estimation with optimization techniques.

Outcome : Students will be able to design low power VLSI circuits.

Module I: Power Dissipation **9 Hours**

Introduction: Need for low power circuit design - sources of power consumption - design methodology - low power figure of merits - limits and applications of low power VLSI Design.

Module II: Power Analysis **9 Hours**

Power Analysis: SPICE circuit simulation - discrete transistor modeling and analysis - gate level logic simulation - architecture level analysis - data correlation analysis; Probabilistic Power Analysis: Random logic signals - probabilistic power analysis techniques - signal entropy.

Module III: Circuit and Logic Level **9 Hours**

Circuit Level: Transistor and gate sizing - equivalent pin ordering - network restructuring and reorganization - special latches and flip flops; Logic level: Gate reorganization - signal gating - logic encoding - precomputation logic- FINFET logic.

Module IV: Energy Recovery Techniques **9 Hours**

Energy recovery techniques: Energy dissipation using the RC model - energy recovery circuit design - power reduction in clock networks - low power bus - delay balancing.

Module V: Instructional Activity **9 Hours**

Simulation study: Sources of power dissipation in SRAMs - low power SRAM circuit techniques; Sources of power dissipation in DRAMs - low power DRAM circuit techniques using related tools

Reference Books:

1. Kaushik R and Sharat C P, “Low-Power CMOS VLSI Circuit Design”, Wiley Student Edition, 2009.
2. Gary K Y, “Practical Low Power Digital VLSI Design”, Kluwer Academic Publishers, 1998.
3. Bellaouar A and Elmasry M, “Low-Power Digital VLSI Design: Circuits and Systems”, Kluwer Academic Publishers, 1995.
4. Chandrakasan A and Robert W B, “Low-Power CMOS Design”, Wiley-IEEE Press, 1998.
5. Rabaey J M and Massoud P, “Low Power Design Methodologies”, Kluwer Academic Publishers, 1995.
6. Kiat-Seng Y and Kaushik R, “Low-Voltage, Low-Power VLSI Subsystems”, TMH Professional Engineering, 2009.
7. Soudris D, Piguet C and Goutis C, “Designing CMOS Circuits for Low Power”, Kluwer Academic Publishers, 2002.

Hyperlinks:

1. http://www.nptel.iitm.ac.in/courses/106105034/
2. http://www.eeherald.com/section/design-guide/Low-Power-VLSI-Design.html

ECEICS 541

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 542	MEMS and NEMS	2	1	0	3	45

Prerequisite : Knowledge in basic sensors, actuators and various fabrication techniques.

Objective : To teach the principles in respect of micro and nano electronics, and MEMS /NEMS.

Outcome : The students will come out with a complete knowledge of micro and nano fabrication concepts, micro and nano sensors. MEMS/NEMS for real- time application.

Module I: MEMS **9 Hours**

Introduction: Need for miniaturization technology - from perception to realization - overall MEMS market size - MEMS market character – Silicon MEMS - non-Silicon MEMS - MEMS versus traditional precision engineering.

Module II: Micro Sensors and Actuators **9 Hours**

Sensing and actuation - case studies of real devices; Sensing mechanisms: piezoelectric - piezoresistive - capacitive; Actuation mechanisms: piezoelectric - electrostatic - magnetic and thermal; Physical sensors - opto - fluids - sensors for turbulence measurement and control - micro - actuators for flow control.

Module III: Nanomaterials and Nano devices **9 Hours**

Introduction to nanomaterials : properties of nanomaterials - role of size in nanomaterials and nanoparticles - semiconducting nanoparticles; Nanowires - nanoclusters - quantum wells - conductivity - Carbon Nanotube (CNT): structure of CNT and its properties; Nanosensors- structure- applications

Module IV: Micro and Nano Fabrication Techniques **9 Hours**

Introduction to Lithography: Pattern transfer with different techniques - E beam lithography; Micromachining: Size effect in micromachining - mechanical micromachining; Oxidation - CVD of nanostructures - CVD diamond technology for NEMS and MEMS applications - nano crystals - nanowires - nanolithography - etching techniques.

Module V: Instructional Activity **9 Hours**

Simulation of minimum of five MEMS/ NEMS using related tools.

Reference Books:

1. Marc J M, “Fundamentals of Microfabrication: The Science of Miniaturization”, 2nd Edition, CRC Press, 2002.
2. Groffrey A O, Andre C A and Ludovico C, “Nanochemistry: A chemical approach to nanomaterials”, 2nd Edition, RSC Publishing, 2009.
3. Schmidt G, “Nanoparticles: From theory to applications”, Wiley, 2006.
4. Jackson M J, “Microfabrication and Nanomanufacturing”, CRC Press, 2005.
5. Nadim M and Williams K, “An introduction to Microelectromechanical Systems Engineering”, 2nd Edition, Artech House, 2004.
6. Stephen B, Graham E, Michael K and Neil W, “MEMS Mechancial Sensors”, Artech House, 2004.
7. Stephen D S, “Microsystem Design”, Kluwer Academic Publishers, 2002.
8. Michael J O, “Carbon Nanotubes: Properties and Applications”, CRC Press, 2006.
9. Rao C N R and Govindaraj A, “Nanotubes and Nanowires”, RCS Publishing, 2005.
10. Kouroush K, Benjamin F, “Nanotechnology enabled sensors”, Springer, 2008.
11. Jackson M J, “Micro fabrication and Nanomanufacturing”, CRC press, 2005.
12. Cao G and Wang Y, “Nanostructures and Nanomaterials: Synthesis, properties and applications”, 2nd Edition, World Scientific, 2011.

Hyperlinks:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-152j-micro-nano-processing-technology-fall-2005/
2. http://www.lithoguru.com/scientist/CHE323/
3. http://www.iap.uni-jena.de/iapmedia/de/Lecture /Micro_+and+Nano_Technology1505685600/MNT2017_1_Introduction.pdf

ECEICS 542

Course Code	Name of the Course	Periods			Credits	Total Hours
ECEICS 543	MICROWAVE THEORY AND TECHNOLOGY	L	T	P	3	45
		2	1	0		

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Prerequisite : Knowledge in electromagnetic waves, transmission lines and circuit

Objective : To make the students to have a clear knowledge about different concepts of microwave circuits.

Outcome : Students will be aware of different microwave circuits' and their working principles.

Module I: Introduction **9 Hours**

Two port network characterization: Scattering matrix representation of microwave components - maximum power transfer theorem; Transmission lines: Need - quarter wave transformer - smith chart.

Module II: Planar Transmission lines **9 Hours**

Strip line - microstrip line - coplanar waveguide - coplanar strips - slot line - Fin line and characteristics - properties - design parameters and its applications

Module: Microstrip Components **9 Hours**

3dB hybrid design - backward directional coupler - hybrid ring and power dividers - MIC filters - Kuroda transformation - K inverter - J inverter - resonator filters - realization using microstrip lines.

Module IV: Substrate Integrated Waveguide **9 Hours**

Substrate Integrated Waveguide: Substrate integrated waveguide technology - design of SIW - losses in SIW - SIW circuits composed of metallic posts - SIW circuits with dielectric posts.

Module V: Instructional Activity **9 Hours**

Simulation of (minimum of four) two port networks using various microwave circuits with the help of related tools; Assignments on applications of microwave circuits: space/defense/wireless.

Reference Books:

1. Hoffman R K, “Handbook of Microwave Integrated Circuits”, Artech House, 1987.
2. Gupta. K. C and R. Garg, “Microstrip Line and Slot Line”, Artech House, 1996.
3. Ravender Goyal, “Monolithic MIC Technology & Design”, Artech House, 1989.
4. Gupta K C and Amarjit S, “Microwave Integrated Circuits”, John Wiley, 1974.
5. Ramesh G, Inder B, Maurizio B, “Microstrip Line and Slot Line”, Artech House, 3rd Edition, 2013.

Hyperlinks:

1. http://nptel.iitm.ac.in/syllabus/117105029/
2. http://www.microwaves101.com/encyclopedia/
3. ieeexplore.ieee.org/iel5/4126157/5936981/05936990.pdf
4. ieeexplore.ieee.org/document/7546658/
5. journal.utem.edu.my/index.php/jtec/article/view/836
6. downloads.hindawi.com/journals/ijap/2013/746920.pdf

ECEICS 543

Course Code	Name of the Course	Periods			Credits	Total Hours
ECEICS 544	OPTICAL COMMUNICATION AND NETWORKS	L	T	P	3	45
		2	1	0		

Prerequisite : Fiber Optics

Objective : To enable the student to understand the basic principles of operation of optical system components, the different network architectures and issues associated with network design.

Outcome : At the end of the course the student would be able to demonstrate an understanding of the differences and challenges involved in the design of optical systems and networks.

Module I: Optical System Components **9 Hours**

Optical System Components – MZIM, Multiplexers; filters; switches; wavelength converters; optical amplifiers – EDFA, Raman Amplifiers and hybrid; Transmission system Engineering – System Model, transmitter, receiver, cross talk, dispersion compensation, wavelength stabilization, FWM.

Module II: Coherent Systems **9 Hours**

Basic principles of Coherent detections – Practical constraints – Injection laser line width state of polarization, local oscillator power, fiber limitations; Modulation formats – ASK, FSK, PSK, DPSK and polarization shift keying (POL SK); Demodulation schemes – Homodyne - Heterodyne – Synchronous and Non synchronous detection; Comparison; Carrier recovery in Coherent detection.

Module III: Optical Network Architectures **9 Hours**

Introduction to Optical Networks; First Generation optical networks –SONET / SDH Network - Second Generation (WDM) Optical Networks - Need for Multilayered Architecture - Layers and Sub-layers - Spectrum partitioning - Optical Network Nodes - Network Access Stations - Overlay Processor - Logical network overlays.

Module IV: Optical Network Survivability **9 Hours**

Protection and Restoration Objectives - Fault Protection and Restoration Techniques in the Logical Layer – Point-to-Point Systems - SONET Self-Healing Rings - Interconnection Techniques - Architectures with Arbitrary Mesh Topologies - Optical-Layer Protection: Point-to-Point and Ring Architectures - Mesh Architectures.

Module V: Instructional Activity **9 Hours**

Simulate and study at least two of the above-mentioned concepts using the appropriate simulator - Design and analysis of a particular sub-system and comparison with others - Numerical computation of the above concepts.

Reference Books:

1. Max Ming-Kang Liu, —Principles and Applications of Optical Communication‖, Tata McGraw Hill Education Pvt., Ltd., New Delhi, 2012.
2. Thomas E. Stern, Georgios Ellinas, Krishna Bala, —Multiwavelength Optical Networks – Architecture, Design and control —, Cambridge University Press, 2nd Edition, 2009.
3. Rajiv Ramaswami and Kumar N. Sivarajan, —Optical Networks : A Practical Perspective‖, Harcourt Asia Pte Ltd., Second Edition 2006.
4. P.E. Green, Jr., —Fiber Optic Networks‖, Prentice Hall, NJ, 1993.

Hyperlinks:

1.https://www.frontiersin.org/journals/communications-and-networks/sections/optical-communications-and-networks

ECEICS 544

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 545	OPTO ELECTRONIC DEVICES	2	1	0	3	45

Prerequisite: Fiber Optics

Objective : To enable the student to understand the basic principles of operation of opto-electronic devices

Outcome : At the end of the course the student would be able to demonstrate an understanding of the differences and challenges involved in the design of opto-electronic devices.

Module I:Elements of Light And Solid State Physics **9 Hours**

Wave nature of light - Polarization - Interference - Diffraction - Light Source - review of Quantum Mechanical concept - Review of Solid State Physics - Review of Semiconductor Physics and Semiconductor Junction Device.

Module II: Display Devices And Lasers **9 Hours**

Introduction - Photo Luminescence - Cathode Luminescence - Electro Luminescence - Injection Luminescence - Injection Luminescence - LED - Plasma Display - Liquid Crystal Displays Numeric Displays - Laser Emission - Absorption - Radiation - Population Inversion - Optical Feedback - Threshold condition - Laser Modes - Classes of Lasers - Mode Locking - laser applications.

Module III: Optoelectronic Modulator **9 Hours**

Introduction - Analog and Digital Modulation - Electro-optic modulators - Magneto Optic Devices - Acoustoptic devices - Optical - Switching and Logic Devices - Photo detector - Thermal detector - Photo Devices - Photo Conductors - Photo diodes - Detector Performance.

Module IV: Optoelectronic Integrated Circuits **9 Hours**

Introduction - hybrid and Monolithic Integration - Application of Opto Electronic Integrated Circuits - Integrated transmitters and Receivers - Guided wave devices.

Module V: Instructional Activity **9 Hours**

Simulate and study at least two of the above-mentioned concepts using the appropriate simulator - Design and analysis of a particular sub-system and comparison with others. Numerical computation of the above concepts.

Reference Books:

2. J. Wilson and J.Haukes, “Opto Electronics – An Introduction”, Prentice Hall of India Pvt. Ltd., New Delhi, 1995.
3. Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., New Delhi, 1995.
4. Jasprit Singh, “Opto Electronics – As Introduction to materials and devices”, McGraw-Hill International Edition, 1998.

Hyperlinks:

1.https://ece.mst.edu/media/academic/ece/documents/coursenotes/ee2200introductiontoelectronicdevices/EE_2200_Lecture_C-2.pdf

ECEICS 545

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 546	REAL TIME EMBEDDED SYSTEM DESIGN	2	1	0	3	45

Prerequisite : Fundamentals in advanced microcontrollers and embedded systems

Objective : To study various SOC, RTOS concept, programming of various communication interfaces for automatic systems

Outcome : Students will be able to understand the SOC concepts and the programming for automatic systems.

Module I:Introduction to Embedded Automatic Systems **9 Hours**

Embedded Automatic Systems (EAC): Overview - architecture; Components of the system: Processors-memories and interconnects - processor architectures - memory and addressing: SOC memory examples - addressing.

Module II: System On Chip **9 Hours**

Introduction to Arduino :Types of Arduino devices - common Arduino shields - Beagle Bone ; Introduction to Raspberry Pi

Module III: Communication Interfaces and Python Basics **9 Hours**

Communication interfaces: I2C- SPI Bus- UART- RS-232- RS-485- USB- IEEE 139.4 (Firewire) - Infrared (IRDA) - Bluetooth - Wi-Fi - ZigBee – GPRS; Python basics: Introduction - variables - displaying output - reading user input - arithmetic - operations on strings - running commands conditionally - comparing values - logical operators- loops.

Module IV: RTOS Programming **9 Hours**

Tasks and Task states - semaphores - shared data - message queues - mail boxes and pipes - memory management - interrupt routines - encapsulating semaphore and queues - task management - inter task communication - process input/ output.

Module V: Instructional Activity **9 Hours**

RFID based attendance management system - embedded video processing - home automation systems using Raspberry Pi/ Arduino /any other SOC.

Reference Books:

1. Michael J F and Wayne L. “Computer System Design: System-on-Chip”, John Wiley and Sons, 2011.
2. Hughes M J, “Arduino: A Technical Reference”, 1st Edition, O’REILY, 2016.
3. David E S, “An Embedded software premier”, Pearson Education, 1999.
4. Shibu, “Introduction to Embedded Systems”, 1st Edition, Tata McGraw Hill, 2009.
5. Simon M, “Raspberry Pi Cookbook”, 2nd Edition, O’REILY, 2014.
6. Richardson M and Shawn W, “Make: Getting Started with Raspberry Pi”, 3rd Edition, O’REILY, 2016.
7. Prasad K V K K, “Embedded/ Real-Time Systems”, Dream Tech Press, 2003.
8. Hermann K, “Real–Time systems – Design Principles for Distributed Embedded Applications”, 2nd Edition, Springer, 2011.
9. Derek M, “Top of Form Exploring Beagle Bone: Tools and Techniques for Building with Embedded Linux”, Wiley, 2015.

Hyper Links:

1. https://makezine.com/2013/04/15/arduino-uno-vs-beaglebone-vs-raspberry-pi/
2. https://www.arduino.cc/en/Main/Boards

ECEICS 546

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 711	INTERNET OF EVERY THINGS (IoE)	2	1	0	3	45

Prerequisite : Basics of computer communication networks and wireless sensor networks

Objective : To study the architecture and security principles of Internet of Everything's (IoE).

Outcome : Students will be able to design efficient IoE based projects.

Module I: Introduction **9 Hours**

IoT: Architectural overview - main design principles - standards considerations; M2M and IoT technology fundamentals: devices and gateways - data management - business processes in IoT - everything as a service - M2M and IoT analytics - knowledge management.

Module II : IoE Sensors **9 Hours**

Sensors for IoE: Wireless sensor structure - energy storage module - power management module - RF Module - sensing module.

Module III: IoE Security **9 Hours**

Security requirements in IoE architecture - security in enabling technologies - security concerns in IoE applications: Architecture - insufficient authentication/authorization - insecure access control - threats to access control, privacy, and availability - attacks specific to IoE.

Module IV: IoE Testbed **9 Hours**

ACOEM Eagle - EnOcean Push Button - NEST sensor - Ninja blocks focus on wearable electronics.

Module V: Instructional Activity **9 Hours**

Simulation of (minimum of any five) IoE applications - home and office infrastructures - security - home appliances and other IoE electronic equipment- interfacing of sensor with sensor node using any embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino).

Reference Books:

1. Asoke K Talukder and Roopa R Yavagal, “Mobile Computing: Technology, Application and Service Creation”, Tata McGraw Hill, 2010.
2. William Stallings, “Data and Computer Communications”, 8th Edition, Pearson Education Pte. Ltd., 2009.
3. Adelstein F and Gupta S.K.S, “Fundamentals of Mobile and Pervasive Computing”, McGraw Hill, 2009.
4. Barrie Sosinsky, “Cloud Computing Bible”, Wiley-India, 2010.
5. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.
6. Manoel Carlos Ramon, “Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers”, Apress, 2014.
7. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014.

Hyperlinks:

1. https://www.ibm.com/developerworks/library/iot-top-tutorials-aug2017/index.html
2. https://www.codeproject.com/Learn/IoT/
3. https://www.edureka.co/blog/iot-tutorial/
4. https://www.bbvaopenmind.com/en/the-internet-of-everything-ioe/

ECEICS 711

Course Code	Name of the Course	Periods			Credits	Total Hours
ECEICS 712	MACHINE LEARNING AND DEEP LEARNING	L	T	P	3	45
		2	1	0		

Prerequisite : Digital Image Processing and Pattern Recognition

Objective : To understand the concepts and mathematical foundations of machine learning and types of problems tackled by machine learning

Outcome : Students will be able to understand and outline problems for various applications.

Module I: Supervised Learning **9 Hours**

Introduction-Discriminative and Generative Models - Linear Regression - Least Squares -Under-fitting / Overfitting - Cross-Validation - Classification - Logistic Regression- Gradient Linear Models -Support Vector Machines - Kernel Methods - K-Nearest Neighbors - Tree based Methods -Decision Trees - ID3 - CART - Ensemble Methods - Random Forest.

Module II : Unsupervised Learning and Reinforcement Learning **9 Hours**

Introduction - Clustering Algorithms - K – Means - Hierarchical Clustering - Cluster Validity - Dimensionality Reduction -Principal Component Analysis - Recommendation Systems - EM Algorithm. Reinforcement Learning - Elements - Model based Learning - Temporal Difference Learning.

Module III: Neural Networks **8 Hours**

About Neural Network - Building Blocks of Neural Network - Optimizers - Activation Functions - Loss Functions - Data Pre-processing for neural networks - Feature Engineering.

Module IV : Convolutional Neural Network **10 Hours**

About CNN - Building a Convolutional Neural Network- Input Layers - Convolution Layers- Pooling Layers - Dense Layers - Backpropagation through the Convolutional Layer and pooling layer - Various Optimizers: LeNet - AlexNet - VGG16 - ResNet. Transfer Learning using Inception Oxford - VGG Model - Google Inception Model - Microsoft ResNet Model: R-CNN- Fast R-CNN- Faster R-CNN- Mask-RCNN - YOLO.

Unit V: Instructional Activity **9 Hours**

Study at least 3 Tools available for Machine Learning and discuss pros & cons of each- Take an example of a classification problem- Draw different decision trees for the example and explain the pros and cons of each decision variable at each level of the tree-Develop a CNN - R-CNN - Fast R-CNN - Faster-R-CNN - Mask-RCNN for detection and recognition.

Reference Books:

1. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, Chapman & Hall/CRC, 2nd Edition, 2014.
2. Kevin Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012
3. Ethem Alpaydin, “Introduction to Machine Learning”, Third Edition, Adaptive Computation and Machine Learning Series, MIT Press, 2014.
4. Josh Patterson and Adam Gibson, “Deep Learning A Practitioner’s Approach” O’Reilly Media, Inc.2017.

Hyperlink:

1. https://nptel.ac.in/courses/106106139
2. https://nptel.ac.in/courses/106106184

ECEICS 712

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 713	MILLIMETER WAVE TECHNOLOGY	2	1	0	3	45

Prerequisite : Microwave Engineering.

Objective : To understand the fundamentals and various components of Millimeter wave devices and circuits.

Outcome : Ability to understand Millimeter devices and circuits.

Unit I: Introduction **9 Hours**

Millimetre wave characteristics- millimetre wave wireless- implementation challenges- radio wave propagation for mm wave: large scale propagation channel effects -small scale channel effects -outdoor and indoor channel models-emerging applications of millimetre wave communications.

Unit II: MM Wave Circuits **9 Hours**

Millimetre wave generation and amplification: peniotrons – ubitrons - gyrotrons - free electron lasers; HEMT models for mm wave transistors- transistor configurations- analog mm wave components: amplifiers- mixers-VCO - PLL.

Unit III: Millimeter Wave Technology **9 Hours**

Millimeter wave characteristics – applications – challenges – material properties – sources of losses – different guiding modes – guiding structure at millimeter wave frequencies: rectangular and circular waveguides – microstrip lines – CPW – SIW.

Unit IV: Millimeter Wave Components and Devices **9 Hours**

Passive components: dielectric resonators – filters – power dividers – couplers – active devices: BJT and HBT – Schottky and PIN diodes – GUNN diode – avalanche transit time devices – FET – HEMT.

Unit V: Instructional Activity **9 Hours**

Assignments on millimetre wave link budget - transceiver architecture - transceiver without mixer - receiver without oscillator.

Reference Books:

1. Huang K C and Wang Z, "Millimeter Wave Communication Systems", Wiley-IEEE Press, March 2011.
2. I. J. Bahl and P. Bhartia, “Millimeter wave Engineering and Applications”, Wiley, 1984.
3. Robert W H, Robert C. D and James N M, Theodore S. Rappaport, Murdock, "Millimeter Wave Wireless Communication", Prentice Hall, 2014.
4. Xiang W, Zheng K, Shen X.S, "5G Mobile Communications”, Springer, 2016.
5. Theodore S R, Robert W H, Robert C D and James N M, “Millimeter Wave Wireless Communications", Pearson Education, 2015.
6. Nguyen C, “Analysis methods for RF, microwave and millimeter wave planar transmission line structures”, Wiley, 1st Edition, 2000.
7. Yu Jian Cheng, “Substrate interated antennas and arrays”, Taylor Series Group, 2015

Hyperlinks:

1. http://nptel.ac.in/courses/117105139/
2. https://www.youtube.com/watch?v=9HGUkvrurVc

ECEICS 713

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 714	MOBILE AD-HOC NETWORKS	2	1	0	3	45

Prerequisite: Introduction to Computer Communications or an equivalent networking course

Objective : This course covers major aspects of ad hoc networks, from design through performance issues to application requirements.

Outcome : Students will able to understand the basic principles, standards, and system and protocol architecture of Mobile Ad-hoc Networks

Module I: Introduction **9 Hours**

Introduction to Ad-hoc networks: definition - characteristics features - applications; Ad-hoc mobility models: indoor and outdoor models; Channel Characteristics

Module II: Medium Access Protocols **9 Hours**

MAC Protocols: Design issues - goals and classification; Contention based protocols with reservation - scheduling algorithms - protocols using directional antennas; IEEE standards: 802.11a - 802.11b - 802.11g - 802.15. HIPERLAN- recent standards in IEEE.

Module III: Routing Protocols **9 Hours**

Routing Protocols: Design issues and goals ; Classification; Proactive Vs reactive routing - unicast routing algorithms - Multicast routing algorithms - hybrid routing algorithm - hierarchical routing - QoS aware routing; Security issues in adhoc networks: issues and challenges - network security attacks - secured routing protocols

Module IV: End – End Delivery And Cross Layer Design **9 Hours**

Transport Layer: Issues in designing Transport layer classification - adhoc transport protocols; Cross layer Design: Need - cross layer optimization - parameter optimization techniques - cross layer cautionary perspective; Integration of adhoc with Mobile IP networks

Module V: Instructional Activity **9 Hours**

Simulation of Adhoc Network Scenario with any one of the MAC /Routing Protocols using open source network simulation tool

Reference Books:

1. C. Siva Ram Murthy and B. S. Manoj, “Ad hoc Wireless Networks Architecture and Protocols” , 2nd Edition, Pearson Publishers, 2007.
2. Charles E. Perkins, “ Ad hoc Networking” , Addison – Wesley, 2000.
3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, “Mobile Adhoc Networking”, Wiley-IEEE Press, 2004.
4. Mohammad Ilyas,” The handbook of ad-hoc wireless networks” , CRC press, 2002.
5. T. Camp, J. Boleng, and V. Davies , “ A Survey of Mobility Models for Ad-hoc Network” , Wireless Communication and Mobile Computing, August 2022
6. Fekri M. bduljalil and Shrikant K. Bodhe, “A survey of integrating IP mobility protocols and Mobile Ad-hoc networks”, IEEE communication Survey and Tutorials, 2007

Hyperlinks:

1. http/www.winlab.rutgers.edu/~crose/dimacs03/kumar.pdf

ECEICS 714

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 715	MULTIMEDIA COMPRESSION	2	1	0	3	45

Prerequisite : Digital Image Processing

Objective : To understand the various algorithms used for different data compression.

Outcome : Students will be able to implement compression techniques for various applications.

Module I : Fundamentals of Compression **9 Hours**

Introduction to multimedia - Graphics, Image and Video representations - Fundamental concepts of video, digital audio - Storage requirements of multimedia applications - Need for compression - Taxonomy of compression Algorithms - Elements of Information Theory - Error Free Compression - Lossy Compression.

Module II : Text Compression **9 Hours**

Huffman coding - Adaptive Huffman coding - Arithmetic coding - Shannon - Fano coding- Dictionary techniques - LZW family algorithms.

Module III : Image Compression **9 Hours**

Image Compression: Fundamentals - Compression Standards - JPEG Standard - Sub-band coding – Wavelet Based compression - Implementation using Filters – EZW, SPIHT coders – JPEG 2000 standards.

Module IV: Audio Compression and Video Compression **9 Hours**

Audio compression Techniques - law, A-Law companding - Frequency domain and filtering - Basic sub-band coding - G.722 - Video compression techniques and Standards - MPEG video coding: MPEG-1 and MPEG2 video coding - H.261 standard

Module V: Instructional Activity **9 Hours**

Simulation - Implementation of various compression techniques for real time applications.

Reference Books:

1. Darrel Hankerson, Greg A Harris, Peter D Johnson, “Introduction to Information Theory and Data Compression”, Second Edition, Chapman and Hall, CRC press, 2003
2. David Solomon, “Data Compression – The Complete Reference”, Fourth Edition, Springer Verlog, New York, 2006.
3. Khalid Sayood, “Introduction to Data Compression”, Morgan Kauffman Harcourt India, Third Edition, 2010.
4. Peter Symes , “Digital Video Compression”, McGraw Hill Pub., 2004.
5. Yun Q.Shi, Huifang Sun, “Image and Video Compression for Multimedia Engineering, Algorithms and Fundamentals”, CRC Press, 2003.

Hyperlinks:

1. https://onlinecourses.nptel.ac.in/noc22_ee49/preview
2. https://www.nptelvideos.com/video.php?id=989

ECEICS 715

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 716	NETWORK SECURITY	2	1	0	3	45

Prerequisite : Computer Networks and Information Security

Objective : This course covers major aspects of cryptography techniques, network security and system security mechanism

Outcome : Students will able to understand the basic principles and various algorithms related to network security to mitigate the effects of attacks

Module 1: Introduction To Network Security **9 Hours**

Need for Network Security - Attacks (Passive, Active, Layerwise attacks) Security Goals and Mechanisms; A model for Internetwork security - Internet Standards and RFCs - Buffer overflow and format string vulnerabilities

Module 2: Cryptographic Techniques **9 Hours**

Conventional Encryption Principles and Algorithms - Message Authentication - Secure Hash Functions and HMAC - Digital signatures - Digital Certificates - Certificate Authority and Key management Kerberos - X.509 Directory Authentication Service.

Module 3: Network Security **9 Hours**

Email privacy: Pretty Good Privacy (PGP) and S/MIME; IP Security Overview - IP Security Architecture - Authentication Header - Encapsulating Security Payload - Combining Security Associations and Key Management - Web Security Requirement - SSL - TLS and SET

Module 4: System Security **9 Hours**

Basic concepts of SNMP - Advanced SNMP Versions; Intruders - Viruses and related threats - Firewall; Design principles - Trusted Systems - Intrusion Detection Systems and its types.

Module 5: Instructional Activity **9 Hours**

Simulation of any of the network security aalgorithms using open-source software.

Reference Books:

1. William Stallings , “Network Security Essentials :Applications and Standards, Pearson Education, 4th Edition ,2011
2. Bernard Menezes, “Network Security and Cryptography”, CENGAGE Learning, 2011
3. Atul Kahate, “Cryptography and Network Security”, Mc Graw Hill ,2016
4. Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, “Hack Proofing your network”, Syngress Publisher, 2nd Edition, 2002.
5. William Stallings,“Cryptography and Network Security -Principles and Practices”, Prentice Hall, 4th Edition, 2005

Hyperlinks:

1. https://www.engppt.com/2012/10/cryptography-and-network-security.html
2. https://www.skylineuniversity.ac.ae/pdf/computer/ Network security essentials applications and standards 17376.pdf

ECEICS 716

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 717	OPTICAL WIRELESS COMMUNICATIONS	2	1	0	3	45

Prerequisite : Fiber Optics and Wireless Communication

Objective : This subject provides the in-depth knowledge in Optical Wireless Communication systems.

Outcome : Students are able to Interpret the principles of Optical wireless communication devices and systems.

Module I: OWC Theory **9 Hours**

Optical communication systems- wireless access- Need of Optical Wireless Communication-block diagram-challenges - applications. Indoor optical wireless communication channel-LOS propagation model-Spherical and Guassian wave model-outdoor channel- Attenuation-Beam Wander-Turbulence –Turbidity - Cloud-free line of sight-log normal negative exponential- gamma-gamma turbulence model-modulation schemes for optical wireless -Digital base band-pulse modulation-subcarrier intensity modulation –optical polarization shift keying- BER performance analysis.

Module II: Free Space Optical Communications **9 Hours**

Introduction-operating principles-characteristics-Qos and availability-- FSO OFDM communication-FSO underwater- Free space optical networks-laser satellite communication.

Module III: Coded Modulation Techniques for OWC **9 Hours**

Coded MIMO for OWC- Indoor OWC MIMO channel-Point to point OW MIMO communications-MIMO FSO-Wireless optical CDMA Communication system-System description-indoor wireless optical CDMA-FSO CDMA.

Module IV: Visible Light Communications **9 Hours**

VLC principle- VLC system model- system implementation-VLC applications Infrared optical wireless communications - Optical wireless in sensor networks- FSO Sensor networks – LiFi.

Module V Instructional Activity **9 Hours**

Simulate and study at least two of the above-mentioned concepts using the appropriate simulator. Design and analysis of a particular sub-system and comparison with others. Numerical computation of the above concepts.

Reference Books:

1. Z. Ghassemlooy, W.Popoola, S. Rajbhandari “Optical Wireless Communications- Systems and channel modelling with MATLAB” CRC press, Taylor & Francis, 2013.
2. Shlomi Armon, John R. Barry, Geroge K. Karagiannidis, Robert Schober, Murat Uysal “Advanced Optical Wireless Communication Systems” Cambridge university press, 2012.
3. Heinz, Phd. Willebrand, “Free Space Optics,” Sams, 1st Ed., 2001.
4. Stamatioas V. Kartalopouls “Free space optical Networks for Ultra Broadband services” John Wiley & Sons, 2011.
5. Morris Katzman, “Laser Satellite Communication,” Prentice Hall Inc., New York, 1991.
6. Roberto Ramirez-Iniguez, Sevia M.Idrus, Ziran sun “Optical wireless communications: IR for wireless connectivity” CRC Press, Taylor and Francis Group, 2007.
7. Recent literature in Optical Wireless Communication.

Hyperlinks:

1. https://Optical_wireless_communications

ECEICS 717

Course Code	Name of the Course	Periods			Credits	Total Hours
ECEICS 718	PHOTONIC INTEGRATED CIRCUITS	L	T	P	3	45
		2	1	0		

Prerequisite : Photonics

Objective : To introduce essential concepts required to understand the operation of various integrated photonic components and draws a parallel with bulk components.

Outcome : On successful completion of the module students will be able to understand different types of integrated photonic resonators and the properties of their resonant modes

Module I: Introduction to Photonic Integrated Circuits **9 Hours**

Brief history of optical communication -Advantages of integrated optics configuration - Analysis of optical waveguides and devices - Planar waveguides - channel waveguides - graded index - waveguides - coupled mode theory - variational method - beam propagation method.

Module II: Materials and fabrication Technology **9 Hours**

Materials: glass - lithium niobate – silicon - compound semiconductors – polymers; General fabrication steps – Photolithography - Ti: LiNbO3 process - Proton exchange process - Silicon based IC process - Compound semicondutor process - Solgel and other processes.

Module III: Dynamic and active Devices **9 Hours**

Electro-optic devices - acousto-optic devices - thermo-optic and magneto-optic device - integrated optical amplifiers - optical resonators - input-output coupling in integrated optics; Applications to communication – sensors - optical computing.

Module IV: Photonic Crystal Structures **9 Hours**

Introduction to 1D and 2D photonic crystal structures – dispersion properties – Brilluion zone – band gap – band structure calculations; Photonic crystal waveguides – bends – cavities; Photonic crystal integrated circuits: waveguide couplers – add/drop filters - delay lines.

Module V: Instructional Activity **9 Hours**

Study of Numerical methods (FDTD, BPM etc) for optical waveguide simulations and their limitations using OPTIFDTD software; Simulate and study the optical waveguide devices such as directional couplers and splitters based on photonic crystals.

Reference Books:

1. C. R. Pollock and M. Lip Son, “Integrated Photonics”, Kluwer Publisher, 2003.
2. H. Nishihara, M. Haruna, and T. Suhara, “Optical Integrated Circuits”, McGraw-Hill, 1988.
3. H Nishihara, M Haruna and T Suhara, “Optical Integrated Circuits”, Mc Graw-Hill Book Company, New York, 1989.
4. A Ghatak and K Thyagarajan, “Optical Electronics”, Cambridge University Press, 1989.

Hyperlinks:

1. https://www.synopsys.com/glossary/what-is-a-photonic-integrated-circuit.html
2. https://en.wikipedia.org/wiki/Photonic_integrated_circuit
3. https://www.rp-photonics.com/photonic_integrated_circuits.html

ECEICS 718

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 719	RADAR ENGINEERING	2	1	0	3	45

Prerequisite : Electromagnetics and communication theory.

Objective : To learn in-depth understanding of Radar and its components.

Outcome : The students are expected to have the ability to describe the radar fundamentals, Analyze the radar signals.

Module I: Introduction to RADAR Systems **9 Hours**

Basic Radar Equation - Radar Frequencies and Waveforms - Radar Range Equation - Radar Cross Section.

Module II: RADAR System Components **9 Hours**

Random Antennas - Transmitters and Receivers - Waveguides and Transmission Lines - Duplexers and Circulators - Radar Signal Processing.

Module III: RADAR Signal Analysis **9 Hours**

Matched Filters - Ambiguity Function - Doppler Processing - Clutter and Jamming - Pulse Compression

Module IV: RADAR Imaging **9 Hours**

Synthetic Aperture Radar (SAR) - Inverse Synthetic Aperture Radar (ISAR) - Multistatic and Passive Radar - FMCW Radar - MIMO Radar.

Module V: Instructional Activity **9 Hours**

Design and Simulation of RADAR Components using related Tools.

Reference Books:

1. "Introduction to Radar Systems" by Merrill Skolnik.
2. "Radar Principles" by Peebles and Richards.
3. "Radar Systems Analysis and Design Using MATLAB" by Bassem R. Mahafza.
4. "Radar Handbook" by Merrill Skolnik.
5. "Principles of Modern Radar" by Mark Richards.
6. "Radar and Electronic Warfare Principles for the Non-Specialist" by C. Rino and M. Currie.

Hyperlinks:

1. http://www.nptel.ac.in/courses/117107035/
2. http://www.nptel.ac.in/courses/108101092/
3. http://www.nptel.ac.in/courses/108104099/
4. http://www.nptel.ac.in/courses/108104087/

ECEICS 719

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 720	RADIO FREQUENCY INTEGRATED CIRCUIT DESIGN	2	1	0	3	45

Prerequisite : Electromagnetics and microwave theory.

Objective : To learn the RFIC design concepts, different types of RFIC and their design methodology.

Outcome : Students will be able to design different types of RFIC design for various applications.

Module I: Fundamentals of Architectures **9 Hours**

Transmitter and Receiver architectures: Review of modulation schemes - Receiver architectures - Transmitter architectures

Module II: Passive and Active Components for CMOS RFIC **9 Hours**

Review of MOSFET - RF transistor layout - CMOS process - Capacitors - Varactors - Resistors - Inductors - Transformers - Transmission lines Resonance - Matching - S-parameters - etc. Noise in electrical circuits and NF calculations - Two port noise theory.

Module III: Low Noise Amplifiers **9 Hours**

Resistive terminated CS and CG LNA - Inductive degenerated LNA - Shunt feedback LNA - Noise canceling LNAs - Linearity improvement techniques.

Module IV: Power Amplifiers **9 Hours**

Basics and Class A, B, C, AB, D, E, F and other configurations - Power combining - Linearity improvement techniques

Module V: Instructional Activity **9 Hours**

Design - simulation and analysis of different RFIC for wireless applications using related simulation tools.

Reference Books:

1. B.Razavi,"RF Microelectronics", 2nd Ed., Pearson, 2012.
2. Thomas H. Lee, "The design of CMOS radio-frequency integrated circuits", 2nd Ed., Cambridge University Press, 2004.

Hyperlinks:

1. http://www.nptel.ac.in/courses/117107035/
2. http://www.nptel.ac.in/courses/108101092/
3. http://www.nptel.ac.in/courses/108104099/
4. http://www.nptel.ac.in/courses/108104087/

ECEICS 720

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 721	RF MEMS DESIGN AND TECHNOLOGY	2	1	0	3	45

Prerequisite : Microwave Theory and Technology and MEMS

Objective : To familiarize the student with the technology and applications of Micro-Electro Mechanical Systems (MEMS).

Outcome : Students will be able to design different types of MEMS based devices, circuits and subsystems.

Module I: Introduction to MEMS **9 Hours**

Evolution of Micro Electro Mechanical Systems (MEMS): Driving force for MEMS development - MEMS material properties - microelectronics technology for MEMS; The Finite Element Method (FEM): Important mathematical and physical concept in FEM - discretization and other approximation.

Module II: Micromachining Technology for MEMS **9 Hours**

Fabrication Process: MEMS fabrication technologies - bulk micro machining - surface micro machining - LIGA process; Bonding and packaging of MEMS - MEMS reliability - scaling in MEMS; Recent research direction in MEMS: CMOS- MEMS integration - polymer MEMS - NEMS etc.

Module III: Sensor and Actuators **9 Hours**

Sensors: Classifications - principle - design and characterization of thermal – micro-machined - mechanical - pressure - flow sensor - bio– sensor; Actuation in MEMS Devices: Electrostatic actuation - parallel plate capacitor - cantilever beam based movement; MEMS accelerometers; optical MEMS: Micro mirror.

Module IV: RF MEMS **9 Hours**

Switches: Cantilever MEMS based switch; Inductors and Capacitors: Modeling and design issues of planar inductor and capacitors; RF Filters: Modeling of mechanical filters; Phase Shifters: Classifications and limitations; Micro machined antennas: Micro-strip antennas - design parameters.

Module V: Instructional Activity **9 Hours**

Modeling - simulation and analysis of applications of MEMS switch - sensors and actuators using related platform.

Reference Books:

1 Madou M, “Fundamentals of Micro Fabrication” CRC Press, 3rd Edition, 2011.

2 Senturia, “Micro System Design”, Kluwer, 2007.

3 *Maluf N ,* Williams K, “An Introduction to Micro- electromechanical Systems Engineering*”, Artech House,* 2nd Edition, 2004.

4 Varadan V K, Vinoy K J, Jose K A, “RF MEMS and Their Applications” Wiley & Sons, 2003.

5 Rebeiz G, “RF MEMS: Theory, Design, and Technology”, Wiley/ IEEE Press, 2004.

6 Robert D C, “Finite Element Modeling for Stress Analysis”, John Wiley and Sons, 1995.

Hyperlinks:

1. https://www.ece.ucsd.edu/faculty-research/books-by-faculty/rf-mems-theory-design-and-technology
2. https://www.meripustak.com/Rf-Mems-Theory-Design-And-Technology-230241

ECEICS 721

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 722	ROBOTICS	2	1	0	3	45

Prerequisite : Engineering Mathematics

Objective : On completion of this course, the students will have a knowledge of different types of robots, their operations, control, programming and applications.

Outcome : Students will be able to analyze the advanced technical details behind the Robotics.

Module I: Introduction and Types of Robotics **9 Hours**

Automation and Robotics- Robot Anatomy- Classification of Robots by DOF motion- platform- power source- intelligence and application area.

Module II: Basic Components of Robots **9 Hours**

Manipulators: Wrists- End effectors- control units- power units- Robot sensors- proximity sensors- range sensors- tactile sensors- visual sensors- sensors for mobile robots.

Module III: Robot Motion Analysis and Control **9 Hours**

Introduction to manipulator kinematics- Homogeneous transformations and Robot Kinematics- manipulator path control- robot dynamics- configuration of a Robot controller- Obstacle avoidance.

Module IV: Robot Programming and Applications **9 Hours**

Method of Robot Programming- lead through programming methods- A robot program as a path in space- motion interpolation- weight- signal and delay commands- branching- capabilities and limitations of lead through methods - Material handling- processing operations- Assembly and inspection- future applications

Module V: Instructional Activity **9 Hours**

Design and Analysis of IoT-Based Intelligent Robot for Practical Monitoring and Control. Design drone in simple way with minimal components.

Reference Books:

1. Timothy Pratt and Charles W. Bostain, “Satellite Communications”, 2nd Edition, Wiley, 2012.
2. D. Roddy, “Satellite Communication”, 4th Edition (Reprint), McGraw Hill, 2009.
3. Wilbur L. Pritchard, Hendri G. Suyderhoud and Robert A. Nelson, “Satellite Communication Systems Engineering”, Prentice Hall/ Pearson, 2007.
4. Tri T. Ha, “Digital Satellite Communication”, 2nd Edition, McGraw Hill, 1990.
5. Brian Ackroyd, “World Satellite Communication and Earth Station Design”, BSP Professional Books, 1990.

Hyperlinks:

1. http://advancedengineering.umd.edu/node/2320
2. http://ece564web.groups.et.byu.net
3. http://personal.stevens.edu/~yyao/syllabus-674.html
4. http://staff.um.edu.mt/carl.debono/lectures.htm

ECEICS 722

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 723	TERAHERTZ TECHNOLOGY	2	1	0	3	45

Prerequisite : Electromagnetics and microwave theory.

Objective : To impart RF system design for different applications. To learn the high power source design concepts, different types of mm/THz wave sources and their design methodology.

Outcome : Students will be able to design different types of mm/THz sources for various applications.

Module I: Introduction **9 Hours**

THz Terminologies - Physical Principles of THz Interaction with Matter - Electromagnetic Waves in Matter - THz Radiation and Elementary Excitations - Laser Basics.

Module II: THz Detectors and Sources **9 Hours**

Ultrafast Optics - THz Emitters and Detectors based on Photoconductive Antennas - Optical Rectification - Free-space Electro-optic Sampling - Ultrabroadband Terahertz Pulses - Terahertz Radiation from Electron Accelerators - Novel Techniques for Generating Terahertz Pulses - Continuous-Wave Terahertz Sources and Detectors.

Module III: Materials and THz Components **9 Hours**

Graphene - Carbone Nano Tubes - Plasma - Photoconductive materials and properties - Terahertz Components: Antenna - Filters - Oscillators etc.

Module IV: THz Imaging **9 Hours**

Imaging with Broadband THz Pulses. Imaging with Continuous-Wave THz Radiation. millimeter-Wave Imaging for Security. Medical Applications of T-Ray Imaging. Concealed Objects Real-Time Imaging for Security.

Module V: Instructional Activity **9 Hours**

Design - simulation and analysis of different RFIC for wireless applications using related simulation tools.

Reference Books:

1. Yun-Shik Lee, Principles of Terahertz Science and Technology, Springer 2009.
2. Erik Bründermann, Et Al., Terahertz Techniques, Springer 2012.
3. R. A. Lewis, Terahertz Physics, Cambridge University Press 2012.
4. Handbook of Terahertz Technologies: Devices and Applications, Edited By Ho-Jin Song And Tadao Nagatsuma, Jenny Stanford Publisher, New York, 2015
5. Handbook of Terahertz Technology for Imaging, Sensing and Communications, Edited By D. Saeedkia, Woodhead Publisher, 2013.

Hyperlinks:

1. http://www.nptel.ac.in/courses/117107035/
2. http://www.nptel.ac.in/courses/108101092/
3. http://www.nptel.ac.in/courses/108104099/
4. http://www.nptel.ac.in/courses/108104087/

ECEICS 723

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 724	UNDER WATER COMMUNICATION	2	1	0	3	45

Prerequisite : Sensor Networks and Acoustics Communication

Objective : To acquire knowledge on basics of Underwater Acoustics and basics concept of underwater sensors and noises

Outcome : Students will be able to understand the benefits and in-depth functioning of underwater communication

Module I : Fundamentals of Underwater Acoustics **9 Hours**

The ocean acoustic environment - measuring sound level - sound velocity in sea water - sources and detectors - relevant units; sound propagation in the Ocean-; characteristic of sound propagation paths-deep water and shallow water; Range dependent environment - sound attenuation in sea water - surface bottom loss and volume scattering - Snell's law for range dependent Ocean.

Module II: Characteristics of Sonar Systems **9 Hours**

Sonar systems - active and passive sonar equations - transducers and their directivities; Sensor array characteristics: array gain - receiving directivity index - beam patterns - shading and super directivity - adaptive beamforming

Module III: Underwater Sensors **9 Hours**

Sonars - hydrophones - DAS - ROV - AUV - Side scan sonar - Echo sounder - MBEC - Sub bottom profiler - magnetometer - dredger - sensors application in shallow water and deep water.

Module IV: Underwater Noises **9 Hours**

Basic Concept of noises in underwater - Types of noises : natural - man made - ambient noise types –seismic - wind - biological - lobsters - dolphin - shipping, turbulence noise - rain etc. - Study on location based noises - Comparison between various noises in underwater.

Module V: Instructional Activity **9 Hours**

Study the performance analysis of underwater communication wireless model for different types of noise effects/ simulate the underwater wireless communication model for nodes placed in different positions and determine its data rate using open source software tool.

Reference Books:

1. Robert J Urick, “Principles of Underwater Sound” 3rd Edition, Peninsula Publications, 2013
2. L.M.Brekhovskikh & Yu.P.Lysanov, “Fundamental of ocean acoustics”, Springer, 2002.
3. Gross M.G., “Principles of Oceanography”, 7th Edition, Prentice-Hall, 1995.
4. Ask T., “Handbook of Marine Surveying”, Sheridan House, 2007.

Hyperlinks:

1. https://www.ssn.edu.in/wp-content/uploads/2020/02/Impulse_Jan-2017.pdf
2. https://www.science.gov/topicpages/u/underwater+communication+systems

ECEICS 724

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 725	VEHICULAR NETWORK	2	1	0	3	45

Prerequisite : Introduction to Data Communications or an equivalent networking course

Objective : To develop an understanding of the basic concepts of vehicular networks and their communications protocols.

Outcome : Students will able to understand the basic principles, standards, and system and protocol architecture of Vehicular Networks.

Module I: Introduction **9 Hours**

ITS & IVC - V2V & V2I communication - Motivation, Common Terms - past and ongoing VANET activities - Issues and Challenges - Vehicle Localization - Applications of V2X: Safety vs. non-safety; Use cases: Traffic information systems; Mapping service requirements to communication technologies

Module II: Architecture **9 Hours**

Network Architecture ; Protocols Stack: Layering and Standards - Fundamental principles of layering - DSRC/WAVE - ETSI ITS-G5 and ARIB architectures; IEEE 802.11p ; PHY and MAC ; Security Mechanism; IEEE 1609 WAVE multi-channel operation

Module III: Channel Modelling And Modulation Schemes **9 Hours**

Vehicular channel characteristics; Impact of channel impairments on system design; Techniques for combating channel impairments; Design of OFDM parameters in 802.11p ; Digital modulation schemes in 802.11p; Transmit power control and transmit masks

Module IV: Routing Protocols **9 Hours**

Routing in VANETs: Flooding and the 'Broadcast Storm Problem' - Opportunistic packet forwarding - topology based routing - geographic routing; Beaconing; DTN and peer-to-peer ideas for VANET routing; Mobility models - Traffic flow models

Module V: Instructional Activity **9 Hours**

Simulation of VANET scenario with any one of channel model/modulation/ routing protocols using any of the open source network simulation tool

Reference Books:

1. Luca Delgrossi, Tao Zhang, "Vehicle Safety Communications: Protocols, Security, and Privacy",1st Edition, John Wiley & Sons Ltd., 2012.
2. Hannes Hartenstein and Kenneth P. Labarteaux, "VANET: Vehicular Applications and Inter-Networking Technologies",1st Edition, John Wiley & Sons Ltd., 2010.
3. Christophe Sommer and Falko Dressler, "Vehicular Networking", Cambridge University Press, 2014.
4. Claudia Campolo, Antonella Molinaro and Riccardo Scopigno, "Vehicular ad hoc Networks: Standards, Solutions and Research", Springer, 2015.
5. Moustafa H, Zhang Y, "Vehicular Networks: Techniques, Standards, and Applications", CRC Press, 2009.
6. K. Sampigethaya et al.," CARAVAN: Providing Location Privacy for VANET", ESCAR 2005.
7. I. Chisalita and N. Shahmehri, " A Novel Architecture for Supporting Vehicular Communication", VTC Fall 2002.

Hyperlinks:

1. http://www.irma-international.org/viewtitle/43163/
2. https://en.wikipedia.org/wiki/Vehicular_ad_hoc_network
3. http://comp.ist.utl.pt/~rmr/WSN/CaseStudies2007-no/WSN_Transportation

ECEICS 725

Course Code	Name of the Course	Periods			Credits	Total Hours
		L	T	P		
ECEICS 726	WIRLESS NETWORKS	2	1	0	3	45

Prerequisite: Wireless Communication

Objective : To study the different types of wireless networks

Outcome : Students able to design different types of wireless networks

Module I: Wide Area Networks **9 Hours**

Introduction:WLAN technologies - IEEE802.11: System architecture - protocol architecture - 802.11b - 802.11a - Hiper LAN: WATM – BRAN - HiperLAN2 : Architecture; WPAN : Bluetooth - IEEE 802.15.4 - Wireless USB – Zigbee - 6LoWPAN - Wireless HART: Characteristics and Architecture; WiMAX: BWA - issues and challenges of WiMAX - network architecture - protocol stack of IEEE 802.16 - differences between IEEE 802.11 and IEEE 802.16

Module II: Wireless Internet **9 Hours**

Introduction: Mobile IP - IP packet delivery - Agent discovery - tunneling and encapsulation - IPV6- Network layer in the internet - Mobile IP session initiation protocol ; Wireless TCP: Limitations of Conventional TCP - Classification of Wireless TCP; IoT: CoAP

Module III: Wireless Sensor Network and IOT **9 Hours**

WSN: Issues and Challenges - Architecture: System - Protocol Stack; Characteristics; MAC Protocols - Routing Protocols; Enabling Technologies: IoT - Issues and Challenges- Characteristics - Network and Protocol Architecture- Applications

Module IV: 5G Networks **9 Hours**

Introduction: 5G vision - 5G features and issues - Applications of 5G - 5G Technologies: Multicarrier Modulation – NOMA - Smart antenna techniques - System Architecture and Protocol Stack

Module V: Instructional Activity **9 Hours**

Simulation of WLAN/WiMAX/ WSN/ IoT /5G Network using open source network simulation tool

Reference Books:

1. KavehPahlavan and Prashant Krishnamurthy, “Principle of Wireless Networks - A Unified Approach”, Prentice Hall of India, 2006.
2. William Stallings, “Wireless Communication and Networks”, 2nd Edition, Prentice Hall, 2005.
3. Clint Smith and Daniel Collins, “3G Wireless Networks”, 2nd Edition, Tata McGraw Hill, 2007.
4. Vijay Garg K, “Wireless Communications and Networks”, 2nd Edition, Morgan Kaufmann Publishers (Elsevier), 2007.
5. AmitabhaGhosh and RapeepatRatasuk, “Essentials of LTE and LTE-A,” Cambridge University Press, 2011.

Hyperlinks:

1. http://doktora.kirbas.com/Kitaplar/Wireless Networking /Complete.pdf
2. www.tutorialspoint.com/wimax/
3. http://www.infotech.monash.edu.au/units/archive/2012/s2/fit5083.html
4. http://www.utdallas.edu/~venky/

ECEICS 726

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PONDICHERRY UNIVERSITY

SCHOOL OF HUMANITIES

NEP SYLLABUS AND REGULATIONS

FOR

B.A. (HONORS) ENGLISH

[UNIVERSITY DEPARTMENTS]

(from the academic year 2023-24 onwards)

B.A. (Honors) in English

Learning Outcome-Based Curriculum (Compliant with NEP)

Preamble

BA (Honours) in English aims at enriching the students' knowledge in the study of English Language and Literature, familiarising them with various authors, genres, contemporary theories, cultures and historical contexts. It also aims at empowering the learners with their research aptitude through oral and written presentations. The programme helps the students gain access to literatures across the world and assess various socio-cultural aspects as delineated in the literary and visual texts.

Programme Eligibility:

Aspirants should have passed 10+2 from any recognised board and must have studied the Hons seeking subject at the qualifying level.

Course Code: **Duration:** 4 years. **Intake:**25

Programme Outcomes:

After the successful completion of the programme, the graduated students will be able to:

PO1	Understand the significance of literary works in their social, cultural and ideological contexts and acquire mastery of the discipline in a holistic manner.
PO2	Discover the incredible diversity of Languages and Literature throughout the history of the world.
PO3	Gain employability skills like excellence in teaching, creative writing, content writing, script writing etc and inculcate research tendencies
PO4	Appreciate the hermeneutic engagement of creative writings/texts with gender, race, region and identity across various contexts

Program-Specific Outcomes (PSO):

After four years of successful completion of the program, the students will be able to:

PSO1	Acquire profound knowledge of literature and proficiency in communicative language skills that would guarantee good employment opportunities
PSO2	Gain vast knowledge in the field of English studies, which would help them face competitive exams like UGC-NET, GATE, SET, UPSC etc…
PSO3	Validate the literary texts with contemporary critical theories, methodologies, and practices in the field.
PSO4	Celebrate the diversity of humanist discourses delineated in the texts-both literary and visual
PSO5	Acquire professional skills related to comparative literature, translation and media studies.

PSO to Mission Statement Mapping

	PSO1	**PSO2**	**PSO3**	**PEO4**	**PEO5**
M1	✓	✓	✓	✓	✓
M2	✓	✓	✓	✓	✓
M3	✓	✓	✓	✓	✓
M4	✓	✓	✓	✓	✓

PO to PSO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
PSO1	✓	✓	✓	✓	✓
PSO2	✓	✓	✓	✓	✓
PSO3	✓	✓	✓	✓	✓
PSO4	✓	✓	✓	✓	✓
PSO5	✓	✓	✓	✓	✓

6. Programme Structure:

SEMESTER 1

	Type of Course	**Title**	**Course Code**	**Credits**
1.	Major Discipline 1	English Literature—I		4
2.	Minor Discipline 1	Communicative English		4
3.	Multi-disciplinary 1	English for Competitive Exams		3
4.	Skill Enhancement 1	Spoken English		3
5.	Value Added Course 1	Understanding India		2
6.	Value Added Course 2	Environmental Studies		2
7.	Modern Indian Languages			3

SEMESTER 2

	Type of Course	Title	Course Code	Credits
1.	Major Discipline 2	English Literature—II		4
2.	Minor Discipline 2	Academic Writing Skills		4
3.	Multi-disciplinary 2	Professional Communication in English		3
4.	Ability Enhancement 1	Functional English—I		3
5.	Skill Enhancement 2	Creative Writing in English		3
6.	Value Added Course 3	Health and Well-Being, Yoga Education, Sports and Fitness		2
7.	Value Added Course 4	Digital Technologies		2

SEMESTER 3

	Type of Course	Title	Course Code	Credits
1.	Major Discipline 3	History of English Literature		4
2.	Major Discipline 4	Literary Forms and Movements		4
3.	Minor Discipline 3	Literature and Visual Media		4
4.	Multi-disciplinary 3	Content Writing		3
5.	Ability Enhancement 2	Functional English—II		3
6.	Skill Enhancement	Functional Communicative English		3

SEMESTER 4

	Type of Course	Title	Course Code	Credits
1.	Major Discipline 5	English Language Studies		4
2.	Major Discipline 6	American Literature—I		4
3.	Major Discipline 7	Indian Writing in English—I		4
4.	Minor Discipline 4	Literature and Environment		4
5.	Internship	Community Engagement		2
6.	Modern Indian Languages			3

SEMESTER 5

	Type of Course	Title	Course Code	Credits
1.	Major Discipline 8	Literary Criticism—I		4
2.	Major Discipline 9	Shakespeare		4
3.	Major Discipline 10	Indian Writing in English—II		4
4.	Major Discipline 11	Internship		4
5.	Minor Discipline 5	New Literatures in English		4

SEMESTER 6

	Type of Course	Title	Course Code	Credits
1.	Major Discipline 12	Introduction to Linguistics		4
2.	Major Discipline 13	Modern Poetry		4
3.	Major Discipline 14	Modern Drama		4
4.	Major Discipline 15	Modern Fiction		4
5.	Minor Discipline 6	Subaltern Literature / Indian Aesthetics		4

SEMESTER 7

	Type of Course	Title	Course Code	Credits
1.	Major Discipline 16	Literary Criticism—II		4
2.	Major Discipline 17	American Literature—II		4
3.	Major Discipline 18	Translation: Theory and Practice		4
4.	Minor Discipline 7	Postcolonial Literature		4
5.	Minor Discipline 8	Gender Studies		4

SEMESTER 8

	Type of Course	Title	Course Code	Credits
1.	Major Discipline 19	Comparative Literary Studies		4
2.	Major Discipline 20	Research Methodology		4
3.	Research **OR**	Project Dissertation		12
	Three Major Discipline Courses	Post-Millennial Literary Trends		4
		Regional Literatures		4
		Cultural Studies		4

Total Credit Pattern:

Students are required to obtain **164 credits** to be eligible for the award of the degree of B.A. (Honours) in English.

Sl.No	Semester	Core	Total Credits
1	**SEMESTER I**		**21**
2	**SEMESTER II**		**21**
3	**SEMESTER III**		**21**
4	**SEMESTER IV**		**21**
5	**SEMESTER V**		**20**
6	**SEMESTER VI**		**20**
7	**SEMESTER VII**		**20**
8	**SEMESTER VIII**		**20**
Total Credits			**164**

SEMESTER 1

Course Type: Major Discipline – 1

Course Title: ENGLISH LITERATURE- I

Course Code:

Credits: 4

Course Description:

The course is meant to familiarize the students with the essence, diversity and cadence of early British literature upto the 18th century and to throw open to them the socio-political issues and movements that abounded the British world. Besides, these works hold immense relevance to contemporary times of unrest and would enable students toevaluate the contingencies of life critically.

Course Objectives:

- To provide a comprehensive view of early British literature from the age of Anglo-Saxons.
- To enable learners to widen their awareness of the various writers of literature and their works.
- To create an understanding of the individuality of each writer, the context to which s/he belongs and thespecificities of British literature.
- To make learners decipher for themselves the interface of writers with the contexts, the conflicts theyencounter, the relevance of their thinking, resistance and the reasons for the transitions.

Course Learning Outcomes: Upon successful completion of this course, learners will be able to:

CLO1	Understand the need for literary expression and the distinctiveness of this expression
CLO2	Corroborate literary texts as an admixture of the age and its socio-political culture
CLO3	Relate the literary works to the particular period and the prevailing trends of artistic expression
CLO4	Examine the significance of the evolving forms of literature with respect to the Age in which they appear
CLO5	Use these prescribed texts to develop an insight into a critical appreciation of British Literature

Mapping of Programme Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

Unit 1 – Poetry I

Geoffrey Chaucer: Prologue to *The Canterbury Tales*

Edmund Spenser: "Epithalamion"

William Shakespeare: "Sonnet 116" / "Sonnet 130"

Unit 2 – Poetry II

John Donne: "A Valediction: Forbidding Mourning"

John Milton: Book IX (Lines 568-732) *Paradise Lost*

Alexander Pope: *The Rape of the Lock* (Canto I)

Unit 3 - Prose

Francis Bacon: "Of Studies"

Joseph Addison: "Sir Roger at the Theatre"

Jonathan Swift: "A Proposal for Correcting, Improving and Ascertaining the English Tongue"

Unit 4 - Drama

Christopher Marlowe: *Doctor Faustus*

Thomas Dekker: *The Shoemaker's Holiday*

William Shakespeare: *King Lear*

Unit 5 - Fiction

Daniel Defoe: *Robinson Crusoe*

Samuel Richardson: *Pamela*

Henry Fielding: *Tom Jones*

References:

Albert, Edward. *History of English Literature.* Oxford University Press, 2017.

Chaucer, Geoffrey. -1400. The Pardoner's Prologue & Tale from the Canterbury Tales. Cambridge University Press, 1994.

Hudson, W.H. *An Outline of English Literature.* Maple Press, 2012.

Poplowski, Paul. *English Literature in Context*. Cambridge University Press, 2007.

Spenser, Edmund. *Epithalamion.* Legare Street Press, 2021.

Day, Gary and Docherty Brian, editors. *British Poetry from the 1950s to the 1990s: Politics and Art.* PalgraveMacmillan. 1997.

Smith, Robert Rowland. *On Modern Poetry: From Theory to Total Criticism*. Continuum, 2012.

Stokes, Richard. *The Penguin Book of English Song: Seven Centuries of Poetry from Chaucer to Auden.* Penguin,2016.

Walker, Greg. *Reading Literature Historically: Drama and Poetry from Chaucer to the Reformation.* EdinburghUP, 2013.

Woodman, Thomas. Editor. *Early Romantics: Perspectives in British Poetry from Pope to Wordsworth.* Macmillan, 1998.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each

(10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences

each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Minor Discipline – 1

Course Title: COMMUNICATIVE ENGLISH

Course Code:

Credits: 4

Course Description:

The course will introduce students to the basic aspects of language, grammar and functional usage. It focuses on developing skills in listening, speaking, reading, and writing, as well as concepts like pronunciation, sentence structure, word choice, and style. Students will learn the nuances and technicalities of the language and how to apply English communication skills in various contexts.

Course Objectives:

- Make students proficient and confident communicators in English across a variety of contexts.
- Enable learners to comprehend both spoken and written English in diverse settings.
- Develop students' abilities in the nuances of listening, speaking, reading and writing in English.
- Prepare learners to tackle situations and seek employment with assurance in the modern, globalized world.

Course Learning Outcomes:

Upon successful completion of this course, learners will be able to:

CLO1	Comprehend diverse communication facets through the LSRW macro skills – Listening, Speaking, Reading, and Writing.
CLO2	Employ both verbal and non-verbal communication strategies in a professional setting.
CLO3	Assess language errors, generate grammatically and idiomatically sound spoken and written expressions.

CLO4	Assess one's oral proficiency, encompassing delivering concise formal speeches, engaging in group discussions, and participating in debates.
CLO5	Cultivate an appreciation for literary texts and films.

Mapping of Programme Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Unit 1 – Basics of Communication

Introduction to Communication skills, Importance of Communication, Communication Process, Verbal and Non-verbal Communication, Barriers to Effective Communication

Unit 2 – Listening and Speaking Skills

Importance of Listening, Types of Listening, Barriers, Dialogue and Conversation, Discussion, Public Speaking, Extempore

Unit 3 – Reading Skills

General and Technical Comprehension, Intensive reading, Extensive reading, Skimming and Scanning ,Vocabulary, Idioms and Phrases, Synonyms and Antonyms

Unit 4 – Writing Skills

Functional Grammar, Common Errors, Paragraphs and Essays, Report Writing, Formal and Informal Letters, Emails, Notices, Agenda, Minutes

Unit 5 – Personality Development

Personality Development, Soft Skills, Self-assessment, Emotional Quotient, Body Language; Leadership Qualities; Time Management; Professional Ethics

References:

Dutt, Kiranmai, et al. *A Course in Communication Skills.* Cambridge University Press, 2008.

Green, David. *Contemporary English Grammar: Structures & Composition*. Trinity Press, 2018.

Howard, Peter. *Perfect Your Punctuation.* Orient Longman, Delhi. 1997.

Lewis, Norman. *Word Power Made Easy*. Penguin Publishers, 2015.

Murphy, Raymond. *Essential English Grammar*. 3rd ed., Cambridge University Press, 2004.

Narayanaswami, V. R. *Strengthen Your Writing*. Orient Blackswan, 2009.

Nicholls, Anne. *Mastering Public Speaking*. Jaico Publication, 1999.

Raman, Meenakshi. *Principles and Practice in Technical Communication*. Oxford University

Thomson, A.J. and A.V. Martinet. *A Practical English Grammar*. Oxford University Press.

End Semester Examination

Communicative English

Duration:3 hours **Maximum Marks:100**

SECTION A

I. Answer the following by choosing the most appropriate answer:

10 x 1 = 10

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

II. Answer ANY FIVE of the following in about 100 words each:

5 x 6 = 30

1.
2.
3.
4.
5.
6.
7.
8.

SECTION B

III. Read the passage and answer the given questions:

10 x 1 = 10

Passage

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

IV. Write a paragraph in about 150 words on ANY ONE of the topics below:

1 x 10 = 10

1.

2.

3.

V.: Write any two from the given topics

(Paragraphs, Essays, Report Writing, Formal and Informal Letters, Emails, Notices)

1 x 7.5 = 7.5

1 x 7.5 = 7.5

SECTION C

VI. Fill in the blanks (different aspects of grammar):

5 x 1 = 5

1.
2.
3.
4.
5.

VII. Complete the following sentences (different aspects of grammar):

5 x 1 = 5

1.
2.
3.
4.
5.

VIII. Match any FIVE of the words in Column A with their correct meanings in Column B: 5 x 1 = 5

A	B
1.	
2.	
3.	
4.	
5.	
6.	
7.	

IX. Correct the following sentences (different aspects of grammar):

10 x 1 = 10

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Course Type: Multidisciplinary – 1

Course Title: ENGLISH FOR COMPETITIVE EXAMS

Course Code:

Credits: 3

Course Description:

This course is designed keeping in mind the English language needs of students attending different competitive exams. It is structured in a way to increase the language proficiency of the learners to enable them to crack competitive exams questions that test their language and reasoning skills. The learners will be able to work on their grammar and vocabulary through exercises in reading comprehension, error spotting and correction, idioms and phrases, word substitution, synonyms and antonyms etc. Students will also be trained in basic writing skills to help them deal with descriptive type questions. The course aims to make learners employable and industry ready on graduation.

Course Objective:

- This course prepares students for competitive exams like UGC-NET, SLET, UPSC Civil Services by developing English proficiency.
- Enhance their knowledge of grammar and stylistics to write better answers
- Teach time management.
- Refine language through improved vocabulary

Course Learning Outcomes:

Upon successful completion of this course, learners will be able to

CLO1	Demonstrate strong reading comprehension skills and analyse complex texts effectively.
CLO2	Write well-structured essays, precise answers, reports, and letters using clear language and grammatical structure.
CLO3	Translate passages accurately from English to native language and vice versa.
CLO4	Use a wide range of vocabulary and understand idioms, phrases, and figures of speech.
CLO5	Apply grammar rules and concepts like synonyms, antonyms, concord, and error spotting to produce linguistically sound written work.

Mapping of Programme Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

Unit 1: Reading Comprehension

Reading for main idea and details; Inferring from the context; Critical reading and evaluation of texts; Reading strategies; Types of reading - skimming, scanning, intensive and extensive reading; Understanding tone and style, rhetorical devices in texts; Reading comprehension practice using different types of passages

Unit 2 – Functional Grammar

Parts of speech; Articles; Prepositions; Subject-verb Agreement; Active/Passive Voice; Phrasal verbs; Clauses; Reported speech; Idioms and Phrases; Synonyms and Antonyms

Unit 3 – Written Communication

Paragraph Writing; Essay Writing; Description and Narration; Developing an argument; Presenting arguments, ideas and opinions; Report Writing; Formal and Informal Letters; Note-making; Summarizing and Paraphrasing; Precis Writing; Notice; Poster making

Unit 4 – Listening and Speaking Skills

Listening and Hearing; Importance of listening skills; Features of effective speech; Simple social exchanges; Dialogue practice; Making persuasive arguments; Elocution

Unit 5 – Study Skills

Expanding vocabulary - learning new words, understanding meanings, and using them correctly

Research and using the library—finding relevant information; Using catalogues, books, periodicals, bibliographies and indexes; Note-making; Paraphrasing; Summarizing; Quoting; Making a references list; Answering exam questions; Understanding the question; Planning the answer; Evaluating the answer.

Recommended Reading:

Aggarwal, R.S. *Objective General English*. S. Chand Publishing, 2022.

Bhatnagar, R.P and Bhargava, Rajul. *English for Competitive Examinations*. Macmillan India Ltd.

Green, David. *Contemporary English Grammar: Structures & Composition*. Trinity Press, 2018.

Narayanaswami, V. R. *Strengthen Your Writing*. Orient Blackswan, 2009.

Sadanand, Kamlesh and Susheela Punitha. *Spoken English; A Foundation Course Part I*. Orient Blackswan; 2011.

Swan, Michael. *Practical English Usage*. Oxford University Press, 2013

Thorpe, E. and Thorpe, S. *English for Competitive Examinations*. Pearson, 2012.

Wallace, Michael J. *Study Skills in English*. Cambridge University Press, 2004.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each

(10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences

each: (5x4=20)

1. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Skill Enhancement – 1

Course Title: SPOKEN ENGLISH

Course Code:

Credits: 3

Course Description:
This course is meant to familiarize students with the basics of conversing in the English Language. It aims at equipping them with the skills that will help them to learn the building blocks of the language, the use of which has become essential in everyday life. It will also be beneficial for those who wish to improve their skills of spoken English. The course content will cover topics that deal with speaking skills, listening skills, grammar, pronunciation, vocabulary building, communication, etc.

Course Objectives:
- To familiarize learners with the skills of spoken English
- To enhance the speaking and listening skills of learners
- To aid learners in employing basic grammar and pronunciation accurately
- To enable learners to understand group dynamics and participate in group activities
- To help learners in being able to communicate effectively, both verbally and non-verbally

Course Learning Outcomes:

CLO1	Speak English with proficiency
CLO2	Demonstrate knowledge in the correct use of grammar and pronunciation
CLO3	Develop an appreciation of practical ways of learning to speak simple and correct English
CLO4	Use the studies undertaken in the field of spoken English in a range of practical contexts
CLO5	Apply knowledge and skills in the field of spoken English to relevant contexts thus aiding in handling everyday situations

Course Content:

Unit I – Working with Grammar
Sentence construction; Types of sentences; Parts of speech; Auxiliary verbs; Singular and plural; Active and passive voice; Degrees of comparison; Subject-verb agreement; Determiners; Punctuation; Common errors and usage

Unit II – Vocabulary Building and Pronunciation

Word formation; Synonyms and Antonyms; Homonyms; One-word substitutes; Changing one part of speech to another; Odd-one-out exercises; Idioms and phrases; Joining sentences; Vowel and Consonant sounds; Word Stress; Sentence stress; Intonation; Practice in pronunciation

Unit III – Conversational Skills

Basics of conversation (Introductions, greetings, asking questions); Describing people, places, situations and events; Extempore speeches; Persuasive and descriptive speeches; Speaking through narration; Narrating stories; Describing characters and situations of the story

Unit IV – Group Communication

Basics of group discussion; Assigning tasks to class groups; Appointing group leaders to communicate; Completion of tasks based on communication; Group cohesion through communication; Group presentations; Use of power point presentations

Unit V – Listening Skills and Non-verbal Communication

Importance of listening; Basics of listening; Barriers to listening; Listening for gist, style, and tone; Voice recording exercises; Body language; Importance of body language in communication; Gestures, posture, eye contact, and facial expressions; Etiquette

Recommended Reading:

Balan, K.R. and Rayudu C.S. *Effective Communication*. Beacon, 1996.

Howard, Peter. *Perfect Your Punctuation.* Orient Longman, Delhi. 1997.

Lewis, Norman. *Word Power Made Easy*. Penguin Publishers, 2015.

McCarthy, Michael and Felicity O'Dell. *English Vocabulary in Use: Advanced*. Cambridge University Press, 2008.

Mohan Krishna & Banerji, Meera. *Developing Communication Skills*. Macmillan India, 1990.

Quirk, Randolph and Greenbaum Sidney. *A University Grammar of English*. Longman. 1973.

Wren P.C. and Martin H. *High School English Grammar and Composition*. Blackie ELT Books, 2011.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Value Added Course – 1

Course Title: Understanding India

Course Code:

Credits: 2

Course Type: Value Added Course – II

Course Title: Environmental Studies

Course Code:

Credits: 2

Course Type: Modern Indian Languages

Course Title:

Course Code:

Credits: 3

SEMESTER 2

Course Type: Major Discipline – 2

Course Title: ENGLISH LITERATURE II

Course Code:

Credits: 4

Course Description:

The course is meant to provide a background study of literature from the Romantic Age to the Contemporary Age and to develop appropriate strategies to evaluate seminal literary works critically. Students will also learn the various emerging trends and styles in the literary landscape of post-war Britain, along with the socio-political implications as seen in the prescribed works. The learners will be able to effectively synergise independent learning, analytical and critical thinking capabilities.

Course Objectives:

- To provide a comprehensive view of British literature from the 19th century.
- To learn the social, political and cultural implications and develop appropriate strategies to critically evaluate them.
- To provide an in-depth knowledge of the changing trends and fashions in literature.
- To facilitate an appreciation of literature by introducing the student to the selected seminal literary works.

Course Learning Outcomes: Upon successful completion of this course, learners will be able to:

CLO1	Understand the modes and conventions of the ages covered through critically studying canonical works.
CLO2	Read literary texts as historically representative of the age and its socio-political climate.
CLO3	Identify the prevailing literary trends of different periods and critically evaluate the evolving genres.
CLO4	Acquire a chronological awareness of the literary ages from Romantic Age to the Contemporary Age.
CLO5	Develop the acumen for analysing and evaluating the recent developments in British literature.

Mapping of Programme Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□		□	□	□
CLO2			□	□	
CLO3	□		□	□	□
CLO4		□			
CLO5					□

Course Content:

Unit 1 – Poetry I

William Blake: "The Lamb"

P. B. Shelley: "Ode to the West Wind"

Elizabeth Barrett Browning: "How do I love thee?"

T.S. Eliot: Part I & II "The Waste Land"

Unit 2 – Poetry II

Philip Larkin: "Church Going"

Ted Hughes: "Hawk Roosting"

Seamus Heaney: "Seeing Things"

UNIT 3 - Drama

Bernard Shaw: *Arms and the Man*

John Osborne: *Look Back in Anger*

Tom Stoppard: *Rosencrantz and Guildenstern are Dead*

UNIT 4 - Fiction

Jane Austen: *Pride and Prejudice*

D.H. Lawrence: *Sons and Lovers*

Virginia Woolf: *To the Lighthouse*

UNIT 5 – Short Fiction

H.G. Wells: "Empire of Ants"

Graham Greene: "The End of the Party"

Martin Amis: "Heavy Water"

References:

Albert, Edward. *History of English Literature.* Oxford University Press, 2017.

Blamires, Harry. *Twentieth Century English Literature*. Macmillan, 1982.

Hudson, W.H. *An Outline of English Literature.* Maple Press, 2012.

Poplowski, Paul. *English Literature in Context*, Cambridge University Press, 2007.

Recommended Reading:

Day, Gary and Docherty Brian, editors. *British Poetry from the 1950s to the 1990s: Politics andArt.* Palgrave Macmillan. 1997.

Smith, Robert Rowland. *On Modern Poetry: From Theory to Total Criticism*. Continuum, 2012.

Stokes, Richard. *The Penguin Book of English Song: Seven Centuries of Poetry from Chaucer toAuden.* Penguin, 2016.

Walker, Greg. *Reading Literature Historically: Drama and Poetry from Chaucer to theReformation.* Edinburgh UP, 2013.

Woodman, Thomas. Editor. *Early Romantics: Perspectives in British Poetry from Pope toWordsworth.* Macmillan, 1998.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Minor Discipline – 2

Course Title: ACADEMIC WRITING SKILLS

Course Code:

Credits: 4

Course Description:

One of the major prerequisites for learners at the university level is to show evidence of their learning in the form of written tests, assignments, project reports and dissertations. The aim of this course is to develop the proficiency of the learners in writing English for academic purposes. As these learners have already had the basics of the English structure and pronunciation, this course intends to integrate the various skills and subskills of writing into meaningful writing activities. In addition to this, the learners will also be introduced to academic writing for research and career development.

Course Objectives:

- Introduce students to the practice of writing for academic purposes.
- Review and concentrate on aspects of functional grammar, sentence structure, vocabulary, spelling, punctuation, etc.
- Provide emphasis on composition writing such as essays, paragraphs, and related aspects like coherence, unity; paraphrasing, summarizing, developing an argument etc.
- Enhance writing skills to effectively convey ideas and information through written mediums like letters, resumes, emails, reports, etc.
- Introduce basic research writing skills, formats of research writings, conducting research, note taking, styles of referencing and citation, research ethics and plagiarism tools.

Course Learning Outcomes: Upon successful completion of this course, learners will be able to:

CLO1	Understand the elements of writing and the importance of error-free writing.
CLO2	Exhibit a fundamental knowledge of grammar and demonstrate an ability to synthesise and summarise important ideas, develop arguments and write effective paragraphs and essays.
CLO3	Gain proficiency in written communication at the workplace by being able to effectively compose written modes of professional communication like letters, reports, resumes, emails, etc.

CLO4	Comprehend the idea of research, ways to do research, basic aspects of research writing, framing a hypothesis, documenting, formatting and employing appropriate citation styles.
CLO5	Demonstrate an understanding of integrity in research, ethical practices in research and avoiding plagiarism.

Mapping of Programme Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□		□	□	□
CLO2			□	□	
CLO3	□		□	□	□
CLO4		□			
CLO5					□

Course Content:

Unit I: Introduction

The writing process; style and diction; pre-writing; elements of writing; mechanics of writing; functional grammar; punctuation and spelling; vocabulary building; idioms and phrases; common errors; reading comprehension and note-making; paraphrasing and summarizing; note-taking.

Unit II: Writing in the Classroom

Effective sentences; cohesive writing; clarity and conciseness in writing; introduction to technical writing; modes of writing – description, narration, exposition and argument; essay and paragraph writing; types of essays and paragraphs; organizing paragraphs; introductions and conclusions; organizing the main body; developing an argument; critical thinking skills; reference skills related to note taking, collating information and organizing it.

Unit III: Professional Writing

Importance of writing; written vs. spoken language; formal and informal styles of writing; writing at the workplace; letter writing; format and style; cover letters; business letters; job applications; writing e-mails – style and tone; effective resumes; chronological and functional resumes; types of reports and format of formal reports, short reports for newspaper; memorandum and notice.

Unit IV: Research Writing

Research proposal; writing a research paper; writing an abstract; research methods and methodology; types of research – descriptive, analytical, quantitative, qualitative, conceptual, empirical, etc; planning the research topic; defining and formulating the research problem, importance of literature review, identifying a research gap; developing a working hypothesis; using research databases, citation – MLA and APA styles; in-text citations; footnotes and endnotes; compiling a bibliography; proof reading.

Unit V: Ethics in Writing

Research ethics; plagiarism and other ethical issues; publication ethics; citation and acknowledgement; political correctness; inclusive language; best practices, setting initiatives and guidelines; copyright and intellectual property rights; conflict of interest; open access publications and initiatives.

References:

Bailey, Stephen. *Academic Writing: A Practical Guide for Students*. Routledge Falmer, 2004.

Dutta, Sumanta. *Research and Publication Ethics in Social Sciences*. Bharti Publications, 2022.

Cholij, Mark. *Towards Academic English: Developing Effective Writing Skills*. Cambridge Univ Press, 2007.

Gibaldi, Joseph. *MLA Handbook for Writers of Research Papers*. 9th ed. Modern Language Association of America, 2021.

Hamp-Lyons, Liz, and Ben Heasley. *Study Writing: A Course in Written English for*

Academic Purposes. Cambridge University Press, 2006.

Hewings, Martin. *Advanced English Grammar*. Cambridge University Press, 2007.

Gupta, Renu. *A Course in Academic Writing*. Orient Blackswan, 2017.

Kothari, C. R., and Gaurav Garg. *Research Methodology: Methods and Techniques*. New Age International Publishers, 2019.

Kumar, Ranjit. *Research Methodology: A Step by Step Guide for Beginners*. Sage Publications, 2011.

Narayanaswami, V. R. *Strengthen Your Writing*. Orient Blackswan, 2009.

Ray, Partha Pratim. *A Guide to Research and Publication Ethics*. New Delhi Publishers, 2022.

Rodeny Huddleston, Rodney, et al. *A Student's Introduction to English Grammar*. Cambridge University Press, 2021.

Seely, John. *Oxford Guide to Effective Writing and Speaking*. Oxford University Press, 2013.

Seely, John and Judith Leigh. *CVs and Job Applications*. Oxford University Press, 2005.

Swan, Michael. *Practical English Usage*. Oxford University Press, 2013

Tickoo, Champa, and Jaya Sasikumar. *Writing with a Purpose*. Generic Publishers, 2014

End Semester Examination

ACADEMIC WRITING SKILLS

Duration:3 hours **Maximum Marks:100**

SECTION A

I. Answer the following by choosing the most appropriate answer:

10 x 1 = 10

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

II. Answer ANY FIVE of the following in about 100 words each:

5 x 6 = 30

1.
2.
3.
4.
5.
6.
7.
8.

SECTION B

III. Read the passage and answer the given questions:

10 x 1 = 10

Passage

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

IV. Write a paragraph in about 150 words on ANY ONE of the topics below:

1 x 10 = 10

1.

2.

3.

V. Draft an application letter and resume to be sent in response to a job advertisement:

1. Letter

1 x 7.5 = 7.5

2. Resume

1 x 7.5 = 7.5

SECTION C

VI. Fill in the blanks (different aspects of grammar):

5 x 1 = 5

1.
2.
3.
4.
5.

VII. Complete the following sentences (different aspects of grammar):

5 x 1 = 5

1.
2.
3.
4.
5.

VIII. Match any FIVE of the words in Column A with their correct meanings in Column B: 5 x 1 = 5

A	**B**
1.	
2.	
3.	
4.	
5.	
6.	
7.	

IX. Correct the following sentences (different aspects of grammar):

10 x 1 = 10

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Course Type: Multidisciplinary – 2

Course Title: PROFESSIONAL COMMUNICATION IN ENGLISH

Course Code:

Credits: 3

Course Description:

We live in an age where fluency in English has become an important feature in the job market for any profession. 'Excellent communication skills' is a criterion that employers stress upon for all positions. Considering these factors, this course attempts to impart the basics of communication in English through written exercises and spoken activities to improve students' general communication abilities and enhance their 'employability'. This is done by laying emphasis on the four key language skills – listening, speaking, reading and writing.

Course Objectives:

- Develop proficiency in all four language skills [LSRW] in the context of professional communication in English.
- Enhance speaking skills to communicate effectively in various professional settings such as interviews and discussions.
- Improve reading and comprehension skills to understand spoken and written English in professional and general contexts.
- Enhance writing skills to effectively convey ideas and information through various written mediums like letters, resumes, emails and reports and explore the different types of writing.

Course Learning Outcomes: Upon successful completion of this course, learners will be able to:

CLO1	Apply communication skills in order to overcome communication barriers, and adapt individual communication style to different professional contexts effectively.
CLO2	Demonstrate proficiency in listening to understand spoken English in various contexts and also to be able to synthesise and summarise important points.
CLO3	Exhibit effective speaking skills by communicating eloquently and confidently in professional contexts like seminars, group discussions and interviews by learning to generate ideas and present them in a structured manner.
CLO4	Display improved reading skills by comprehending and analysing texts to extract relevant information and identify main ideas to evaluate critically.
CLO5	Produce well-written documents like business letters, emails, resumes, essays, reports and professional correspondence utilising appropriate language and formatting.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

Unit 1-Basic Communication Skills

Introduction; relevance of communication; communication process; types of communication; barriers to communication; overcoming barriers; frames of reference.

Unit 2-Listening

Types of listening; barriers to effective listening; listening and note taking; identifying important points; extracting salient points to summarise.

Unit 3 -Speaking

Public speaking; Setting clear objectives; generating ideas; preparing the speech; seminars; purpose of seminars; making notes to speak from; presentations; structure of presentations; group discussions; types of group discussions and topics; group dynamics; interviews; types of interviews; basic interview structure

Unit 4 -Reading

Comprehension, skimming, scanning, intensive reading, extensive reading, determining vocabulary from word parts and context clues; identifying the central argument as well as details; inferring and identifying implied main ideas; reference and library skills; critical reading and evaluating the text.

Unit 5 - Writing

Functional grammar; spelling and punctuation: vocabulary; common errors; letter writing; format and style; cover letters; business letters; job applications; e-mails; resumes; report writing; note-making; description; narration; essay and paragraph writing.

Recommended Reading:

Billingham, Jo, and Beatrice Baumgartner Cohen. *Giving Presentations*. Oxford University Press, 2003.

Cholij, Mark. *Towards Academic English: Developing Effective Writing Skills.* CUP, 2007.

Dutt, Kiranmai P, et al. *A Course in Communication Skills.* Cambridge University Press, 2008.

Glendinning, Eric H., and Beverly Holmström. *Study Reading: A Course in Reading Skills for Academic Purposes*. Cambridge University Press, 2004.

Hamp-Lyons, Liz, and Ben Heasley. *Study Writing: A Course in Written English for Academic Purposes*. Cambridge University Press, 2006.

Mohan, Krishna, and Meera Banerji. *Developing communication skills*. Macmillan, 2016.

Murphy, Raymond. *Intermediate English Grammar*. Cambridge University Press, 2012.

Narayanaswami, V. R. *Strengthen YourWriting*. Orient Longman, 1979.

Ogidi, O. C. *Study Speaking: A Course in Spoken English for Academic Purposes.* CUP, 1993.

Patnaik, Priyadarshi. *Group Discussion and Interview Skills*. Foundation Books, 2011.

Prasad, Hari Mohan. *How to Prepare for Group Discussion and Interview*. Tata McGraw-Hill Publishing Company, 1998.

Seely, John. *Oxford Guide to Effective Writing and Speaking: How to Communicate Clearly*.
Oxford University Press, 2013.

Tickoo, Champa, and Jaya Sasikumar. *Writing with a Purpose*. Generic Publishers, 2014.

Ur, Penny. *Discussions That Work*. Cambridge University Press, 1981
.

Van Emden, Joan. *Effective Communication for Science and Technology*. Macmillan, 2001.

Department of English, Pondicherry University

End Semester Examination

PROFESSIONAL COMMUNICATION IN ENGLISH

Three hours **100 Marks**

SECTION A

I. Answer the following by choosing the most appropriate answer:

10 x 1 = 10

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

II. Answer the following in about 50 words each: **10 x 2 = 20**

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

SECTION B

III. Answer ANY FIVE of the following in about 300 words each: **5 x 6 = 30**

1.
2.
3.
4.
5.
6.
7.
8.

IV. Read the passage and answer the given questions: 10 x 1 = 10

Passage

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

V. Scan the information below and answer the given questions: 10 x 1 = 10

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

SECTION C

IV. Write a paragraph in about 500 words on ANY ONE of the topics below:

1 x 10 = 10

1.

2.

3.

V.Answer the question in 250 words:

1. 1 x 5 = 5

2. 1 x 5 = 5

Course Type: Ability Enhancement – 1

Course Title: FUNCTIONAL ENGLISH - I

Course Code:

Credits: 3

Course Description: This is the first of the two mandatory courses in English for students of all the departments. Its primary objective is to equip students with the necessary knowledge, skills, and understanding of the English language to communicate effectively. The course also emphasizes the use of grammar in communicative ways, fostering effective and efficient English communication. Classroom interactive exercises like extempore, public speaking, and presentations encourage oral communication skills. After each of the five units, students will engage in comprehensive exercises focusing on listening, speaking, reading, and writing (LSRW) skills. Overall, the course aims to develop creative abilities and a genuine proficiency in language, literature, and communication within their respective subjects.

Course Objectives:

- To equip students with the essential knowledge and skills required for effective communication and fostering their ability to think critically and express their thoughts coherently.
- To emphasize the practical and communicative use of grammar.
- To enhance oral communication abilities of students through classroom interactive exercises such as extempore, public speaking, and presentations.
- To instill a genuine appreciation for language, literature, and effective communication. To nurture well-rounded individuals by offering a comprehensive learning experience.

Course Learning Outcomes: Upon the successful completion of the course, learners will be able to:

CLO1	Develop fluency and confidence in their English language abilities
CLO2	Apply grammar rules effectively in their spoken and written communication, making them efficient communicators in English.
CLO3	Express their ideas confidently and articulately.
CLO4	Explore and express their creativity through the study of prose, poetry, and literature.
CLO5	Be proficient in the English language and also connect language skills to their respective subjects.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□	□	□	□	□
CLO2		□			□
CLO3	□		□	□	
CLO4	□		□		□
CLO5		□			□

Course Content:

Unit 1

MulkRaj Anand: The Lost Child

Abdul Kalam: My Early days

Essential English Grammar Units 1 to 14

Unit 2

William Wordsworth: The Affliction of Margaret

Oscar Wilde: The Model Millionaire

Essential English Grammar: Units 15 to 33

Unit 3

A J Cronin:	The Two Gentlemen of Verona
Kamala Das:	Punishment in Kindergarten
Essential English Grammar:	Units 34 to 48

Unit 4

Larry Collins & Dominique Lapierre:	The Second Crucifixion
Sylvia Plath:	Mirror
Essential English Grammar:	Units 49 to 63

UNIT 5

Group discussions; Listening Skills; Note-making

Prescribed Text References:

Pillai, Radhakrishna G and Geetha Rajeevan. *Impressions-1: A Multi-skill Course in English.* Cambridge University Press, 2010.

Murphy, Raymond. *Essential English Grammar*. Cambridge University Press, 2012.

Recommended Reading:

Craven, Miles and Kristin Donnalley Sherman.*Q: Skills for Success: Listening and Speaking(Advanced)*.Oxford University Press, 2019.

Dev, Anjana Neira. *Academic Writing and Composition*. Pinnacle, 2015.

Hamp-Lyons, Lizand Ben Heasley. *Study Writing: A Course in Writing Skills for Academic Purposes.* Cambridge University Press, 2006.

Hancock, Mark. *English Pronunciation in Use*. Cambridge University Press, 2017.

Richards, Jack C. And David Bohlke. *Speak Now: Communicate with Confidence 3*. Oxford University Press, 2014.

End Semester Examination

FUNCTIONAL ENGLISH – I

Duration:3hours **Total**

Marks:100

Section A

I. Answer the following questions in a single word or phrase: 10x1= 10

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Section B

Answer any FIVE of the following in 100words: 5x7=35

1.
2.
3.
4.
5.
6.
7.
8.

Section C

III

Answer any ONE from the following in about 200 words: 2x10=20

1.
2.
3.

Section D

IV. Write an essay on any ONE of the following:

(10x1=10)

1.
2.
3.

Section E

V. Read the questions carefully and answer all of the following: (25 marks)

a. Match only FIVE of the following words in Column A with their correct meanings in Column B
(5 marks)

No.	A	B
1.		
2.		
3.		
4.		
5.		
6.		

b. Read the following sentences carefully and identify the most appropriate word given in the list below to complete the sentences: much, many, a few, few, for, since, during
(5 marks)

1
2.
3.
4.
5.

c. Make sentences with any FIVE of the following words: (5 marks)

a. b. c. d. e. f. g.

d. Rewrite the sentences given below to Reported speech: (5 marks)

1.
2.
3.
4.
5.

e. Combine the following sentences, using when or because: (5 marks)

1.

2.

3.

4.

5.

Course Type: Skill Enhancement – 2

Course Title: CREATIVE WRITING IN ENGLISH

Course Code:

Credits: 3

Course Description: This course provides students with the tools and techniques to become imaginative and skilled writers across multiple genres. Through a mix of reading, writing exercises, workshops, and discussions, students will develop their creativity, personal writing style, and skills for poetry, fiction, drama, and writing for media.

Course Objectives:

- Develop creativity and imagination in writing across different genres.
- Analyze literary devices and language varieties to strengthen personal writing style.
- Practice core creative writing techniques for poetry, fiction, and drama.
- Adapt writing products for different media formats.

Course Learning Outcomes: Upon successful completion of this course, learners will be able to:

CLO1	Students will produce original creative writing pieces using inventive ideas and perspectives.
CLO2	Students will intentionally employ literary techniques to craft a distinctive writing voice.
CLO3	Students will effectively apply genre conventions and forms in poetry, fiction, and drama writing.
CLO4	Students will successfully tailor their writing for print, digital, and multimedia platforms.
CLO5	Students will develop edited manuscripts that reflect clarity, cohesion, and writing quality expected for publication.

Mapping of Programme Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

Unit 1: Introducing Creative Writing

This unit covers finding inspiration, the importance of creativity and imagination, and building reading skills to enrich creative writing.

Unit 2: Developing a Distinctive Writing Craft

This unit analyzes literary devices, language varieties, grammar and syntax to help develop personal writing style and voice.

Unit 3: Core Creative Writing Genres

A) Poetry - This module explores poetic language, forms, techniques, and modes, including practices like rhyme, free verse, dramatic monologues, and writing verse for children.

B) Fiction - This module examines crafting short stories and novels, using literary and popular fiction, modeling, and writing fiction for young audiences.

C) Drama - This module covers dramatic structure, characterization, theatrical elements, styles, and Indian playwrights. It also provides instruction on writing screenplays and children's theater.

Unit 4: Writing for Media

This unit discusses adapting writing for different media like print, broadcast, online, and advertising.

Unit 5: Editing and Publishing

This unit focuses on revising drafts, proofreading, editing, and preparing manuscripts for publication.

Recommended Reading:

Barnet, Sylvan, and William E. Cain. A Guide to Writing about Literature. Pearson, 2006.

Bennet, Hal Zina. Write from the Heart: Unleashing the Power of Your Creativity. New World Library, 2001.

Scholes, Robert, et al. Elements of Literature: Essay, Fiction, Poetry, Drama, Film. Oxford University Press, 2007.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each

10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences

each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or.
b.

III. Answer the following questions in about 500 words (4x15=60)

2. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or
b.

Course Type: Value Added Course – 3

Course Title: Health and Well-Being, Yoga Education, Sports and Fitness

Course Code:

Credits: 2

Course Type: Value Added Course – 4

Course Title: Digital Technologies

Course Code:

Credits: 2

SEMESTER 3

Course Type: Major Discipline – 3

Course Title: HISTORY OF ENGLISH LITERATURE

Course Code:

Credits: 4

Course Description:

The course begins with the Anglo-Saxon traditions and traverses through the different eras that followed. The course provides basic details of English literary history through times and accounts for the developments and evolution of literature through writers of each age from the Anglo Saxon, to the Renaissance, Victorian Era up to the Modern era.

Course Objectives:

- To provide a grounding to the background history of literature at the undergraduate level.
- To equip learners with the knowledge of each era and its bearing upon literary writings.
- To help the learner discern how the socio-political contexts entwine with literary expressions. To facilitate learners with the nuances of literature that would elevate their skills in understanding the discipline at the higher education level.

Course Learning Outcomes:

Upon the successful completion of the course, learners will be able to:

CLO 1	Acquire a thorough understanding of the basics of English literary history
CLO 2	Develop critical insights into the various trends of literary expressions of the times
CLO 3	Reason out why and how literature serves as an archive of historical changes
CLO 4	Assess how writers of each age acquire as well as oppose the conventions of the previous age and how it equips them to make a prominent difference to their own writings
CLO 5	Accomplish a newer outlook towards literatures of the future

Course Content:

UNIT I

Anglo Saxon Literature – 5th to 14th Century

Chaucer's and Medieval Age 14th to 15th Century

The Renaissance and Reformation (1485-1660 CE)

Tudors and Elizabethan Age 16th to Early 17th Century

Early Tudor Period (1485-1558)

Elizabethan Period (1558-1603)

Jacobean Period (1603-1625)

Caroline Age (1625-1649)

Puritanism (1649-1660)

UNIT II

The Age of Enlightenment (Neo classical period) (1660-1790 CE)

Restoration Age 17th to 18th Century (1660-1700)

The Augustan Age (1700-1750)

Age of Pope

Johnson's Age (1750-1790)

UNIT III

Romantic Age from 19th Century (1790-1830)

Poetry

Novel

Gothic Writings

UNIT IV

Victorian Age and Early 19th Century (1832-1901)

Unit V

The Age of Hardy

Modernism (1914-1945)

Recommended Readings:

Baugh, A.C. Editor. *A Literary History of England (2nd ed.).*Routledge& Kegan Paul,
1967.

Blamires, Henry. *A Short History of English Literature.* Routledge, 2003.

Ford, Boris. Editor. *The New Pelican Guide to English Literature Series.* Penguin
Publications, 1982.

Hudson, William Henry. *An Outline History of English Literature*. Rupa, 2015.

Jayapalan, N. *History of English Literature*. Atlantic Publishers, 2001

Peck, John. Martin Coyle. *A Brief History of English Literature*. Palgrave Macmillan, 2002.

Trivedi, R. D. *A Compendious History of English Literature.* Vikas Publication house.

Sanders, Andrews. *The Short Oxford History of English Literature*. Oxford, 1994.

End Semester Examination

Time: Three Hours Maximum Marks: 100

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or.
b.

III. Answer the following questions in about 500 words (4x15=60)

3. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or
b.

Course Type: Major Discipline – 4

Course Title: LITERARY FORMS AND MOVEMENTS

Course Code:

Credits: 4

Course Description: This paper provides a comprehensive overview of the foundational genres and forms that categorize literature. Students will survey major genres including poetry, drama, fiction, and literary nonfiction while closely examining subgenres within these broader categories. The course explores each genre's unique characteristics, conventions, and historical development with an analysis of representative texts.

Course Objectives:

- Define the characteristics and conventions of major literary genres including drama, narrative fiction, poetry, and literary nonfiction
- Distinguish between subgenres within broader categories like tragedy and comedy in drama, or the novel, short story, and essay in fiction/nonfiction
- Identify important examples of each genre and subgenre, and explain how they exemplify the literary characteristics of their assigned categories
- Analyze a given literary text and determine which genre or subgenre it belongs to based on its formal elements, style, and content
- Understand the historical development and evolution of literary genres across different time periods and cultural contexts

Course Learning Outcomes: Upon successful completion of this course, learners will be able to:

CLO1	Define and identify the core characteristics and conventions of major literary genres including drama, poetry, fiction, and literary nonfiction.
CLO2	Analyze a literary text and determine its genre or subgenre based on literary elements like plot structure, meter, rhyme, point of view, and writing style.
CLO3	Explain how specific texts exemplify or subvert the typical conventions of their assigned genre or subgenre.

CLO4	Discuss the historical development and evolution of literary genres and forms across different literary periods and cultural contexts.
CLO5	Develop critical vocabulary and terminology to write and speak effectively about genre distinctions and innovations in literature.

Mapping of Programme Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

Unit I

Tragedy

Comedy

Tragicomedy

Satire

Unit II

Drama

Novel

Short Story

Essay

Unit III

One-Act Play

Biography

Autobiography

Melodrama

Unit IV

Farce

Ballad

Masque

Epic

Unit V

Lyric

Sonnet

Elegy

Prosody

Ode

Recommended Reading:

Abrams, M.H. *A Glossary of Literary Terms*. Cengage Learning, 1999.

Carter, Ronald. *The Routledge History of Literature in English*. Routledge, 2001.

Nayar, Pramod K. *Studying Literature: An Introduction to Fiction and Poetry*. Orient Blackswan, 2012.

Turco, Lewis. *The Book of Literary Terms: The Genres of Fiction, Drama, Nonfiction, Literary Criticism and Scholarship.* UPNE, 1999.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Minor Discipline – 3

Course Title: LITERATURE AND VISUAL MEDIA

Course Code:

Credits: 4

Course Description:

The course is designed to analyse and interpret the increasing visualisation of contemporary culture. It also helps students develop specific visual and verbal skills for observing, analysing, describing, and critiquing visual imagery from diverse theoretical perspectives. The course will also familiarise the students with the construction of media images, dominant modes of

representation and media's socio-political context. The prime objective of the course is to train

students to experience, analyse and appreciate visual media/ cinema academically. The course is intended to equip the learner with a variety of approaches to the study of media technology, history, aesthetics, and politics. It also helps students to view media/film not just as a medium of entertainment but as a catalyst for social and cultural change.

Course Objectives

- Critiquing the interconnection between popular culture and mass media.
- Understanding the convention of realism and its dependence on technological development.
- Surveying the rise of cinema as discourse and as a literary text.
- Exploring major film theories and their implications.

Course Learning Outcomes: Upon successful completion of this course, learners will be able to:

CLO1	Understand different modes of visual culture and its implications on everyday life.
CLO2	Analyse visual media in the light of gender, race, religion, and caste.

CLO3	Evaluate critical commentaries and theorisations on film from the point of view of Cultural Studies.
CLO4	Apply the theoretical approaches learnt in this course to film analysis and understand the different genres of alternative cinema.
CLO5	Analyse visual media/ films as literary text using various theoretical insights.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□	□			
CLO2		□	□		
CLO3		□	□	□	
CLO4				□	□
CLO5		□		□	□

Course Content:

Unit 1 - Introduction to Visual Culture and Everyday Life

Concept of Visual Culture Visual culture and everyday life

Difference between visual culture, art history and cultural studies Post modernism as a culture of pastiche and simulation

Essays:

Jean Baudrillard : "Postmodern and Popular Culture Simulations" .

Raymond Williams: "Culture," "Art," and "Democracy" definitions from *Keywords: A Vocabulary of Culture and Society.*

Roland Barthes: "The Photographic Message". Nicholas Mirzoeff:"What is Visual Culture?"

Unit - 2 Visualizing Gender, Race, Religion and Caste

The notion of gender as cultural construction of femininity and masculinity. Effects of globalisation on popular culture.

Perspectives of race and ethnicity in visual media.

Contextualizing caste in visual media.

Essays:

Frantz Fanon: "The Fact of Blackness" Richard Dyer: "White"

Films:

Vittorio De Sica**:** *Bicycle Thieves*

Walter Salles*:* *Motorcycle Diaries*

Unit 3 - Theoretical Approaches to Film

Auteur theory Gender film theory Formalist film theory Marxist film theory Psychoanalytical film theory Structuralist film theory Genre studies

Essays:

Andre Bazin: "The Evolution of the Language of Cinema".

Gilbert Harman: "Semiotics and the Cinema: Metz and Wollen".

Films:

Charlie Chaplin: *City Lights*

Sergei Eisenstein: *Battleship Potemkin*

Unit 4 - Understanding Film as Genre Language of film and fiction Narratology in literature and cinema Film and Theatre; Intertextuality

Film and its interaction with other art forms

Alternative Cinema like Queer Cinema, Subaltern Cinema, Documentary.

Essays:

Stephen Neale: "Film Noir"

S Theodore Baskaran: "Patriotic Cinema: An

Aspect of the Freedom Struggle" Sundar Sarukkai:

"Reading Against the Reel"

Film: Akiro Kurosawa: *Rashomon* Robert Bresson: *Pickpocket* Jean-Luc Godard*:* *Breathless*

Unit 5 - Film as Text Language of films Discourse Analysis of films Examining the ideology

Essays:

"What is Wrong with Indian Films?" from *Our films, Their films* by Satyajit Ray.

"Tamil Cultural Elites and Cinema: Outline of an Argument" by M. S. S. Pandian.

Ideology of the Hindi Film: A Historical Construction by M. Madhava Prasad.

Films:

Satyajit Ray*:* *Pather Panchali*
Anand Patwardhan *Jai Bhim Comrade*

References:

Arnold, R. "Fashion." *Feminist Visual Culture*. edited by Carson & Claire Pajaczkowska, London: Routledge, 2001, pp. 207-220.

Barthes, Roland. "The Photographic Message." *Image, Music, and Text,* London: Fontana,1977. Baskaran, S. Theodore. "Patriotic Cinema: An Aspect of the Freedom Struggle." *The Message Bearers,* University of Michigan, 1981, pp. 97-120.

Baudrillard, Jean. "Postmodern and Popular Culture." *Simulations.* New York: Semiotext (e), 1983: pp. 1-13.

Bazin, Andre. "The Evolution of the Language of Cinema." *The Film Theory Reader: Debates and Arguments*, edited by Marc Furstenau, Routledge, 2010.

Dyer, Richard. "White." *Visual Culture: The Reader*. edited by Stuart Hall and Jessica Evans, London: Sage Publications, 1999, pp. 457 – 468.

Fanon, Frantz. "The fact of blackness." *Black Skin White Masks*. New York: Grove Press, 1991, pp. 109 – 140.

Harman, Gilbert. "Semiotics and the Cinema: Metz and Wollen." *Quarterly Review of Film & Video,* vol. 2, no.1, 1977, pp. 15-24.

M. S. S. Pandian. "Tamil Cultural Elites and Cinema: Outline of an Argument." *Economic And Political Weekly*, 1996, pp. 950-955.

Mulvey, Laura. "Visual Pleasure and Narrative Cinema." *Feminism and Film Theory.* Routledge, 2013, pp. 57-68.

Nicholas, Mirzoeff. "What is visual culture?" *An Introduction to Visual Culture.* London and New York: Routledge, 1999, pp. 1 - 34.

Prasad, M. Madhava. *Ideology of the Hindi Film: A Historical Construction*. Delhi; NewYork: Oxford University Press, 1998.

Ray, Satyajit. "What is Wrong with Indian Films?" *Our films, Their Films.* 1976

Raymond Williams, "Advertising: The Magic System." *Problems in Materialism and Culture: Selected Essays.* London and New York: Verso, 1997, 1980, pp. 170 – 195.

Sarukkai, Sundar. "Reading Against the Reel." *The Hindu,*2 Sept. 2017, https://www.thindu.com/entertainment/movies/reading-against-the-reel/article19608515.ece.

Neale, Stephen. "Film Noir." *Genre and Hollywood*, Routledge, 2000, pp. 142-167.

Williams, Raymond. “Culture, Art, and Democracy.” *Keywords: A Vocabulary of Culture and Society*. Revised Edition, NY Oxford, 1976, 1983 pp. 41-45, & 87-98.

Recommended Reading:

Andrew, J. Dudley. *Concepts in film theory*. Oxford University Press, 1984. Baudrillard, Jean. *Simulacra and simulation*. University of Michigan press, 1994.

Brooker, Peter and Will Brooker (eds). *Postmodern After-Images. A Reader in Film, Television and Video*. London: Arnold, 1997.

Bruno, Giuliana. *Atlas of emotion: Journeys in Art, Architecture, and Film*. Verso Books, 2018. Dirks, Nicholas B. *Colonialism, and culture*. University of Michigan Press, 1992.

Hayward, Susan. *Cinema Studies: The Key Concepts.*, 2018. Print.

Marks, Laura U. *The Skin of the Film: Intercultural Cinema, Embodiment, and the Senses*, 2007. Rajadhyaksha, Ashish. *Indian Cinema in the Time of Celluloid: From Bollywood to the Emergency.* Bloomington, Ind: Indiana University Press, 2009. Print.

Williams ,Linda. *In Viewing Positions: Ways of Seeing Film.* New Brunswick: Rutgers University Press, 1995.

Blood Simple (Cohen Brothers, 1984) Citizen Kane (1941) by Orson Welles Deewar (Yash Chopra, 1975) Manthan (Shyam Benegal, 1976) Paranormal Activity (Oren Peli, 2007)

Sant Tukaram (FattelalandDamle, 1936)

The Blair Witch Project (Sanchez and Myrick, 1999)

The Cabinet of Dr. Caligari (Robert Wiene, 1920) 4) Rome, Open City (Roberto Rosellini, 1945) Vertigo (Alfred Hitchcock, 1958)

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each

(10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences

each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course type: Multi-disciplinary 3

Course Title: CONTENT WRITING

Course Code:

Credits: 3

Course Description:

Since the invention of the internet, content writing has become a very profitable and promising vocation. While a degree in mass media or literature is not necessary to work as a content writer, it is nonetheless advantageous in the highly competitive sector.

Course Objectives:

1. To familiarize learners with the basic concepts of Content Writing
2. To brief them on the various styles and techniques of writing and editing
3. To sustain their creative faculty
4. To increase the employability of the learners
5. To generate industry-academia interface through institutional support

Course Learning Outcomes:

CLO1	Understand the basic concepts of Content Writing
CLO2	Learn the knowledge of various styles and techniques of writing and editing
CLO3	Use of their creative skills
CLO4	Corroborate their employability
CLO5	Create an industry-academia interface through institutional support

Mapping of Programme Outcomes with Couse Outcomes:

CLO/ PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CLO1					

CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

Unit 1: Fundamentals of Content Writing

1. The Concept of Content Writing and its relevance
2. Role and Functions of Content Writers
3. Print and Web Content Writing
4. Scope and Types of Content Writing
5. Principles and processes of content writing

Unit 2: Types of Content Writing

1. The process of Content Writing – getting the brief, ideating, researching, structuring, formatting

2. Editing and Proof-Reading—following company style sheet, grammar, copy flow, restructuring, market research

3. Writing Styles - Non-fiction (Essays, Reports), Advertising, Newspapers

4. Writing blogs, case studies, white papers

5. Corporate Communications -- Writing for business-to-business (B2B), business-to-consumer (B2C), press releases, and newsletters – focus on language, jargon, writing style, target audience, formal and informal language

Unit 3:

A. Visual Content

1. Infographics- Importance and relevance
2. Images, Screenshots
3. Videos, Memes, GIFs, 30-degree videos
4. Product Demonstrations

B. Interactive Content

1. Quizzes
2. Polls
3. Interactive white papers

C. Free Tools and Paid Tools

Unit 4: Tools of the Trade

A. Social Media

1. Understanding the basics of social media
2. Understanding social media content writing
3. Understanding PR

B. Plagiarism laws in Content Writing

1. What is plagiarism, rules on plagiarism
2. How to write plagiarism-free copies

Unit 5: Copywriting

A. Introduction to Copywriting

1. Definition, Types, Understanding Audience
2. Writing and Editing

B. Writing for Different Mediums

1. Print Advertising
2. Email Marketing
3. Social Media Copy
4. Website Content

References:

Felder, Lynda. *Writing for the Web: Creating Compelling Web Content Using Words, Pictures, and Sound*. New Riders, CA, USA. ISBN-13: 978-0321794437, ISBN10: 9780321794437.

James, Anthony. *Blog Writing: The Content Creation Blueprint*. Amazon Digital Services LLDKDP print US, 2018.

Jones, Colleen. *Clout: The Art and Science of Influential Web Content*. New Riders, CA, USA. ISBN-13: 978-0321733016, ISBN-10: 0321733010.

Nielsen, Jakob and Budiu, Raluca. *Mobile Usability*. New Riders, CA, USA. ISBN13: 978-0321884480, ISBN-10: 0321884485.

Redish, Janice. *Letting Go of The Words: Writing Web Content That Works*. Morgan Kaufmann. ISBN: 0123859301.

Robinson Joseph. *Content Writing Step-by-step*. Amazon Digital Services LLC--KDP print US, 2020. ISBN: 9798603871929.

Williams, Andy. *How To Write Great Website Content in 2019*. Independently published. ISBN: 1731384467.

https://www.mindler.com/blog/how-to-become-a-content-writer-in-india/

https://www.clearvoice.com/blog/10-types-content-writers-use/

https://study.com/articles/What_is_a_Content_Writer.html

https://www.entrepreneur.com/article/247908 https://www.locationrebel.com/b2b-writing/

https://wordpress.com/support/prevent-content-theft/

https://blog.unisquareconcepts.com/content-writing/what-is-plagiarism-why-is-itimportant-for-blog-writing/

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

III. Answer any TEN of the following in about 2-3 sentences each

(10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences

each: (5x4=20)

IV. Answer the following questions in about 200 words (4x5=20)

2. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

2. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Ability Enhancement – 2

Course Title: FUNCTIONAL ENGLISH II

Course Code:

Credits: 3

Course Description:

This course is a natural progression from Functional English-1, building upon the foundation laidin the previous semester. It caters to students from multiple disciplines. Continuing the momentum set by Functional English-1, this course aims to develop students' proficiency in English, a language widely acknowledged as the preferred medium for international communication across various fields. Throughout the five units, the course is dedicated to enhancing students' linguistic competence and equipping them with essential communication skills for both academic and career pursuits. With a dynamic mix of interactive tasks, students are immersed in activities that aim to elevate their English proficiency.

Course Objectives:

To enhance students' proficiency in English, recognizing it as a crucial language for communication across various fields.

To equip students with essential communication skills that are applicable to both academic and professional settings.

To foster active participation and engagement, encouraging students to immerse themselves in the learning process.

To offer a comprehensive and immersive learning experience, encompassing prose, poetry, literature, and interactive language and grammar exercises.

To nurture students' overall growth, beyond language proficiency, enabling them to havebetter chances of success in both academic and personal endeavors.

Course Learning Outcomes: Upon the successful completion of the course, learners will be able to:

CLO1	Attain English language proficiency and employ it with ease.
CLO2	Express themselves fluently and confidently in English.

CL03	Express their ideas confidently and articulately.
CLO4	Perform better in their academic and personal endeavors.
CLO5	Be proficient in the English language and also connect language skills to their respective subjects.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□		□		□
CLO2		□		□	
CLO3	□			□	
CLO4	□		□		
CLO5		□			□

Course Content:

Unit 1

O Henry:	After Twenty years
Mina Assadi:	A Ring to Me is
Bondage	
Jamaica Kincaid:	Girl
Essential English Grammar:	Units 64 to 74

Unit 2

Raja Rao:	The Cow of the
Barricades	
Aldous Huxley:	The Beauty Industry
Essential English Grammar:	Units 75 to 83

Unit 3

Seamus Heaney:	Digging
Amitav Ghosh	The Town by the Sea
Sujata Bhatt:	A Different History
Essential English Grammar:	Units 84 to 95

Unit 4

R.K. Narayan:	Engine Trouble
Erich Fromm:	Is Love an Art
Essential English Grammar:	Units 96 to 106

Unit 5

Understanding Communication;	Greeting and Introduction;
Making Requests;	Understanding Telephone
Communication	
Essential English Grammar:	Units 107 to 114

Prescribed Texts:

Nayar, Nandini et al. I*mpressions-II: A Multi-skill Course in English.* CUP, 2011.

Murphy, Raymond. *Essential English Grammar*. Cambridge University Press, 2012.

Recommended Reading:

Barker, Alan. *Improve Your Communication Skills*. Kogan Page, 2010.

Brody, Marjorie. *Effective Communication Skills.* B&N Audio Books 2010.

Koneru, Aruna. *Professional Speaking Skills*. Oxford University Press, 2018.

Kulbhushan, Kumar. *Effective Communication Skills.* Khanna Publishing House, 2016.

Murphy, Raymond. *English Grammar in Use Book without Answers: A Reference and Answer Book for Intermediate Learners of English.* CUP, 2012.

End Semester Examination

Functional English – II

Duration: 3 hours **Total Marks: 100**

Section A

I. Answer the following questions in a sentence each:

10x1= 10

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

Section B

II. Answer any FIVE of the following in about 100 words each:

5x7=35

1.
2.

3.

4.

5.

6.

7.

8.

Section C

III. Answer any TWO from the following in about 200 words:

2x10=20

1.

2.

3.

Section D

IV. Write an essay on any ONE of the following: (10x1=10)1.

2.

3.

Section E

V. Read the questions carefully and answer all of the following: (25 marks)

a. Match only FIVE of the following words in Column A with their correct meanings inColumn B (5 marks)

No.	A	B
1.		
2.		
3.		
4.		
5.		
6.		

b. Read the following sentences carefully and identify the most appropriate word given inthe list below to complete the sentences: much, many, a few, few, for, since, during
(5 marks)

1

2.

3.

4.

5.

c. Make sentences with any FIVE of the following words: (5 marks)

a. b. c. d. e. f. g.

d. Rewrite the sentences given below to Reported speech: (5 marks)

1.

2.

3.

4.

5.

e. Combine the following sentences, using *when* or *because*: (5 marks)

1.

2.

3.

4.

5.

Course Type: Skill Enhancement

Course Title: Functional Communicative Writing

Course Code:

Credits: 3

Course Description

The paper aims to help improve and develop the learners' written proficiency in the English language. The course offers learners adequate opportunities to use writing skills in a wide array of situations, which will aid them in the practicality of language use. The course aims to endow students with those study skills so they can function in English in the social and academic spheres. It will also teach them professional skills which will assist them in the preparation for a job. This course aims at equipping the learner with adequate writing skills to be able to put them to use in everyday practical situations.

Course Objectives

- To make learners familiar with the sub-skills of writing
- To enhance learners' writing skills
- To train learners in the use of specific formats of the written discourse
- To enable the learner to employ grammar and vocabulary effectively

Course Learning Outcomes: Upon successful completion of this course, the learners will be able to:

CLO1	Write English with proficiency
CLO2	Demonstrate comprehensive knowledge of the use of different styles of writing
CLO3	Develop an appreciation of varied types of writing
CLO4	Use the studies undertaken in the field of functional communicative writing in a range of writing contexts
CLO5	Apply knowledge and skills in the field of functional communicative writing to relevant contexts thus aiding in everyday situations

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CLO1	□		□		□
CLO2		□		□	
CLO3	□			□	

CLO4	□		□		
CLO5		□			□

Unit I

Types of writing/writing brief descriptions

Expository, descriptive, narrative, and persuasive types of writing
Writing messages
Descriptions of objects, people, places, and situations
Narrating events and stories

Unit II

Detailed writing

Paragraph Writing
Precis writing
Blog writing
Pictorial writing

Unit III

Letter/email writing

Letter Writing in email format
Resume writing
Covering letter
Writing applications

Unit IV

Newspaper articles/ report writing

Letters to the editor
Writing newspaper articles
Report Writing

Unit V

Grammar and vocabulary

Punctuation
Synonyms
Antonyms
Direct and indirect speech
Common errors

Recommended Readings:

Lesikar, Raymond V and Petit, John D. (1994) Business Communication: Theory and Application, Richard D. Irwin Inc. Ilinois.

Raman, Meenakshi and Sharma, Sangeeta (2004) Technical Communication: Principles and Practice, Oxford University Press, New Delhi.

Bahl, J.C. and Nagamia, S.M. (1974) Modern Business Correspondence and Minute Writing.

Balan, K.R. and Rayudu C.S. (1996) Effective Communication, Beacon, New Delhi.

Guffey, Mary Allen, and Dana Loewy. (2018) *Essentials of Business Communication*. 11th ed., Cengage Learning.

Quirk Randolph and Greenbaum Sidney. (1973). A University Grammar of English, Longman.

Wren P.C. and Martin H. (1935) High School English Grammar and Composition, Blackie ELT Books, New Delhi.

McCarthy, Michael and Felicity O'Dell. (2002) English Vocabulary in Use: advanced. Cambridge: CUP, South Asian Edition, 2008.

Mohan Krishna & Banerji, Meera. (1990) Developing Communication Skills. New Delhi: Macmillan India.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

V. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

VI. Answer the following questions in about 200 words (4x5=20)

3. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

3. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

SEMESTER 4

Course Type: Major Discipline 5

Course Title: ENGLISH LANGUAGE STUDIES

Course Code:

Credits:4

Course Description:

The course is designed to introduce students to the fundamental concepts of English Language. It focuses on the study of language, its origin, nature, structure, and function in human society. It seeks to assist students in developing their understanding of the nuances of language in general and English in particular. The course intends to teach various aspects of language like object language, metalanguage, paradigm and syntagm, diachronic and synchronic, structure and pattern, metaphor and metonymy, literary devices, etc The course also seeks to enable learners to understand important theories of language. This, in turn, will help them to develop a broad base that will equip them with the ability to engage with more complex concepts related to language.

Course Objectives

- To help students learn about the origins of language.
- To enable the students to develop an understanding of the structural and functional aspects of language.
- To help students develop a clear understanding of fundamental aspects of the language: structural combination, relationship with paradigm and syntagm, addresser and addressee encounter, and functional English.
- To develop the ability to appreciate literary texts better through a sound knowledge of language.

Course Learning Outcomes: Upon successful completion of this course, the learners will be able to:

CLO1	Demonstrate comprehensive knowledge and skills in multiple areas of English Language Studies.
CLO2	Apply disciplinary knowledge in areas related to English Language Studies to new/unfamiliar contexts in order to solve complex problems.

CLO3	Develop an appreciation of literary texts across languages and regions.
CLO4	Disseminate the studies undertaken in the field of English Language Studies in a range of contexts.
CLO5	Apply knowledge and skills related to English Language Studies to relevant professional contexts like teaching, research, content development, etc.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CLO1	□		□		□
CLO2		□	□		□
CLO3	□		□	□	
CLO4		□	□		
CLO5	□	□	□		□

Course Content:

Unit1-Fundamental Concepts of Language

What is language? Origin of language; Definition of Language; Four chief Theories; Design features of Language, Artificial vs Natural Languages, Human vs Animal Languages, Verbal and Nonverbal Communication, Gestures and Sign Language; The Difference between Language and Communication, and Varieties of Language

Unit 2 – Diachronic Approach to Language

Diachronic, Descent of the English language, Indo-European, Anglo-Saxon and English in Middle Ages, Growth of Vocabulary and Standard English

Unit 3 – Synchronic Approach to Language

Synchronic, Word-Sentence-Utterance, Subject –Predicate, Sentence structure, contiguity and contexture, Agreement of Various Units of the Syntagmatic Structure, Addresser and Addressee Encounter

Unit 4 – Aspects of language

Object Language, Meta-language, Paradigmatic, Syntagmatic, Metaphor and Metonymy, and Literary Devices, and Projections

Unit 5 – Language and Meaning

Definition of Semantics, Some Terms and Distinctions in Semantics, Theories of Semantics.

References:

Barber, Charles. *The English Language: A Historical Introduction*. Cambridge University Press, 2007.

Crystal, David. *The Cambridge Encyclopedia of the English Language*. Cambridge University Press, 2018.

Murphy, Raymond. *English Grammar in Use*. Cambridge University Press, 2002.

Swan, Michael. *Practical English Usage*. 4th ed., Oxford University Press, 2016.

Verma, Shivendra Kishore, and N. Krishnaswamy. *Modern Linguistics*. Oxford University Press, 1989. Yule, George. *The Study of Language*. Cambridge University Press, 2010.

Wood T. Frederick, *An Outline History of the English Language*, Macmillan India Limited, 2008.

Recommended Reading:

Balasubramanian T. 2013. *A Textbook of English Phonetics for Indian Students*. 2nd Edition. Laxmi Publications.

Bauer, L. 2007. *The linguistics Student's Handbook*. Edinburgh: Edinburgh University Press.

Bhaskararao, Peri. *Practical Phonetics.* Pune: Deccan College. 1997.

Burridge, Kate and Tonya N. Stebbins. 2016. *For the Love of Language: An Introduction to Linguistics.*

Cambridge University Press.

Crystal, David. 2006. *How language works*. Penguin Books.

Verma, S.K., and N. Krishnaswamy. 1993. *Introduction to Modern Linguistics*. Delhi: Oxford University Press.

Victoria Fromkin, Robert Rodman, Nina Hyams. 2013. *An Introduction to Language,* 10th Ed.

Wadsworth, Boston. Yule, . The Study of Language Cambridge, Cambridge University Press, 1987.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

III. Answer any TEN of the following in about 2-3 sentences each

(10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences

each: (5x4=20)

IV. Answer the following questions in about 200 words (4x5=20)

2. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

2. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Major Discipline 6

Course Title: AMERICAN LITERATURE – I

Course Code:

Credits: 4

Course Description:

This course offers a comprehensive overview of American Literature, focusing on the foundation and origins of the American literary tradition. Exploring the significant literary works up to the end of the 19th century, the course aims to provide an understanding of the evolution of American Literature, its themes and its engagement with historical and cultural contexts. Each unit concentrates on specific genres like poems, essays, novels, short stories and plays, in addition to an introduction to important historical, political and philosophical thoughts of the period.

Course Objectives:

- To analyse the literary works that laid the groundwork for American literary traditions and understand the socio-cultural context in which they emerged.
- To study the major American writers of the period and their contributions.
- To encourage students to critically examine the texts, considering both literary elements and historical significance.

Course Learning Outcomes: Upon successful completion of this course, learners will be able to:

CLO1	Obtain a comprehensive knowledge of the historical, cultural, and literary foundations of American Literature.
CLO2	Demonstrate an understanding of the literary works through an analysis of themes, characters, styles and other literary devices.
CLO3	Identify the socio-cultural conditions and major historical events that influenced the selected writers and shaped their works.

CLO4	Acquire an in-depth awareness of the diverse voices that contributed to the rich tradition of American Literature.
CLO5	Appreciate the evolution of the existing genres and the emergence of a new genre like the short story in American Literature.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□				
CLO2	□		□		□
CLO3				□	□
CLO4		□	□	□	□
CLO5			□		

Course Content:

Unit 1 - Introduction

Puritanism; American Romanticism; American Renaissance; Abolitionism; Slavery; Civil War and its aftermath; Transcendentalism; American Realism.

Unit 2– Poetry

Anne Bradstreet:	"Prologue"
Phillis Wheatley:	"A Hymn to the Evening"
George Moses Horton:	"On Liberty and Slavery"
Walt Whitman:	"Out of the Cradle Endlessly Rocking"
Emily Dickinson:	"Success is Counted Sweetest"

Unit 3 - Prose

Ralph Waldo Emerson:	"Self Reliance"
Henry David Thoreau:	"Civil Disobedience"

Unit4 - Novel

Nathaniel Hawthorne:	*The Scarlet Letter*
Mark Twain:	*The Adventures of Huckleberry Finn*
Henry James:	*The Turn of the Screw*

Unit 5 - Short Story

Washington Irving:	"The Legend of Sleepy Hollow"
Edgar Allan Poe:	"The Murders in the Rue Morgue"
Herman Melville:	"Bartleby, the Scrivener"
Charlotte Perkins Gilman:	"The Yellow Wallpaper"
Kate Chopin:	"The Story of an Hour"

Recommended Readings:

Atkinson, Brooks, ed. *The Essential Writings of Ralph Waldo Emerson*. Modern Library Inc, 2000.

Crane, Gregg. *The Cambridge Introduction to the Nineteenth Century American Novel*. CUP, 2007.

Franklin, R.W., ed. *The Poems of Emily Dickinson: Reading Edition*. The Belknap Press, 2003.

Gilman, Charlotte Perkins. *The Yellow Wallpaper and Other Stories*. Dover Thrift Edition, 1892.

Hawthorne, Nathaniel. *The Scarlet Letter*. Penguin Classics, 2015.

Irving, Washington. *The Legend of Sleepy Hollow and Other Stories*. Penguin Classics, 2014.

James, Henry and T. J. Lustig, eds. *The Turn of the Screw and Other Stories*. Oxford UP, 2010.

Lehhman, David. *The Oxford Book of American Poetry*. Oxford University Press, 2006.

Melville, Herman. *Moby Dick*. Wordsworth Classics, 1993

Poe, Edgar Allan. *Selected Tales*. Penguin Classics, 1994.

Porte, Joel; Morris, Saundra, eds. *The Cambridge Companion to Ralph Waldo Emerson*. CUP,1999.

Solomon, Barbara H. *The Awakening and Select Stories of Kate Chopin*. Signet Classics, 1976.

Spengemann, William C. *Nineteenth Century American Poetry*. Penguin Classics,1996.

Thoreau, Henry David. *Civil Disobedience and Other Essays*. Thrift Editions, 2000.

Twain, Mark. *Adventures of Huckleberry Finn*. Oxford UP, 2009.

Whitman, Walt. *Leaves of Grass*. Penguin Classics, 1855.

Buell, Lawrence. *New England Literary Culture*. Cambridge University Press, 1986.

Chase, Richard. *The American Novel and Its Tradition*. John Hopkins University Press, 1980.

Bierce, Ambrose. *Tales of Soldiers and Civilians*. E.L.G. Steele, 1892.

Brown, William Hill. *The Power of Sympathy.* William S. Kable, ed. Ohio State Univ Press, 2015.

Brown, William Wells. *The Escape, Or, A Leap for Freedom.* University of Tennessee Press, 2001.

Dutta, Nandana. *Literary Contexts: American Literature*. Orient Blackswan, 2018.

Gray, Ricard J. *A History of American Literature.* Blackwell Publishing, 2011.

Matthiessen, F. O. *American Renaissance: Art and Expression in the Age of Emerson & Whitman.* OUP, 1968.

Patil, Mallikarjun. *Studies in American Literature*. Atlantic Publishers, 2009.

Ruland, Richard and Malcolm Bradbury. *From Puritanism to Postmodernism. A History of American Literature.* Penguin, 1992.

Stowe, Harriet Beecher. *Uncle Tom's Cabin*. Tauchnitz, 1852.

Thompson, G. R. *Reading the American Novel*. Wiley-Blackwell, 2012.

Voss, Arthur. *American Short Story: A Critical Survey*. University of Oklahoma Press, 1980.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

V. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

VI. Answer the following questions in about 200 words (4x5=20)

3. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

3. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Major Discipline 7

Course Title: INDIAN WRITING IN ENGLISH I

Course Code:

Course Credit: 4

Course Description:

The development in Indian writing in English can be traced back to the implementation of Lord Macaulay's Minute in 1835 under the British rule. Ever since then, Indian literature in English is an ongoing process. Today, Indian writing in English is appreciated and well received by the global audience.

Course Objective:

The course aims to trace the development of poetry, prose and fiction in India from the 1940's.The paper attempts to include the works of writers who have contributed to the enrichment of literature during and after India's Independence to the contemporary scenario.

Course Learning Outcomes: Upon successful completion of this course, learners will be able to:

CLO1	It will equip the readers with knowledge about the culture, history and political issues which are reflected in the works of the writers who have immensely contributed to the field of Indian Literature and Language.
CLO2	This will be beneficial to the students in understanding the historical aspect of India's past and present.
CLO3	It will also enable the readers to gain knowledge on the theme, the pattern, the language and the style in Indian writing in English.
CLO4	It will also highlight the impact and effects of India under the British rule on our language, culture and traditions.
CLO5	It will enable the students to have a detail understanding of the Indian writing in English through the various phases of development in Literature.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

UNIT-I- Brief Introduction of the Background of English Education in India

Macaulay's Minute (1835)

Sri Aurobindo (1872-1950) Renaissance in India (Essay Chapter-1)

Poetry:

Henry Louise Vivian Derozio: (1809-1831) "The Harp of India", "The Orphan Girl".

Toru Dutt: (1856-77) " Our Casuarina Tree", " Lakshman".

Michael Madhusudhan Dutt:(1824-1873) The Captive Ladie

Rabindranath Tagore :(1861-1941) " Leave this Chanting", "Purity".

Sorojini Naidu: (1879-1949) "Summar Woods", "The Palanquin Bearers".

Nizzim Ezekiel: (1924-2004) "Goodbye party to Miss Pushpa T S", "Night of the Scorpion".

Kamala Das: (1934-2009) " AnIntroduction", "Someone Else Song".

JayantaMahapatra: (1928….) " Freedom", "Twilight".

UNIT II- Nationalism, Gandhism and Freedom Movement

Mulk Raj Anand: (1950-2004) *Two Leaves and a Bud* (1937)

R.K Narayan : (1906-2001) *TheGuide (1958)*

Raja Rao: (1908-2006) Kanthapur**a**.(1938)

UNIT –III- Short Stories

Shashi Despande: (1938….) Intrusion

Khushwant Singh: (1915…..) The Agnostic

Rita NathKeshari: (1961…) The Transplanted Wife

TemsulaAo: (1945…..) Laburnum for my Head

Unit –IV – Novels and Essays

Anita Desai (1937…) *The Village by the Sea (1982)*

Nayantara Sahgal: (1927….) *Rich Like Us (1985)*

Easterine Kire: (1959….) Terrible Matriarchy (2007)

Amitab Ghosh: (1956…..) 'Countdown' (1999)

Arundhati Roy: (1961…..) 'The Greater Common Good'(1999)

UNIT- V- Drama

Manjula Padmanabam: (1953….) 'Harvest' (1998)

Girish Karnard: (1938….) 'The Dreams of Tipu Sultan' (2005)

Testing and evaluation

Internal Assessment: 40 marks

The break- up of the 40 per cent of the total marks meant for internal assessment will be as follows:

a) Two assignments :10
b) One seminar presentation : 10 marks
c) Three tests of which the best 2 will be considered: 20 marks

External Assessment Marks: ((60 from 100)

Multiple Choices: 10x2=20

Short Questions: 4x5=20

Essay type Questions=3x20=60

Recommended Reading:

Ao, Temsula. *Laburnum for my Head*. Penguin Publication, 2009.

Ao, Temsula. *These hills Called Home: Stories from War Zones*. Zuban publication, 2013.

Desai, Anita. *The Village by the Sea*. Heinemann London, 1982.

Dev, Anjana Neira, and Amrita Naira Dev. *Indian Writing in English*.

Derrett, M.E. *The Modern Indian Novel in English*.

Ghosh, Amitab. *Countdown*. Ravi Dayal Publications, 1999.

Griffiths, Gareth, Bill Ashcroft, and Helen Tiffin, eds. *The Empire Writes Back: Theory and Practice in Post-Colonial Literatures*.

Gupta, Monika, ed. *Women Writers in the 20th Century Literature*. Atlantic Publishers, 2008.

Harrex, S.C. *The Fire and the Offering: The Modern Indian Novel in English*.

Iyenger, K.R. Srinivasa. *Indian Writing in English*.

Karnard, Girish. *The Dreams of Tipu Sultan*. Collected Plays Vol-2. Oxford University Press, 2005.

Keshari, Rita Nath. *The Transplanted wife: Collection of Short stories*. Author Press, 2005.

Kire, Easterine. *Terrible Matriarchy*. Zuban Publication, 2007.

King, Bruce. *Indian Poetry in English*.

Mitra, Zinia, ed. *Indian Poetry in English: Critical Essays*. 2012.

Mukherji, Meenakshi. *Realism and Reality - The Novel and Society in India*.

Mukherji, Meenakshi. *The Twice Born Fiction*.

Naik, M.K. *A History of Indian Writing in English*.

Naik, M.K, ed. *Aspects of Indian Writing in English*.

Naik, M.K. *New Dimensions of Indian Literature*.

Naik, M.K., ed. *Critical Essays on Indian Writing in English*.

Nandy, Ashis. *The Intimate Enemy*.

Narsimhaiah, C.D. *The Swan and the Eagle*.

Naipaul, V.S. *An Area of Darkness*.

Naipaul, V.S. *India: A Wounded Civilization*.

Padmanaban, Manjula. *The Harvest. Kali for Women*, 1998.

Roy, Arundhati. *The Greater Common Good*. India Book Distributors, 1998.

Sahgal, Nayantara. *Rich Like Us*. Heinemann London, 1985.

Singh, Khushwant, ed. *Best Indian Short Stories*. Vol-II. Harper Collins Publication, 2015.

Suleri, Sara. *The Rhetoric of English in India*.

Vishwanathan, Gauri. *Masks of Conquest: Literary Study and British Rule in India*.

Vishwanathan, Gauri. *The Beginnings of English Literary Study in British India*.

Walsh, William. *Indian Literature in English.*

Williams, H.M. *Indo-Anglian Literature: 1800-1970: A Survey*.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Minor Discipline 4

Course Title: LITERATURE AND ENVIRONMENT

Course Code:

Course Credit: 4

Course Description:

Taken in its entirety, the planetary ecological crisis has presently reached a magnitude beyond human comprehension. The course on Literature and Environment seeks to explore this shared precarity of human and nonhuman life on Earth. The course traces the intersections between Ecocriticism and other subfields (like The Anthropocene, Climate Change Fiction, Blue Humanities, and Environmental Humanities), shedding light on the way in which Literature and other forms of cultural expression harness the interpretative powers of Humanities in order to understand the ecological crises.

Course Objectives

- To introduce the learner to the literary, historical, scientific, sociological, political, cultural, and ethical aspects of climate change at the local and global levels.
- To contextualise environmental transformations in terms of global politics, gender, aesthetics, and activism.
- To facilitate the learner to understand the diverse trajectories of environmental crises and their complex role in society.
- To expose the learner to diverse genres of the discourse, including Film, Fiction, Poetry, Creative Nonfiction, and Life Writing.
- To deepen the student's sensitivity and sense of responsibility for our planet and nature

Course Learning Outcomes: Upon successful completion of the course, the learner will be able to:

CLO1	Critically analyse and understand environmental debates and perspectives that include histories, narratives, and alternative voices.
CLO2	Engage sensitively and critically in providing meaningful solutions to climate-related issues.
CLO3	Comprehend the need for exposure to diverse literary genres of environmental crises, their impact on literary representations and cultural productions
CLO4	Reflect upon and acknowledge one's moral and ethical obligations to the planet.
CLO5	Create a more sustainable world for humans, the biota and the abiota – our co-inhabitants of the planet.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□				
CLO2		□	□	□	
CLO3			□	□	
CLO4		□	□		
CLO5			□		□

Course Content:

Unit 1 - Ecocriticism: Concepts, Genres, and Positions

Pastoral, Wilderness, Dwelling, Apocalypse, Social Ecology, Spiritual Ecology, Scientific Conservation, Green Politics, Ecofeminism, Deep Ecology, Bioregionalism, Tinai, Environmental Movements and Environmental Justice.

Unit 2 - Disaster Narratives

Rachel Carson: *Silent Spring*

Terry Tempest Williams: *Refuge: An Unnatural History of Family and Place*

Barbara Kingsolver: *Animal Dreams* (Excerpts) Arif Anwar: *The Storm*

Unit 3 - The Anthropocene

Dipesh Chakraborty: "The Climate of History: Four Thesis"

Rob Nixon: *Slow Violence and the*

Environmentalism of the Poor (Excerpt) Amitav Ghosh: *The Gun*

Island

Unit 4 - Eco-cinema

Chasing Ice (2012): Documentary, Dir. Jeff Orlowski
Godavari (2006): Movie, Dir. Sekhar Kammula *Snowpiercer* (2013):

Movie, Dir. Bong Joon-ho *Water Wives*: Short film, Dir. Jaydeep Sarkar

Unit 5 -Eco-Poetry

William Wordsw "Composed Upon Westminster Bridge" Gary Snyder: "Mother Earth: Her Whales"

Mary Oliver: "Wild Geese"

Joy Harjo: "Speaking Tree"

Mamang Dai: "Small Towns and the River"

Tinai Poems : Ainkurunooru 113, Ammuvanaar, Neithaltinai Kurunthokai 3, Thevakulathar, Kurinji tinai

Recommended Reading:

Chakraborty, Dipesh."The Climate of History: Four Thesis". *Critical Inquiry*, Vol. 35, No. 2, 2009, pp. 197-222.

Garrard, Greg. *Ecocriticism*: *The New Ecocritical Idiom*. Routledge, 2012.

Ghosh, Amitav. *The Great Derangement: Climate Change and the Unthinkable*. Penguin Books, 2016.

----. *Gun Island*. Penguin, 2019.

Kingsolver, Barbara. *Animal Dreams.* Hachette, 1990.

Nixon, Rob. *Slow Violence and the Environmentalism of the Poor*. Harvard University Press, 2011.

Guha, Ramachandra. *Environmentalism: A Global History.* Penguin Books, 2014.

Heise, Ursula K. *Sense of Place and Sense of Planet: The Environmental*

Imagination of the Global. Oxford University Press, 2008.

Jaquette Ray, Sarah. *A Field Guide to Climate Anxiety*. University of California Press,

2020.

Kolbert, Elizabeth. *The Sixth Extinction: An Unnatural History*. Bloomsbury, 2014.

Kyle Bladow and Jennifer Ladino. *Affective Ecocriticism: Emotion, Embodiment, Environment.* University of Nebraska Press, Lincoln.2018.

Narain, Sunitha. *Conflicts of Interest: My journey through India's Green Movement.*

Penguin, 2017.

Rangarajan, Swarnalatha. *Ecocriticism: Big Ideas and Practical Strategies.* Orient

Black Swan, 2018.

Shiva,Vandana. *Staying Alive: Women, Ecology and Survival.* Kali for Women, *1988.*

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each

(10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences

each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Internship

Course Title: COMMUNITY ENGAGEMENT

Course Code:

Course Credit: 2

Course Description:

This is envisioned as an exercise in outreach and community service for the learners of the graduate programme. Students will be trained to identify the learning requirements of children from the coastal and rural demographic and will frame learning modules tailor made to the requirements of the identified demographic. This will include training in spoken English, basic writing skills and any other challenges that the beneficiaries may encounter in language learning. The course will help the students to identify the problems existing among communities around the HEI and help tackle and solve them. This will be a learning opportunity for the students in supportive learning and problem solving. It will further help in moulding them as individuals committed to the betterment of the society.

Course Type: Modern Indian Languages

Course Title:

Course Code:

Credits: 3

SEMESTER 5

Course Type: Major Discipline 8

Course Title: Literary Criticism – I

Course Code:

Credits: 4

Course Description:

This is an introductory course mapping the history and principles of literary criticism, from ancient Greece and Rome through Romantic period in England to modern Europe and the United States. The course is an attempt to provide a foundation, to comprehend the philosophy of various modes of thinking within the humanities, specially pertaining to the discipline of English literature. The major objective of this course is to introduce the students to the key texts, figures and ideas in the field of literary theory from the early period to the thirties. The course moves quickly across centuries and among different cultures, from the classical to the later times such as the Reader-response in the thirties.

Course Objectives:

- To provide a thorough idea of theoretical perceptions from the Classical times to the thirties
- To help learners acquire basic understanding of what theory is all about
- To enhance insight into different periods and contexts through a theoretical orientation
- To widen knowledge of theoretical trends, its various reactionary phases and the manner in which theoretical approaches to Literature generate multiple perspectives
- To enable students to acquire good grounding in theory and to help them perceive the complementary nature of Literary theory and Literary texts.

Course Learning Outcomes: Upon successful completion of this course, the learners will be able to:

CLO1	Acquire sound knowledge and difference of Literary theories and Non-literary theories
CLO2	Gather hands on experience of how theories are countered by theories and how they defy and outwit their own stances
CLO3	Gain consciousness of the phenomenal growth of theories into other theories
CLO4	Acquisition of the difference between Literature, Criticism and Theory
CLO5	Get to know the basic tenets of Literature, Criticism and Theory

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□				
CLO2	□		□		□
CLO3				□	□
CLO4		□	□	□	□
CLO5			□		

Unit 1: Classical Literary Criticism:

Aristotle, from Poetics how drama works—an early analysis

Horace, from Ars Poetica (119-133); How to Be a Good Poet

Unit II: British Criticism:

John Dryden: An Essay on Dramatic Poesy

Matthew Arnold: The Study of Poetry

Wordsworth: Poetry and Poetic Diction

T.S. Eliot: Tradition and Individual Talent

Unit III: New Criticism and Russian Formalism:

Victor Shklovsky: Art as Technique

Cleanth Brooks The language of Paradox

Roman Jakobson: "Two Aspects of Language"

Unit IV: Structuralism and Post Structuralism

Jonathan Culler: The Linguistics Foundation

Ferdinand de Sassure: Incest and Myth

Roland Barthes: "Death of an Author"

Foucault: "What is an Author?"

Unit V: Post Modernism and Post Colonialism

Lyotard "What is Post Modernism"

Linda Hutcheon "Historiographic Metafiction"

Homi Bhaba "Interrogating Identity" (from the Book: Location of Culture)

Benedict Anderson(excerpts) from "Imagined Communities"

Recommended Reading:

Ayers, David. *Literary Theory: A Reintroduction*. Wiley India, 2008.

Bennett, Andrew. Nocholas Royle. *An Introduction to Literature, Criticism and Theory.*

Routledge, 1995.

Culler, Jonathan D. *Literary Theory: A Very Short Introduction.* Oxford UP, 2000.

Habib, M.A. R. *A History of Literary Criticism: From Plato to the Present.* Wiley, 2007.

Selden, Raman. et al *Reader's Guide to Contemporary Literary Theory*. Routledge, 2013.

End Semester Examination

Time: Three Hours Maximum Marks: 100

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Major Discipline 9

Course Title: SHAKESPEARE

Course Code:

Credits: 4

Course Description:

This course attempts a thorough study of the Elizabethan theatre, language, and culture the world in which Shakespeare lived. It will make a close reading of a number of Shakespeare's most acclaimed plays. It will also encourage students to explore aspects of tradition and innovation in Shakespeare's use of theatrical modes. The module will allow students to integrate a knowledge of the intellectual, cultural and stage history of the period into their study of the texts.

Couse Objectives:

- to provide students with knowledge and understanding of Shakespeare's plays.
- to promote an analytical appreciation of representative modes and genres in Shakespearean drama.
- to develop students' awareness of the relationship between the texts and wider socio-cultural contexts of the period.

Course Learning Outcomes: Upon successful completion of this course, the learners will be able to:

CLO1	Describe Elizabethan England in social and Historical context.
CLO2	CLO2: Explain the origins of Shakespearean drama in Greek theatre CLOS: Identify and describe the major themes of Shakespearean tragedy, comedy, and history plays.

CLO3	CLO3: Define a variety of Shakespearean dramatic forms, including Shakespearean tragedy, history, and comedy plays.
CLO4	CLO4: Explain the roots of the Shakespearean sonnets in earlier sonnet traditions.
CLO5	To apply knowledge and skills in the fields of English Language Studies to relevant professional contexts like teaching, research, content development, etc.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

Unit 1

Drama, the Theatre and Stagecraft

Shakespeare and His Contemporaries

The Forms of Shakespeare Drama

Unit 2: The Tragedies

Othello

Macbeth

Hamlet

Unit 3: The comedies

A Midsummer Night's Dream

As You Like it

Unit 4: Sonnets (A select Study)

Unit 5: Shakespearean Criticism

John Dover Wilson, The Fortunes of Falstaff

Wilson Knight, The Wheel of Fire

A.C. Bradley, Shakespearean Tragedy

Recommended Reading

Kermode, Frank. Shakespeare's Language. New York: Farrar Straus Giroux, 2000.

Eagleton, Terry. William Shakespeare. Oxford: Wiley-Blackwell, 1991.

Blake, N. F. Shakespeare's Language: An Introduction. New York: St. Martin's Press, 1983.

Bates, Jonathon. The Genius of Shakespeare. London: Picador, 1997

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each

(10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences

each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

Course Type: Major Discipline 10

Course Title: Indian Writing in English II

Course Code:

Credits: 4

Course Description:

This course aims to explore the origins and growth of poetry, prose, and fiction in English in India, with a particular focus on the period from early colonial times to the contemporary times. It will highlight the contributions of influential writers who have shaped the literary landscape, both before and after India's independence. Throughout the course, we will delve into the socio-cultural and political contexts that have influenced the themes, motifs, and narrative techniques in Indian writing in English across different eras. By the end of the course, students will gain a deeper understanding of the complexities of identity and the discourse oncolonial and postcolonial issues as depicted in these literary works.

Course Objectives:

- To investigate the influence of British colonial rule on India's language and culture and how it is reflectedin Indian Writing in English.
- To understand the evolution and growth of Indian Writing in English from the colonial period to thecontemporary period.
- To provide an introduction to the major trends and critical writers during the aforementioned period.
- To familiarise students with the cultural aspects and historical context of Indian Literature by examiningselect works of prominent writers.
- To discuss the importance of Indian Writing in English in shaping the country's identity and representing its diverse cultural heritage.

Course Learning Outcomes: Upon the successful completion of the course, learners will be able to:

CLO1	Become well-versed with prominent writers in Indian literature.
CLO2	Understand the impact of British colonial rule on the development of Indian Literature.
CLO3	Identify and analyse recurring themes and motifs in Indian English Literature.
CLO4	Appreciate diverse writing styles and critically evaluate Indian literary texts from various perspectives.
CLO5	Analyse the sociocultural influence on Indian Literature and its evolution.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□		□		□
CLO2	□		□		
CLO3	□		□		□
CLO4	□		□	□	
CLO5	□		□	□	

Course Content:

Unit 1: History of Indian Writing in English

K R Srinivas Iyengar *Indian Writing in English* Sterling Publications

M K Naik *A History of Indian English Literature* Sahitya Akademi

Unit 2: Poetry

Henry Louis Vivian Derozio: "The Harp of India"

Sarojini Naidu: "Palanquin Bearers"

Rabindranath Tagore: Songs 13 & 14 *Gitanjali*

Kamala Das:	"The Old Playhouse"
Jayanta Mahapatra:	"Twilight"
Nissim Ezekiel:	"Background, Casually"
Mamang Dai:	"Floating Island"

Unit 3: Fiction

A. Mātavaiyā:	*Clarinda, A Historical Novel*
Mulk Raj Anand:	*Coolie*
Arundhati Roy:	*The God of Small Things*
Temsula Ao:	"Laburnum for My Head"
Hansda Sowvendra Shekhar:	"The Adivasi Will Not Dance"

Unit 4: Drama

Girish Karnad:	*Taledanda*
Mahesh Dattani:	*Final Solutions*
Manjula Padmanabhan	*Lights Out*

Unit 5: Prose

Macaulay:	"Minute on Education" (1835)
Sri Aurobindo:	"Renaissance in India" (Chapter I)
Dr B R Ambedkar:	"Castes in India: Their Mechanism, Genesis and Development"
Jawaharlal Nehru:	"Religion, Philosophy and Science" from *The Discovery of India*
Amartya Sen:	"An Approach to Justice"

Recommended Readings:

Ambedkar, B.R. *Castes in India: Their Mechanism, Genesis and Development*. Arjun Publication

House, 2020.Anand, Mulk Raj. *Coolie*. Penguin Books, 1936.

Ao, Temsula. *Laburnum for My Head: Stories.* Penguin India, 2009.Dai, Mamang. "Floating Island". PIW, 2010.

Das, Kamala. *Old Playhouse and Other Poems*. Orient Blackswan, 2011.

Derozio, Henry Louis Vivian. "The Harp of India". All Poetry,

https://allpoetry.com/The-Harp-Of-India.

----. "The Orphan Girl". Lehigh University, 18 May 2020, https://scalar.lehigh.edu/derozio/the-orphan-girl.

Devi, Mahaswata. *Five Plays: Mother of 1084, Aajir, Bayen, Urwashi and Johny, Water*. Seagull Books, 1999.

Ezekiel, Nissim. *Hymns in Darkness.* OUP India, 1977.

Karnad, Girish. *Tale Danda.* Orient Blackswan Private Limited, 2014.

Mahapatra, Jayanta, *Jayanta Mahapatra – Poems*. Poemhunter.com - The World's Poetry Archive, 2012.Mātavaiyā, A. *Clarinda: A Historical Novel.* Sahitya Akademi, 2005.

Naidu, Sarojini. "Palanquin Bearers". All Poetry, https://allpoetry.com/Palanquin-Bearers.

Nehru, Jawaharlal. *The Discovery of India*. Oxford University Press, 2002.

Roy, Arundathi. *God of Small Things.* Penguin, 2017.

Shekhar, Hansda Sowvendra. *The Adivasi Will Not Dance*. Speaking Tiger Publishing Private Ltd, 2017.

Sri Aurobindo. *The Renaissance in India*. Sri Aurobindo Ashram Trust, 1996.

Tagore, Rabindranath. *Gitanjali.* Rupa, 2002.

Gokak, V K *Indian and World Culture*, Sahitya Akademi, 1994.

Gupta, Balram G S. (Ed.) *Studies in Indian Fiction in English*, Kitab Mahal, 1987.Iyenger, K. R. S. *Indian Writing in English*. 3rd ed., Sterling Publication, 2013.

Mukherjee, Meenakshi. *The Twice Born Fiction: Themes and Techniques of the Indian Novel in*

English. Heinemann, 1971.

Nandy, Ashis. *The Intimate Enemy: Loss and Recovery of Self Under Colonialism*. Oxford

University Press, 1988.

Radhakrishnan, N. *Indo-Anglian Fiction: Major Trends and Themes*. Emerald, 1984.

Rao, Krishna. *The Indo-Anglian Novels and the Changing Tradition.* Rao and Raghavan, 1972.

Vishwanathan, Gauri. *Masks of Conquest: Literary Study and British Role in India*. Columbia University Press,1989.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or.
b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or
b.

Course Type: Major Discipline 11

Course Title: Internship

Course Code:

Credits: 4

Course Description:

The internship program aims to impart language skills to the working men and women from coastal and rural areas through an outreach programme in the form of under graduate internships. The students of the programme will impart basic communication and writing skills to working men and women of the neighbouring communities of the HEI and will help address their language learning requirements. While empowering the working men and women who will be the beneficiaries of the programme, the program will offer the under graduate students lessons in community engagement, mutual trust, and support. The course will also enhance their problem-solving skills and team management skills. It will offer the students valuable lessons in community building and development and help to shape them as responsible individuals with social commitment.

Course Objectives:

- To Gain practical experience in their respective fields of study.
- To Become more comfortable working in a professional business setting.
- To Expand their professional networks.
- To Understand the importance of dress codes in professional settings.
- To Improve their interpersonal and communications skills.

Course Learning Outcomes: Upon the successful completion of the course, learners will be able to:

CLO1	Apply appropriate workplace behaviors in a professional setting.
CLO2	Demonstrate content knowledge appropriate to job assignment.

CLO3	Exhibit evidence of increased content knowledge gained through practical experience.
CLO4	Describe the nature and function of the organization in which the internship experience takes place.
CLO5	Evaluate the internship experience in terms of personal, educational and career needs.

Mapping of Programme Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

A. Internship Identification

1. Define career goals.

2. Identify prospective employers conducive to meeting career goals.

B. Internship Application Process

1. Job application and follow-up

2. Interviewing

C. Internship Enrollment

1. Fill out Internship Registration Form

2. Get approval signature of major faculty advisor on registration form

3. Get approval signature of internship coordinator on registration form

4. Get enrolled in course (the internship office will facilitate enrollment; student CANNOT self-enroll)

D. Internship Requirements

1. Work the required hours (80 work hours per credit hour minimum)
2. Submit required written reports and the self-assessment form
3. Facilitate submission of the Employer Evaluation Form
4. Meet all due dates as stated under the Assignments link on Blackboard

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or.
b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or
b.

Course Type: Minor Discipline 5

Course Title: New Literatures in English

Course Code:

Credits: 4

Course Description:

The course aims to introduce the learner to the growth and development of literatures outside Britain. It also envisages acquainting the learner with the richness and diversity of literary creativity.

Course Objectives:

- To introduce the variety of new literatures in English to students
- To familiarize them to the colonial as well as postcolonial experience in those writings.
- To identify different theoretical assumptions and practices in literature.
- To accustom with the non-European, especially Asian, African, Australian, and Latin American writings across genres.

Course Learning Outcomes:

CLO1	**Understand the concept of New Literatures**
CLO2	**Relate the different genres in New Literatures**
CLO3	**Comprehend the concept of the political condition in the Africa, New Zeland**
CLO4	**Understand the significance of the writings**
CLO5	**Realize the concerns of women through the study the works**

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

Unit 1

Introduction to New Literatures

in English- Sri Lankan-Carribean-Australian-Latin American-Canadian-Japanese-Chinese-New Zealand-African.

Unit 2

Kenneth Slessor "Country Towns" (**Non-Detailed**).
David Malouf "The Year of the Foxes" (**Non-Detailed**)

Margaret Atwood "Journey to the Interior" (**Detailed**).
Claire Harris "Framed" (**Non-Detailed**).
A. D. Hope "Moschus Moschiferous: A Song for St. Cecilia's Day" (**Non-Detailed**).

Derek Walcott "Ruined House" (**Detailed**).
Dom Moraes "Sinbad" (**Detailed**).
Jorge Luis Borges "A Compass" (**Detailed**).

Unit 3

Fiction

Jose Saramago "*Blindness*".
Romesh Gunasekera "*Reef*".
Chinua Achebe "*Things Fall Apart*".

Unit 4

Drama

Yukio Mishima "*The Damask Drum*."
Jack Davis "*No Sugar*."

Unit 5

Short Fiction

Gao Xingjian "The Temple."

Katherine Mansfield "A Suburban Fairytale."

Recommended Readings:

1. Thieme, John. *The Arnold Anthology of Postcolonial Literatures in English*. London: Arnold, 1996.
2. Lazarus, Neil. *The Cambridge Companion to Postcolonial Literary Studies*. CUP, 2004.
3. Brown, Russell M. and Donna Bennett, ed. *An Anthology of Canadian Literature in English*. 2 vols. Toronto: Oxford UP, 1982.
4. Howells, Coral Ann and Eva Marie Kroeller, eds. *Cambridge History of Canadian Literature*. London: Cambridge UP, 2009.
5. Kinsella, John. *The Penguin Anthology of Australian Poetry*. Melbourne: Penguin, 2008.
6. Ojaide, Tanure. *Contemporary African Literature: New Approaches*. African World Series. Series Ed. ToyinFalola. Durham: Carolina Academic P., 2012. Cap-press.com. Web.
7. Lau, Joseph S M. *The Columbia Anthology of Modern Chinese Literature*. Columbia: Columbia University Press,1996.
8. Keene, Ronald. *Modern Japanese Literature: From 1868 to the Present Day*. Grove Press, 2007.
9. Irele, Abiola, Simon Gikandi, ed. *The Cambridge History of African and Caribbean Literature*. 2 vols. Cambridge UP, 2004.
10. Fanon, Franz. *Wretched of the Earth*. New York: Grove P, 1968.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

SEMESTER 6

Course Type: Major Discipline 12

Course Title: INTRODUCTION TO LINGUISTICS

Course Code:

Credits: 4

Course Objectives:

- Introduce the fundamental concepts and branches of linguistics
- Provide an overview of the history of linguistics and key approaches
- Examine the core areas of linguistics - phonology, phonetics, morphology, syntax etc.
- Analyze the relation between language, mind, society, culture, identity etc.
- Discuss applications of linguistics in language education, technology etc.

Course Learning Outcomes: Upon the successful completion of the course, learners will be able to:

CLO1	Define basic concepts and terminologies used in linguistic analysis.
CLO2	Outline the evolution of linguistic theories and schools of thought.
CLO3	Apply linguistic concepts to analyze sound systems, word structure, sentence structure etc.
CLO4	Evaluate the complex relationship between language and human psychology, society, culture.
CLO5	Assess the relevance of linguistics for language teaching, computational linguistics and interdisciplinary studies.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

Unit I

Defining linguistics: Dimensions of Linguistics, Language and Linguistics, Interdisciplinary Fields of Linguistics, Language as a symbolic system: Defining symbols--Vocal symbols consisting of signifier and signified.

Unit II

Air stream mechanisms, Organs of Speech, Classification and Description of Speech Sounds, Cardinal Vowels, Active and passive articulators Voiced and voiceless sounds--Classification of sounds according to place of articulation and manner of articulation, Phonology, The Phoneme, Minimal Pairs, Allophones, Free Variation, Distribution, and Supra-segmental features

Unit III

Phonemic transcription, Word Stress, Sentence Stress, Pitch and Intonation.

Unit IV

Morph, Allomorph, Morpheme and Word. Morpheme as A Meaningful Unit and as A Grammatical Unit. Types of Morphs, Sandhi, Word Formation Processes; Inflection, Derivation, Compound Formation, Reduplication Etc., Grammatical Categories and Parts of Speech.

Unit V

Sentence Structure – Nature of Linguistic Knowledge; Competence and Performance. Syntactic Categories – Lexical and Phrasal. Phrase Markers and Tree Diagrams. Generative Grammar, Definition of Semantics, Introduction to Diachronic and Synchronic Variations in Languag

References:

Crystal, David (ed.). Encyclopedia of Language. Cambridge University Press, 1987.

Asher, R.E. (ed.). The Encyclopedia of Language and Linguistics. Pergamon Press, 1994.

Brown, Keith (ed.). Encyclopedia of Language and Linguistics. Elsevier, 2006.
McArthur, Tom. Concise Companion to the English Language. Oxford University Press, 2005.
Swan, Michael. Practical English Usage. 3rd ed., Oxford University Press, 2005.
Peters, Pam and Peters, Adam. The Cambridge Guide to English Usage. Cambridge University Press, 2004.
Syamala, V. *A Textbook of English Phonetics and Structure for Indian Students*. Sharath Ganga Publications.

Recommended Reading:

Gleason, H.A. An Introduction to Descriptive Linguistics. Holt, Rinehart and Winston, 1955.
Balasubramaniam, T. An Introduction to English Phonetics. Macmillan India, 2009.
Verma, S.K., and Krishnaswamy, N. Modern Linguistics: An Introduction. Oxford University Press,
1989.
Crystal, David. Linguistics. Penguin, 1971.
Crystal, David. English as a Global Language. Cambridge University Press, 1997.
Jones, Daniel. The Pronunciation of English. Cambridge University Press, 1956.
Gimson, A.C. An Introduction to the Pronunciation of English. E. Arnold, 1970.
Lyons, John. Language and Linguistics: An Introduction. Cambridge University Press, 1981.
Aitchison, Jean. Linguistics. Hodder & Stoughton, 1992.
Beugrande, Robert de, et al. Intrduction to Linguistics. McGraw-Hill, 2010.
Langacker, R.W. Language and Its Structure: Some Fundamental Linguistic Concepts. Harcourt Brace
Jovanovich, 1968.
Swan, Michael. Practical English Usage. Oxford University Press, 2005.
Palmer, H.E. Grammar. Penguin, 1971.

Materials for Practice

a) Phonetics

Bansal, R.K. Exercises in Spoken English (+audio cassettes)

O Conner, J.D. Better English Pronunciation (+audio cassettes)

b) Spoken English

Sasikumar and Dhamija. Spoken English (+audio cassette)

Radhakrishna Pillai and Rajeevan. Spoken English for You (+audio cassette)

c) Grammar

Murphy, Raymond. Intermediate English Grammar

Thomson and Martinet. A Practical English Grammar

d) Writing

Coe, Norman et al. Writing Skills

Jolly, David. Writing

Department of English 2011

Hedge, Tricia. Writing

Tickoo & Sasikumar. Writing with a Purpose

Narayanaswami. Strengthen Your Writing

End Semester Examination

Time: Three Hours Maximum Marks: 100

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Major Discipline 13

Course Title: Modern Poetry

Course Code

Credits: 4

Course Description:

This course thrown open a new era of modern English poetry that marks the beginning of a new poetic sensibility, newer tendencies in poetic thinking, trend and form. Modern poetry is refreshingly new and re-creative which outdoes the older patterns and traditions and offers a broader variety of natural speech and manner, drawing inspiration and mechanics from the previous generations of poets. The course provides select Georgian, War, imagists and the later poets of the times

Course Objectives:

- To enable learners to have an idea of the historical background that etched itself into poetic expressions.
- To understand how poetry serves as a repertoire of movements and events of the times.
- To allow learners comprehend the involvement of poets with the turn of events and the times
- To provide them the scope to realize how times reshape literary content and conventions

Course Learning Outcomes:

Upon successful completion of this course, the learners will be able to:

CLO 1	To acquire a background history of modernism and its evolution into various forms and creations
CLO 2	Comprehend the context in which the poets lived and how their poems evolved through modernism
CLO3	Develop an awareness of how the wars and the various transitions impact the social psyche and system
CLO 4	To cultivate a critical outlook that allows the learner to grasp the inevitability of various social and creative transformations

CLO 5	To enable a reading beyond the content to see how modern literary expressions are bound by the writers affinity with the social environment

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content

Unit I: Introduction:

The Closure of the Nineteenth Century

The Advent of the Georgians and The War Poets

Imagist Movement

The Rise of Irish Poetry and Yeats

Eliot, Pound and British Modernism

UNIT II

Georgian Poets

Hillaire Belloc "The South Country"

G.K Chesterton "A Prayer in Darkness"

D.H. Lawrence "A Sane Revolution"

Rupert Brooke "The Soldier"

Robert Graves "The God Called Poetry"

UNIT III

War Poets

Siegfried Loraine Sassoon "The Poet as Hero"

Wilfred Owen "Disabled"

Thomas Hardy	"The Children and Sir Nameless"
W.H. Auden	"Refugee Blues"
Stephen Spender	"Ultima Ratio Regum"

Unit IV

Imagist Poets

T.S. Eliot	"The Waste land"
Ezra Pound	"The Return"
C. D. Lewis	"An Expostulation"
Ted Hughes	"The Hawk in the Rain"

Unit V

Later Poets

W.B. Yeats	"The Second Coming"
Rudyard Kipling	"The Epitaphs of War"
Philip Larkin	"Whitsun Wedding"
Robert Bridges	"Melancholia"
Louis MacNeice	"Prayer Before Birth"

Recommended Readings:

Bloom, Harold. Twentieth Century British Poets. Blooms Literary Criticism, 2011

Black, E L. Nine Modern Poets: An Anthology. Macmillan, 1966.

Carey, John. *A Little History of Poetry.* Yale UP, 2020.

Duncan, Andrew. *Centre and Periphery in Modern British Poetry.* Liverpool UP, 2005.

Hamilton, Ian & Jeremy Noel-Tod. The Oxford Companion to Modern Poetry. Oxford UP, 2013

Howarth, Peter. *British Poetry in the Age of Modernism***.** Cambridge,UP. 2005

Untermeyer, Louis. *Modern British Poetry*. Kessinger, 2003.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Major Discipline 14

Course Title: Modern Drama

Course Code:

Credits: 4

Course Description:

The course will closely analyze major plays, authors, and dramatic styles from the advent of modern drama through the post-WWII period; evaluate how modern dramatists experimented with structure, language, and theatrical technique in response to artistic, social and political contexts; critique important works through close reading of dramatic elements; and compose analytical essays evaluating innovations and characteristics of modern drama across styles, genres, traditions, and regions.

Course Objectives:

- The course examines the chief characteristics of modern drama from its inception through
  the post-World War II period.
- The course will also survey the effects of symbolism, expressionism, surrealism, Epic Theater, and Absurdism on modern drama.
- It also helps the students learn the impact of the social and political environments on modern drama and how such a tumultuous period created a lot of experimental and truly glorious trends in the field of drama.
- The course deals with the modern canonical texts from the American, European and British Drama.

Course Learning Outcomes: Upon the successful completion of the course, learners will be able to:

CLO1	Identify and explain the defining characteristics of major literary and theatrical movements and how they influenced modern dramatists.
CLO2	Analyze the thematic content and stylistic techniques employed by specific modern playwrights in response to social and political contexts.

CLO3	Interpret and critique important dramatic works by major playwrights through close reading and analysis of structure, language, characters, and ideas.
CLO4	Evaluate how modern playwrights challenged, reimagined and revolutionized conventional dramatic structure, characterization, language and theatrical techniques.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO 1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content

Unit I

History of Post War Theatre

Introduction to Modern British, American and European

Drama.Introduction to Epic Theatre, Theatre of the

Absurd, etc.

Unit-II

T.S.Eliot: *Murder in the Cathedral*

Samuel Beckett: *Waiting for Godot*

Unit III

Bernard Shaw: *Arms and the Man*

Bertolt Brecht: *The Caucasian Chalk Circle*

Unit IV

John Osborne: *Look Back in Anger*

Arthur Miller: *Death of a Salesman*

Unit V

Oscar Wilde: *The Importance of Being Earnest*

J.M.Synge: *Riders to the Sea*

Reference Books:

Bentley, Eric. The Playwright as Thinker: A Study of Drama in Modern Times. Harcort, Brace &World, Inc. NY 1967.

Bentley, Eric. The Theory of Modern Stage: An Introduction to Modern Theatre and Drama.Kingsport Press. USA. 1968.

Cole, Toby, ed. Playwrights on Playwriting: The Meaning and Making of Modern Drama fromIbsen to Eliot. Hill & Hang. NY. n.d.

Lumley, Frederick. Trends in Twentieth Century Drama. Oxford Univ. Press. NY. 1960.

Styan, J.L. Modern Drama in Theory and Practice I: Realism and Naturalism. Cambridge Univ.Press. 1981.

Styan, J.L. Modern Drama in Theory and Practice II: Symbolism, Surrealism, and the Absurd.Cambridge Univ. Press. 1981.

Styan, J.L. Modern Drama in Theory and Practice III: Expressionism and Epic Theatre.Cambridge Univ. Press. 1981.

Styan, J.L. The Elements of Drama. Cambridge. Univ. Press. 1967. Print.

Szondi, Peter. Theory of Modern Drama. Univ. of Minneapolis. Minneapolis.

1987. Williams, Raymond. Drama From Ibsen to Eliot. Chatto &Windus Ltd.

London. 1954.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Major Discipline 15

Course Title: Modern Fiction

Course Code:

Credits: 4

Course Description:

Course Objectives:

- To familiarize students with the numerous and diverse ideas and practices prevalent in literary modernism.
- To expose students to some of the most representative British novels of the modern movement.
- To provide interpretative tools and strategies to understand these works.
- To examine the radical new ways in which they grappled with language, turned towards interiority, and pushed, in the process, narrative art to its very limits.
- To highlight the experimental quality of Modernist literature, as well as situate it within the context of its emergence - the two world wars, the development of psychoanalysis, the growth of metropolitan cities, and scientific and technological advancements.

Course Learning Outcomes:

Upon the successful completion of the course, learners will be able to:

CLO1	Comprehend the key concepts and trends in the modernist movement.
CLO2	Interpret the texts chosen for study based on various theoretical concepts.
CLO3	Analyze how the texts represent the philosophy and worldview prevalent during the modern period in terms of themes and techniques and understand how these works bring a revolutionary change in literary history.
CLO4	Analyze representative works of modern fiction from around the world.
CLO4	Evaluate human universals expressed in literary works from around the world.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

Background Study

Malcolm Bradbury et al – "The Name and Nature of Modernism"

John Fletcher – "The Introverted Novel"

Virginia Woolf – "Modern Fiction"

Joseph Frank – "The Spatial Form in Modern Literature"

Unit I: Sophistication in Narrative Technique

Joseph Conrad – *Lord Jim* (1900)

Unit II: Influence of Freudian Theories

D.H.Lawrence – *Sons and Lovers* (1915)

Unit III: Self Vs Society

James Joyce – *A Portrait of the Artist as a Young Man* (1916)

Unit IV: Feminist Voices

Virginia Woolf – *Mrs Dalloway* (1925)

Unit V: Antimodernist Trend

Graham Greene – *The Heart of the Matter* (1948)

William Golding – *Lord of the Flies* (1954)

Recommended Reading

Alter, Robert. "The Modernist Revival of Self-Conscious Novel"

America, 1880-1950. London: 1965.

Bloomfield, Morton W. ed. *The Interpretation of Narrative: Theory and Practice.* Cambridge,

Connolly, Cyril. *The Modern Movement: One Hundred Key Books from England, France, and*

Edel, Leon. *The Psychological Novel.* New York, 1955.

Edinburg: Edinburg Univ. Press, 1998.

Kolocotroni, Vassiliki et al. eds. *Modernism: An Anthology of Sources and Documents.*

Lodge, David. "Modernism, Antimodernism and Postmodernism"

Schorer, Mark. "Technique as Discovery"

Tong, Rosemarie. *Feminist Thought: A Comprehensive Introduction.* Unwin Hyman, 1989.

Trilling, Lionell. "On the Modern Element in Modern Literature" 1970.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Minor Discipline 6

Course Title: Subaltern Literature

Course Code:

Credits: 4

Course Description:

The course will examine the significance of the Subaltern literary tradition in shaping both the identities and the history of the myriad indigenous groups in India. The course will try to position subaltern literature within an Indian literary history. Specifically, the course will be considering the ways in which the model of storytelling that shape subaltern narratives. The course will closely consider verbal and literary modes that have created a unique subaltern literary voice, and have affected both subaltern understanding of themselves, as well as in which they have historically been understood in the popular imagination. In an effort to critically map the genealogies of this tradition the course will be interrogating not only the historical and political contexts of the works but also give the students a proper sweep of the subaltern literary landscape- a wide range of genres like autobiographies, short stories, novels, and critical essays.

Course Objectives

- To help students learn about the nature and importance of the Subaltern literary tradition
- To enable the students to develop an understanding of storytelling-model that shapes the subaltern narratives.
- To help students develop a comprehensive understanding of verbal and literary framework consisting of oppressed subaltern voice throughout history.
- To develop the ability to acknowledge a proper sweep of the subaltern literary landscape, and in a variety of genres: testimonies, short stories, novels, and critical essays.

Course Learning Outcomes:

Upon successful completion of this course, the learners will be able to:

CLO1	Obtain comprehensive knowledge and approaches to the interpretation and understanding of what it means to be “Subaltern Literature”.
CLO2	Demonstrate an understanding of the oppressed- voice whose rebellious echoes can be heard through Subaltern Poems.

CLO3	Revisit and relive the horrors of untouchability, transforming the pain into a narrative of resistance through the Subaltern Testimonies.
CLO4	Exemplify the sites of anger and protest conveyed through a specific locale and language in literary works like the Subaltern short stories.
CLO5	Identify the unique emergence of Subaltern novels and films, challenging and shattering the existing genres and canons of the literary worlds.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

Unit 1- Subaltern Studies- Key terms

Bailey Betik: "Subaltern Studies."(2020)

David Ludde: "Introduction." *Reading Subaltern Studies: Critical History,*

Contested Meaning and the Globalization of South Asia (2002).

Paulo Freire: "Introduction" *Pedagogy of the Oppressed*

Léopold Sédar Senghor: "On Negritude"

Ambedkar B.R.: "Castes in India: Their Mechanism, Genesis and Development.*"*

Unit 2- Subaltern Historiography

Antonio Gramsci: "History of Subaltern Classes: Methodological Criteria"

Ranajit Guha: "Preface" to *Subaltern Studies*

Dipesh Chakrabarty: "Subaltern Studies and Postcolonial Historiography"

E.P.Thompson*: "*History from Below"

Unit 3- Gender

Mahasweta Devi: Draupadi

Meena Kandasamy: *Miss Militancy*

Poile Sengupta: *Thus Spake Shoorpanakha, So Said Shakuni* (Play)

Unit 4- Race and Caste

Claude Mckay: *Home to Harlem*

Poomani: *And Then*

Joseph Macwan: *The Stepchild: Angaliyat*

T J Gnanavel *Jai Bhim* (Movie)

Unit 5- Ethnicity/Disability

Liana Badr: *The Eye of the Mirror* (Translated by Samira Kawar)

R. Cheran: *A Second Sunrise*

Shane Burcaw: *Strangers Assume My Girlfriend Is My Nurse*

References

Ambedkar, B.R. *Castes in India: Their Mechanism, Genesis and Development.* Indian Antiquary

Vol. XLI (May 1917).

Chakrabarty, Dipesh. "Subaltern Studies and Postcolonial Historiography." Nepantla: Views from South, vol. 1,

no. 1, 2000, pp. 9–32.

Chakrabarty, Dipesh. "Subaltern Studies in Retrospect and Reminiscence," South Asia: Journal of South Asian

Studies, vol. 38, no. 1, 2015, pp. 10-18.

Gramsci, Antonio. *Selections from the Prison Notebooks.* International Publishers, 1992.

Guha, Ranajit. "On Some Aspects of the Historiography of Colonial India." Postcolonialisms: An Anthology of Cultural Theory and Criticism, 1982, pp. 403-409.

Ludden, David. "Introduction." Reading Subaltern Studies: Critical History, Contested Meaning and the

Globalization of South Asia. Anthem Press, 2002.

Ludden, David E. Reading Subaltern Studies: Critical History, Contested Meaning, and the Globalisation of South

Asia. Permanent Black, 2001.

Thompson, E. P. "History from Below," *Times Literary Supplement*, 1966, pp. 279-80

Recommended Readings:

Amin, Shahid. Event, Metaphor, Memory: Chauri Chaura, 1922-1992. U of California Press, 1995.

Basuli Deb. "Transnational Complications: Reimagining *Oroonoko* and Women's Collective Politics in the Empire." *Frontiers: A Journal of Women Studies*, vol. 36, no. 1, 2015, pp. 33–56.

Chakravorty Spivak." *Alternatives: Global, Local, Political*, vol. 32, no. 4, 2007, pp. 419–43.

Chibber, Vivek. *Postcolonial Theory and the Specter of Capital.* Verso Books, 2014.

Guru, Gopal. "Freedom of Expression and the Life of the Dalit Mind." *Economic and Political Weekly*, vol. 48, no. 10, 2013, pp. 39–45.

Joshi, P. C. "The Subaltern in Indian Literature: Some Reflections on Premchand and His 'Godaan.'" Indian Literature, vol. 49, no. 2 (226), 2005, pp. 101–18.

Rahul Gairola. "Burning with Shame: Desire and South Asian Patriarchy, from Gayatri Spivak's 'Can the Subaltern Speak?' To Deepa Mehta's 'Fire.'" *Comparative Literature*, vol. 54, no. 4, 2002, pp. 307–24.

Roy, Tirthankar. "Subaltern Studies: Questioning the Basics." *Economic and Political Weekly*, vol. 37, no. 23, 2002, pp. 2223–28.

Singh, Poonam. "The Advent of Ambedkar in the Sphere of Indian Women Question." *CASTE: A Global Journal on Social Exclusion*, vol. 1, no. 2, 2020, pp. 17–30.

Trivedi, Harish. "Theorizing The Nation: Constructions of 'India' and 'Indian Literature.'" *Indian Literature*, vol. 37, no. 2 (160), 1994, pp. 31–45.

Films:

Ray, Satyajit. '*Sadgati*' 1981.

Singha, Anubhav. '*Article 15*' 2019.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Minor Discipline – 6

Course Title: INDIAN AESTHETICS

Course Code:

Credits: 4

Course Description:

This course provides an introduction to key concepts, theorists, and philosophical foundations of Indian aesthetics. Through study of seminal Sanskrit texts on poetics, dramaturgy, music, and art, students will analyze the evolution of rasa theory, exploring how Indian philosophers defined aesthetic experience.

Course Objectives:

- Analyze foundational Sanskrit texts on poetics, dramaturgy, music, and art to understand core principles and evolution of Indian aesthetic theory.
- Interpret writings on rasa theory by key Indian philosophers to evaluate differing perspectives.
- Identify connections between traditional Indian aesthetic concepts and artistic practices in literature, visual arts, theater, and music.

Course Learning Outcomes:

Upon successful completion of this course, learners will be able to:

CLO1	Explain and apply core concepts and evolution of Indian aesthetics through analysis of seminal Sanskrit texts on poetics, dramaturgy, music, and art.
CLO2	Interpret and analyze key Indian aesthetic theories on rasa theory.
CLO3	Examine and critique how later scholars like Coomaraswamy and Tagore adapted and reinterpreted classical Indian aesthetic philosophies in their writings.
CLO4	Identify and evaluate connections between traditional Indian aesthetic concepts and artistic practices in literature, visual arts, theater, and music.

Mapping of Programme Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

UNIT- 1

Brief introduction to the basic principles of Indian philosophy as related to the arts.

Concept of aesthetics from Vedic period – Chitra sutra- Shadanga.

UNIT - 2

Natyashastra of Bharat Muni.

UNIT - 3

Rasa theory, Shankuk, Bhattnayak, Bhattlollatt.

UNIT - 4

Abinav Gupta and Anand Varadhana and Theories of Rasa.

UNIT - 5

AK Coomarasamy, Ravindranath Tagore

Recommended Reading

Basham, A. L. The Wonder That Was India. Grove Press, 1954.

Bhatt, G. K. Rasa Theory: A Critical Study. Chowkhamba Sanskrit Series Office, 1964.

Dasgupta, Surendranath. A History of Indian Philosophy. Cambridge University Press, 1922.

Ghosh, Ranjan. Great Thinkers on Indian Art: Creativity, Aesthetic Communication and Freedom. Springer, 2021.

Hiriyanna, M. Essentials of Indian Philosophy. Allen & Unwin, 1949.

Hiriyanna, M. Outlines of Indian Philosophy. Allen & Unwin, 1932.

Kramrisch, Stella. The Hindu Temple. Motilal Banarsidass, 1946.

Tagore, Rabindranath. Art and Aesthetics. Macmillan, 2022.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

III. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

IV. Answer the following questions in about 200 words (4x5=20)

2. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

2. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

SEMESTER 7

Course Type: Major Discipline 16

Course Title: Literary Criticism II

Course Code:

Credits: 4

Course Description: This is a follow-up course that serves as a sequel to the literary theories taught earlier and allows the learner to gather ideas and information about how theories hauled over from intellectual abstraction to a more practical, inclusive orientation that were earlier othered or lost in the debris of power and hierarchy. These theories, much of which emanated from and tempered by socio-cultural issues are meant to provide the learner a thorough understanding of what irresoluble issues weighed the society and what compelled and called for such reactionary transitions that took the form of a set of theories.

Course Objectives:

- To help learners understand the newer trends in theory formations
- To enable them to identify the difference between Criticism, Literary theory, Theory and Cultural theory
- To comprehend how theories are formulated as responses to social issues or are reactionary to the established theoretical norms
- To enhance textual perceptions of the learners through theoretical insights

Course Learning Outcomes:

Upon successful completion of this course, the learners will be able to:

CLO 1	Understand the nuances of Literature through theoretical perspectives
CLO 2	Create an awareness of Literature as an inclusive discipline that incorporates all other disciplines into its web
CLO3	Enhance multiple perceptions of a text
CLO 4	Imbibe a research orientation that takes literature beyond its own authorial and textual boundaries
CLO 5	Knowledge of the contours and routes of Literature and Theory as an insightful and intellectual combination

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

Unit I: Psychoanalytic Criticism

Sigmund Freud "Group Psychology and the Analysis of the Ego"
Jacques Lacan "The Mirror Stage as Formative of the Function of the I"

Unit II: Feminism

Elaine Showalter "Feminist Literary Criticism in the Wilderness"
Simone De Beauvoir "Myth and Reality"

Unit III: Sociological/Marxist approach

Raymond Williams "Base and Superstructure"
Antonio Gramsci "Hegemony"
Louis Althusser "Ideology and Ideological State Apparatuses"

Unit IV: New Criticism and Cultural Materialism

Mikhail Bakhtin "Discourse in the Novel"
Stephen Greenblatt "The Cuircualtion of Social Energy"
Alan Sinfield "Reading Dissidence"

Unit V: Colonial, Post-colonial, and Cultural Studies

NgugiwaThiong'o "Decolonising the Mind"
Homi K. Bhabha "Signs Taken for Wonders"
Spivak "The Politics of Translation"

Recommended Reading:

Barry, Peter.*Beginning Theory.* Manchester UP, 2009.
Eagleton, Terry. After Theory. Persus Books, 2003
Leitch, Vincent B, William E. Caine, et al., editors. *The Norton Anthology of Theory and Criticism*. W.W. Norton, 2001.
Hall, Donald E. Literary and Cultural Theory: From Basic Principles to Advanced Application. Boston: Houghton, 2001.
Hudson, William Henry. An Introduction to the Study of Literature. New Delhi: Atlantic, 2007. Jefferson,
Jefferson Anne. and D. Robey, eds. Modern Literary Theory: A Comparative Introduction. London: Batsford, 1986.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or.
b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or
b.

Course Type: Major Discipline 17

Course Title: American Literature II

Course Code:

Credits: 4

Course Description:

This course offers a comprehensive exploration of American Literature from the beginning of the 20th century to the contemporary era, covering significant literary movements and prominent authors during this period. It aims to provide a broad understanding of the social, cultural, and historical contexts that shaped the literature of the period. It engages the learners with a diverse selection of literary works, including poetry, prose, novels, short stories and plays. The course aims to foster a deep appreciation for the American literary tradition and how these texts reflect and respond to dynamic social contexts.

Course Objectives:

- To introduce learners to the major literary movements and writers from the early 20th century to the present.
- To create an awareness about the historical, social, and cultural factors that shaped the American society during the period and their representation in literature.
- To critically examine the recent trends and developments in American Literature.

Course Learning Outcomes:

Upon successful completion of this course, learners will be able to:

CLO1	Obtain a broad understanding of the major writers and their contributions during the period.
CLO2	Have an awareness of the historical, social and political contexts that shaped the specific literary texts.
CLO3	Interpret and evaluate the themes, styles, techniques, and genres of American literature of the period.

CLO4	Identify the recent trends and developments in American literature.
CLO 5	Develop a capacity for critical reading and appreciation of literary works.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

Unit1- Introduction

The Lost Generation; Literary Regionalism; Harlem Renaissance; Modernism; Avant Garde; Civil Rights Movement; Beat Movement; Postmodernism

Unit2- Poetry

Robert Frost: "Mending Wall"

E. E. Cummings: "my sweet old etcetera"

Langston Hughes: "I Too"

Sylvia Plath: "Mirror"

Robert Penn Warren: "Evening Hawk"

Maya Angelou : "Phenomenal Woman"

Amiri Baraka: "Somebody Blew Up America"

Unit3- Drama

Tennessee Williams: *A Streetcar Named Desire*

Arthur Miller: *The Death of a Salesman*

Lorraine Hansberry: *A Raisin in the Sun*

Edward Albee: *The Sandbox*

Unit4- Novel

Ernest Hemingway: *The Old Man and the Sea*

John Steinbeck: *The Grapes of Wrath*

Alice Walker: *The Color Purple*

Unit5- Short Story

O. Henry: "After Twenty Years"

William Faulkner: "The Bear"

F. Scott Fitzgerald: "Winter Dreams"

Louise Erdrich: "Fleur"

Recommended Reading:

Albee, Edward. *The Zoo Story, And The Sandbox.* Dramatists Play Service, 1999.

Andrews, William L., et al. *The Oxford Companion to African American Literature*. OUP, 2001.

Baker, Sheridan. *Ernest Hemingway: An Introduction and Interpretation*. Holt, 1967.

Beach, Christopher. *The Cambridge Companion to Twentieth-Century American Poetry*.

Bercovitch, Sacvan. *The Cambridge History of American Literature*. Vol.3, CUP, 2005.

Bigsby, Charles W. *American Drama* Vols I, II and III. Cambridge UP, 1990.

Brower, R. A. *The Poetry of Robert Frost*. Oxford UP, 1963.

Cerf, Bennett and Van H. Cartmell, eds. *The Best Short Stories of O. Henry*. Modern Library, 1994.

Cowley, Malcolm, ed. *The Portable Faulkner*. Penguin Classics, 2003.

CUP, 2003.

DeLillo, Don. *The Silence*. Picador, 2020.

Dove, Rita. *The Penguin Anthology of Twentieth Century American Poetry*. Penguin, 2013.

Du Bois, William EB. "Of Our Spiritual Strivings." *Religion in Today's World*, Routledge, 2013,

pp. 233-244.

Ellison, Ralph. *Invisible Man*. Vintage International, 1995.

Erdrich, Louise. "Fleur." https://www.soarnorthcountry.com/images/upload/fleur-erdrich.pdf

Feidelon Jr., Charles and Paul Brodtkorb Jr. *Interpretations of American Literature*. OUP, 1971.

Fitzgerald, F. Scott. "Winter Dreams"

Geyh, Paula, Fred G. Leebron, Andrew Levy. *Postmodern American Fiction: A Norton Anthology*. Norton and Co., 1998.

Hansberry, Lorraine. *A Raisin in the Sun*. Bloomsbury, 2011.

Hemingway, Ernest. *The Old Man and the Sea*. Scribner, 1996.

King, Martin Luther, Jr. *I Have a Dream*. James M. Washington, ed. Harper Collins, 1991.

King, Stephen. *Carrie*. Hodder Paperbacks, 2011.

Levine, Robert S. *The Norton Anthology of American Literature*. Ed. 9, vol. E., Norton, 2017.

London, Jack. *To Build a Fire and Other Stories.* Bantam Classics, 2007

Marcus, Greil. *A New Literary History of America*. Harvard University Press, 2009.

Miller, Arthur. *Death of a Salesman*. Methuen Drama India, 2018.

Salinger, J.D. *The Catcher in the Rye.* Penguin Books, 2010.

Steinbeck, John. *The Grapes of Wrath*. Penguin Classics, 2000.

Walker, Alice. *The Color Purple*. Weidenfeld &Nicolson, 2014.

Williams, Tennessee. *A Streetcar Named Desire*. Penguin Classics, 2009.

Wilson, August. *Fences.* Plume, 1986.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

1 a.

Or

b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course Type: Major Discipline 18

Course Title: Translation: Theory and Practice

Course Code:

Course Credit: 4

Course Description:

This course will introduce a range of literary and theoretical texts which deal with postcolonialism. This will also provide a context for the emergence of postcolonial studies and postcolonial literature in the literary landscape. The learners will be exposed to texts produced from various parts of the world, written during different time periods. In each unit, they will be introduced to various forms of literary texts which address the topics of colonialism and postcolonialism.

Course Objectives

- To understand the origin and development of postcolonial studies
- To infer how the major genres like poetry, prose, drama and fiction are contextualized and modified to accommodate the postcolonial concerns of literary writers around the world
- To make learners aware of the impact of colonization on the literary production in colonized societies
- To familiarize students with major trends postcolonial studies and to understand their relevance in the contemporary literary scene

Course Learning Outcomes

Upon successful completion of this course, the learners will be able to:

CLO 1	Understand the origin and growth of postcolonial literature and theory
CLO 2	Familiarize with the diversity of form and content in the postcolonial literary texts from all around the world
CLO3	Understand various facets of postcolonial writing in the context of postcolonial studies
CLO 4	Understand the relevance of postcolonial writings in the present times.

CLO 5	Analyze how postcolonial authors engage with issues of identity, language, race, gender, and power relations in their writings.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

UNIT-I: Introduction

Thomas Babington Macaulay: Minute on Indian Education
Young, Robert JC. "Postcolonial Remains." *New Literary History*.
Christian, Barbara. "The Race for Theory." *Cultural Critique*.

UNIT-II: Poetry

Derek Walcott: 'Ruins of a Great House', 'The Sea is History'
Louise Bennett-Coverley: 'Colonization in Reverse'
Wole Soyinka: 'Telephone Conversation'
Kamau Brathwaite: 'Negus'
Allen Curnow: 'House and Land
Faiz Ahmad Faiz: 'Nowhere No Trace Can I Discover'
David Diop: 'Africa'

UNIT-III: Prose

Achebe, Chinua. "An Image of Africa."
Spivak, GayatriChakravorty. "Three Women's Texts and a Critique of Imperialism."
NgugiwaThiong'o: "Decolonising the Mind"

UNIT-IV: Plays

Girish Karnad:	*Hayavadana*
George Ryga:	*The Ecstasy of Rita Joe*
Derek Walcott:	*Dream on Monkey Mountain*
Wole Soyinka:	*Lion and the Jewel*

UNIT-V: Fiction

Michael Ondaatje:	*The English Patient* (novel)
J.M Coetzee:	*Waiting for the Barbarians* (novel)
Nadine Gordimer:	*Once Upon a Time* (short story)
Chimamanda Adichie:	*The American Embassy* (short story)

Recommended reading:

Castle, Gregory. *Postcolonial Discourses: An Anthology*. Blackwell, 2006.
CL Innes, *The Cambridge Introduction to Postcolonial Literatures in English*. Cambridge UP,
2007
Edward Said, "Introduction" in *Orientalism*. Penguin, 1978.
John Thieme. *Arnold Anthology of Postcolonial Literatures in English*.
1996.
Macmillan, 2011.

Robert J. C. Young, A Short Introduction to Postcolonialism. Oxford: OUP, 2006.
Spencer, Robert. *Cosmopolitan Criticism and Postcolonial Literature*.
London: Palgrave

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or.
b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or
b.

Course Type: Minor Discipline 7

Course Title: Postcolonial Literature

Course Code:

Course Credit: 4

Course Description:

The course will introduce various literatures of the erstwhile colonies to learners. They learn about key concepts of postcolonialism and will be familiarized with representative theoretical texts to equip them to identify and discuss the problems of the postcolonial. The selected texts of the course include seminal titles from different geographical regions to help learners to understand how colonialism changed lives across the globe through institutionalized exploitation, resistances to colonialism, the survival of the native cultures and memories, and the neocolonial.

Course Objectives:

- To introduce learners to the key concepts of postcolonialism
- To provide the learners a comprehensive understand of the postcolonial
- To make them aware of the historical context of the postcolonial
- To familiarize them with various literary resistances of the colonies
- To enable them to identify and analyse the effects of postcolonialism on cultures and societies across the globe

Course Learning Outcome:

Upon successful completion of the course, the learners will be able to:

CLO1	Understand the key concepts of postcolonialism
CLO2	Learn about the effects of colonialism on different languages, cultures, societies, etc.
CLO3	Understand the historical and political context of colonialism
CLO4	Identify the colonial and postcolonial influences in literatures of the colonies
CLO5	Examine the problems of the postcolonial and neo-colonial lived experiences

Mapping of Program Outcomes with Course Outcomes

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□	□	□	□	□
CLO2	□		□	□	
CLO3	□	□	□	□	□
CLO4	□	□	□	□	□
CLO5	□		□	□	□

Course Content:

Unit 1- What is Postcolonial?

Understanding the Postcolonial, Definitions and Scope, New Literatures in English: African- Caribbean, South Asian-New Zealand- Australian-Canadian.

Key Terms: Colonialism– Diaspora – Eurocentrism – Hegemony – Hybridity – Master and Meta Narratives – Mimicry – Nation – Self and Other – Postcolonialism– Race and Racism – Subaltern

Unit 2- Poetry

Kamau Brathwaite: "Columbe" (Carribean)

Derek Walcott: "Ruins of a Great House" (Carribean)

Leopold Senghor: "New York" (Africa)

Gabriel Okara: "The Mystic Drum" (Africa)

Lee Tzu Pheng: "My Country and My People" (Singapore)

Kishwar Naheed: "The Grass is Like Me" (Pakistan)

Unit 3- Fiction

Salman Rushdie: *Midnight's Children* (India)

Bapsi Sidhwa: *Ice-Candy Man* (Pakistan)

Chimamanda Ngozi Adichie: *Half of a Yellow Sun* (Africa)

Unit 4- Drama

Ama Ata Aidoo: *Anowa* (Africa)

Yvette Nolan: *The Unplugging* (Canada)

Jane Harrison *Stolen* (Australia)

Unit 5- Non-Fiction

Edward Said: Introduction to *Orientalism*

Frantz Fanon: Introduction to *Black Skin White Masks*

Gayatri Chakravorty Spivak: "Can the Subaltern Speak?"

Recommended reading:

Anderson, Benedict. *Imagined Communities.* Verso, 2006. Ashcroft, Bill, et al. *Postcolonial Studie Reader.* Routledge, 1995. Ashcroft, Bill, et al. *The Empire Writes Back.* Routledge, 2002.

Bhabha, K., Homi. *The Location of Culture*. Routledge, 1994. Fanon, Frantz. *Black Skin, White Masks*. Penguin Classics, 2021.

Bindella, M.T. and G.V. Davis. "Introduction". *Imagination and the Creative Impulse in New Literatures in English.* Rodopi,1993. pp. 1 - 12.

Cambridge UP, 2009.

Gilbert, Helen. and Tompkins, Joanne: *Post-colonial Drama: Theory, Practice, Politics*. Taylor & Francis, 2002.

Heirloom of a Multiple Heritage. Pencraft,1995. pp. 12-24.

Howells, Coral Ann and Eva Marie Kroeller. *Cambridge History of Canadian Literature*.

Hutcheon, Linda. *A Theory of Parody: The Teachings of Twentieth-century Art Forms.* U of Illinois P, 2000.

Irele, Abiola. *The Cambridge History of African and Caribbean Literature*. edited by Abiola Irele and Simon Gikandi. Cambridge UP, 2004.

King, Bruce. 'Introduction.' *Literatures of the World in English.* Routledge, 1974. pp.1-22. Kinsella, John. *The Penguin Anthology of Australian Poetry.* Melbourne: Penguin, 2008. Narasimhaiah. C .D. 'Why Commonwealth Literature?' *Essays in Commonwealth Literature:*

Loomba, Ania. *Colonialism and Postcolonialism.* Taylor & Francis, 2007. Said, Edward. *Orientalism,* Penguin India, 2001.

Shohat, Ella and Stam, Robert. *From Eurocentrism to Polycentrism*. Taylor & Francis, 2013.

Spivak, Gayatri Chakravorty. *Can the Subaltern Speak?* Walther Konig, Verlag, 2021.

Thieme, John. *The Arnold Anthology of Postcolonial Literatures in English*. Arnold, 1996.

Thiong'o, Wa Ngugi. *Decolonizing the Mind: The Politics of Language in African Literature.* East African Educational, 1992.

West Indian Literature. Macmillan, 1973.

Young, J.C, Robert. *Postcolonialism: An Historical Introduction.* Wiley, 2016.

Young, J.C., Robert. *Colonial Desire.* Routledge, 2005.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)
Or Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or.
b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or
b.

Course Type : Minor Discipline 8

Course Title: GENDER STUDIES
Course Code:

Credits: 3

Course Description:

This course examines the advanced theories, methodologies, and interdisciplinary perspectives pertaining to Gender and Queer studies. It critically looks at historical and modern ideas, beliefs,prejudices with regard to sexual orientations, gender identities and societal standards. The courseseeks to promote critical thinking, strengthen research abilities and encourage participation in discourses that advance knowledge of gender and such issues in contemporary society.

Course Objectives:

- To acquaint students with the main theoretical frameworks and concepts in Gender studies and Queer theory, including intersectionality, performativity, heteronormativity,and social construction of gender.
- Examine the historical development of gender roles, norms, and queer identities, and comprehend how social, cultural, and political forces have influenced gender and queerexperiences throughout history.
- Analyse and discuss contemporary issues related to gender, sexuality, and queer experiences, discrimination, media (mis)representation, and challenges confronted byqueer communities.
- To recognise the significance of intersectionality in comprehending gender and queerexperiences, including how race, class, ethnicity, disability, and other factors intersectwith gender and sexual identity.
- To encourage critical thought regarding traditional gender norms and stereotypes and toinvestigate alternative and non-binary expressions of gender and sexuality.

Course Learning Outcomes:

Upon successful completion of this course, the learners will be able to:

CLO1	Have a comprehensive understanding of key theoretical concepts and frameworks in Gender studies and Queer theory.
CLO2	Be able to articulate the historical evolution of gender roles, norms, and queer identities and comprehend how historical contexts have influenced contemporary gender and queer experiences.
CLO3	Challenge traditional norms and stereotypes through critical thinking.
CLO4	Recognize biases and incorporate intersectionality into their analysis of gender and sexuality.
CLO5	Evaluate contemporary issues related to gender, sexuality, and queer experiences

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□				□
CLO2			□	□	□
CLO3			□	□	
CLO4	□		□	□	
CLO5	□	□			□

Course Contents:

Unit – 1 Foundations of Gender and Queer Studies

Introduction to Gender and Queer Studies: Key concepts and theoretical frameworks

Intersectionality: Understanding the complexities of multiple identities and oppressions

Historical Perspectives: Evolution of Gender and Queer studies as academic disciplines

Unit 2 - Gender/Sex Roles & Stereotyping

Judith Butler: Excerpts from *Gender Trouble: Feminism and the Subversion of Identity* (1990)

Patricia Hill Collins: "Black Feminist Thought: Knowledge, Consciousness, and thePolitics of Empowerment" (1990).

Alice Munro: "Boys and Girls" (1964)

Pan Nalin: *Angry Indian Goddesses* (2015).

Unit 3 - Deconstructing Binaries: Non-normative Gender and Sexualities.

Monique Witting: "One is not Born a woman" (1993)

Adrienne Rich: "Compulsory Heterosexuality and Lesbian Existence" (1993)Susan Stryker et al: "Introduction: Trans-, Trans, or Transgender (2008) Rituparno Ghosh: *Chitrangada: The Crowning Wish* (2012)

Kalki Subramaniam: *We are not the Others* (2021)

Unit 4 - Gender and Media

Laura Mulvey: "Visual Pleasure and Narrative Cinema" (1999).

Steve Craig: Excerpts from *Men, Masculinity, and the Media* (2002).Jennifer Siebel Newsom: *Miss Representation* (2011), a documentary.

Roxane Gay: "Feminism and Pop Culture", from *Bad Feminists* (2014)

Unit 5 - Masculinity studies

Michael Kimmel: Masculinity as Homophobia: Fear, Shame and Silence" (1994).

R.W. Connell: "The Men and the Boys" (2005)

Jack Myers: Excerpts from *The Future of Men: Masculinity in the Twenty-First Century* (2016)

Kimberly Peirce*:* *Boys Don't Cry* (1999), a film.

Recommended Reading:

Boys Don't Cry. Directed by Kimberly Peirce, 1999.

Butler, Judith. *Gender Trouble: Feminism and the Subversion of Identity*. Routledge, 2015.

Chitrangada: The Crowning Wish. Directed by Rituparno Ghosh, Angel Digital PrivateLimited, 2012.

Chodorow, Nancy J. *Individualizing Gender and Sexuality*. Routledge eBooks, 2012, https://doi.org/10.4324/9780203816066.

Choo, H. Y., & Ferree, M. M. (2010). *Practicing Intersectionality in Sociological Research: ACritical Analysis of Inclusions, Interactions, and Institutions in the Study of Inequalities. Sociological Theory*, 28(2), 129-149.

Collins, Patricia Hill. *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment*. Routledge, 2002.

Craig, Steve. *Men, Masculinity and the Media*. SAGE Publications, 1992.

De Beauvoir, Simone, and H. M. Parshley. *The Second Sex*. 1949, cds.cern.ch/record/2728998. Doane, Mary Ann. *Femmes Fatales: Feminism, Film Theory, Psychoanalysis*. Psychology Press, 1991.

Edelman, Lee.*No Future: Queer Theory and the Death Drive*.Duke UP, 2004.Foucault, Michel. *The History of Sexuality*. 1976, www2.warwick.ac.uk/fac/arts/english/currentstudents/undergraduate/modules/fulllist/speci al/endsandbeginnings/foucaultrepressiveen278.pdf.

Gay, Roxane. *Bad Feminist*. Harper Perennial, 2014.

Gilbert, M.A. *Defeating Bigenderism: Changing Gender Assumptions in the Twenty-first Century.* Hypatia, 24: 93-112.2009. https://doi.org/10.1111/j.1527-Mulvey, Laura. LauraMulvey "Visual Pleasure and Narrative Cinema" 1975. Koenig Books, 2016.

2001.2009.01047.x

Kanter, Rosabeth Moss. *Men and Women of the Corporation*. Basic Books, 1993. Kimmel, Michael S., and Amy Aronson. *Men And Masculinities* [2 Volumes]: *A Social, Cultural, and Historical Encyclopedia*. ABC-CLIO, 2004.

Lockhart, E. *The Disreputable History of Frankie Landau*.Banks. 2008.

Lorber, Judith, and Susan A. Farrell. *The Social Construction of Gender*. SAGE Publications,Incorporated, 1991.

Lorde, Audre. *Zami: A New Spelling of My Name*. Persephone Press, 1982.

Mccann, Carole, and Seung-Kyung Kim. *Feminist Theory Reader: Local and GlobalPerspectives*. Routledge, 2013.

Mulvey, Laura. Laura Mulvey "*Visual Pleasure and Narrative Cinema*" 1975. Koenig Books,2016.

Munro, Alice. "Boys and Girls." *Dance of the Happy Shades*. Macmillan, 1968, pp. 19-35.

Myers, Jack. The Future of Men: Masculinity in the Twenty-First Century. Inkshares, 2016.Nalin, Pan, director. *Angry Indian Goddesses*. 2015

Pizan, Christine de. *The Book of the City of Ladies*. Translated by Rosalind Brown-Grant,Penguin Classics, 1999.

Sedgwick, Eve Kosofsky. *Epistemology of the Closet*. 1990, ci.nii.ac.jp/ncid/BA25990915.Stryker, Susan, et al. *"Introduction: Trans-, Trans, or Transgender?*" Women's Studies Quarterly, vol. 36, no. 3/4, 2008, pp. 11–22. JSTOR, http://www.jstor.org/stable/27649781. Accessed 26 July 2023.

Subramaniam, Kalki. *We Are Not The Others : Reflections of a Transgender Artivist.* NotionPress. 2021.

Wetherell, M., & Edley, N. (1999). *Negotiating Hegemonic Masculinity: Imaginary Positionsand Psycho-Discursive Practices. Feminism & Psychology*, 9(3), 335-356.

Brod, Harry, and Michael Kaufman (Eds.). *The Making of Masculinities: The New Men'sStudies.* Routledge, 1994.

Connell, R.W. *Masculinities*. University of California Press, 2005.

Erickson-Schroth, Laura (Ed.). *Trans Bodies, Trans Selves: A Resource for the TransgenderCommunity.* Oxford UP, 2014.

Halberstam, Jack. *The Queer Art of Failure*. Duke University Press, 2011.

Hooks, Bell. *Feminism Is for Everybody: Passionate Politics*. South End Press, 2000.Hooks, Bell. *Reel to Real: Race, Sex, and Class at the Movies*. Routledge, 2008.

Johnson, Allan. *The Gender Knot: Unravelling Our Patriarchal Legacy*. Temple UP, 2014.Kimmel, Michael. *The Gendered Society*. Oxford UP, 2015.

Irigaray, Luce. Translated by Gillian Gill. *Speculum of the Other Woman*. Cornel UP, 1974.Rich, Adrienne. "Diving into the Wreck." 1972.
Ross, Karen (Ed.). *The Handbook of Gender, Sex, and Media.* John Wiley & Sons, 2012

Serano, Julia. *Whipping Girl: A Transsexual Woman on Sexism and the Scapegoating ofFemininity.* Seal Press, 2007.

Tasker, Yvonne, and Diane Negra (Eds.). Interrogating *Postfeminism: Gender and the*

Politics of Popular Culture. Duke UP, 2007.

West, Candace, and Don H. Zimmerman. "Doing Gender." *Gender & Society*, vol. 1, no. 2,1987, pp. 125-151.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

2. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or.
b.

III. Answer the following questions in about 500 words (4x15=60)

2 a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or
b.

SEMESTER 8

Course Type: Major Discipline 19

Course Title: COMPARATIVE LITERARY STUDIES

Course Code:

Credits: 4

Course Description:

The course inculcates a comparative awareness in the minds of the learners to enable them to realize its cultural significance and inclusive nature. Besides, the central goal of this course is also to find its relevance in the multilingual states of India. The theoretical part of the course is to acquaint the learners with the major issues in various theories of Comparative literature as detailed in Unit I, II and III. While the second part- Unit IV and V creates an awareness of the methodological and interpretative problems in the practice of Comparative literary studies, training the learners by way of seminars and assignments.

Course Objectives:

- To perceive the basics of Comparative Literary Studies
- To assimilate the innate crisis in the theory which adds to both its seamlessness and complexities
- To understand the theory more as a methodology
- To enable more comparative literary studies that would widen inclusiveness of any non-European writings and disciplines

Course Learning Outcomes:

Upon successful completion of this course, the learners will be able to:

CLO 1	Study literatures as the core poetics of humanity which is the very essence of the course
CLO 2	Sense the studies as an invasive drive into Eurocentrism
CLO 3	Develop a positive consciousness of all cultures

CLO 4	Cultivate a sense of awareness of the interdisciplinary nature of comparison, its complementary leanings with other major disciplines as Translation Studies as well as other major Art forms as Music, Art and Sculpture
CLO 5	Sharpen comparative skills and enable an all-inclusive research outcome

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Course Content:

UNIT I

Comparative Literature: Definition Scope and Method
Emergence and Historical Development of the Discipline
French and American School of thought
European and Indian
Comparative Literature as a Methodology
Differences and Ethics of Plurality

UNIT II

Weltliteratur, General Literature, National Literature
Movements and Traditions
Theory of Genres
Oral and Written
Ancient, Medieval and Modern

UNIT III

Thematology
Motifs, Myths and Archetypes
Cross-cultural Literary relations
Influence
Analogy
Reception

UNIT IV

History and Politics of Translation

Interpretations of Culture

Problems of Cultural Translation

Literature and Psychology/Sociology

Mutual Illumination of the Arts

Music/Fine arts/Sculpture

UNIT V

New Comparative Literature-Crisis

Comparative Methodology- Practice

Short Stories:

Chekhov:	"Vanka", Ward No. 6"
Maupassant:	"The Prisoners" "Two Friends"
Poe:	"The Angel of the Odd" "The Spectacles"
Tagore:	"The Home-Coming" "The Wicked Postmaster"
Basheer:	"Mantra Charatu" "The Invaluable Moment"
Perumal Murugan:	"Water Play"

Plays:

Kalidasa:	*Abhijnan Shakuntalam*
Sopholces:	*Oedipus Rex*
Moliere:	*Tartuffe*
Komal Swaminathan:	*Water!*

Novels:

Bankim Chandra Chattopadhyay:	*Durgeshnandini*
Chandu Menon:	*Indulekha*
Rokeya Sakhawat Hossain:	*Sultana's Dream.*
Salma:	*The Hour Past Midnight*
Jean Sasson:	*The Princess*

Recommended reading :

Bassnett, Susan. *Comparative Literature: A Critical Introduction*. Wiley-Blackwell, 1993.
Chattopadhyay, Bankim Chandra. *Durgeshnandini*. *Sundar Prakashani*, 2015.
Guillen, Claudio. *The Challenge of Comparative Literature*. Cambridge, 1993.
Hossain, Rokeya Sakhawat. *Sultana's Dream*. Translated by Durga Bhai. Tara, 2005.
Lefevere, Andre, *Translating Literature: Practice and Theory in a Comparative Literature*
Context. MLA. 1992.
Menon, Chandu. *Indulekha*. Translated by Anitha Devasia Oxford, 2005.
Ravindran, Vanajam. Editor. *Vaikoom Muhammad Basheer: Short Stories*. Katha, 1996.
Spivak, Gayathri Chakravorty. *Death of a Discipline*. Columbia UP, 2005.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or.
b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or
b.

Course Type: Major Discipline 20

Course Title: RESEARCH METHODOLOGY

Course Code:

Course Credits: 3

Course Description:

This paper will introduce the idea of research, ways to do research in English Studies and variousapproaches and methods employed in the field to the learners. By elucidating the mode of research carried out in Humanities and Social Sciences, the paper offers an understanding of research in Literary Studies. The course aims to address certain key concerns of beginners in research such as finding a topic to work, identifying sources and framing the hypothesis.

Course Objectives:

- To make the learners understand the idea of research in English Studies.
- To help beginners in literary research to identify a research area, find resources and framethe hypothesis.
- To familiarize students with the major methods and approaches in literary research and various types of research writing.
- To provide an awareness of documenting, formatting and referencing followed in major research style guides.
- To caution them against plagiarism and to enlighten them on avoiding it

Course Learning Outcomes: Upon successful completion of this course, learners will be ableto:

CLO1	Understand how to go about doing research in English Studies.
CLO2	Be familiar with the various researches done in English Studies.
CLO3	Discuss different methods and approaches employed in LiteraryStudies.
CLO4	Carry out documenting, formatting and referencing in MLA.
CLO5	Avoid plagiarism

Mapping of Programme Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□	□	□	□	
CLO2	□	□	□	□	
CLO3	□		□	□	
CLO4	□		□	□	□
CLO5	□	□	□	□	

Course Content:

Unit 1 - Research: Description, Types and Resources

Major Methods: Archival; Auto/biography; Oral History; Visual; Discourse Analysis; Ethnographic; Quantitative; Textual Analysis; Interviewing; Creative Writing; Digital Humanities; Research Methods vs. Methodology; Types of Research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical.

Unit 2 - Identification of a Research Problem

Planning the research area/topic: delimiting an area of study, defining and formulating the research problem, selecting the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, research databases, web as a source, identifying research gap from literature and research database, development of workinghypothesis.

Unit 3 - Research Writing

Note-taking, Note-making, Summarizing and Paraphrasing, Writing Review of Literature,Preparing Working Outline / Final Outline, Writing Synopsis, Writing Research Proposal.

Unit 4 – Documenting and Referencing

Documentation, List of Works Cited, Citing Periodical Print Publications, Web Publications, In-text Documentation: Citing Sources in the Text, Parenthetical Documentation, Readability, Sample References, Plagiarism, Types of Plagiarism, How to Avoid Plagiarism.

Unit 5 - Formatting

Formatting: Indentation, Margins, Font, Spacing, Heading and Title, Pagination, etc.

Recommended Readings:

MLA Handbook for Writers of Research Papers. 9th edition. Modern Language Association of America, 2021.

Belsey, Catherine. *Critical Practice*. 2nd edition. Routledge, 2002.

Kothari, C. R. and Gaurav Garg. *Research Methodology: Methods and Techniques*. 4th edition.

New Age International, 2019.

Kumar, Ranjit. *Research Methodology: A Step by Step Guide for Beginners*. 4th edition. Sage,2014.

Publication Manual of the American Psychological Association. 7th edition. AmericanPsychological Association, 2020.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

2. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each:

(5x4=20)

3. Answer the following questions in about 200 words (4x5=20)

3. a.
Or
b.

2. a.

Or

b.

3. a.

Or

b.

4. a.

Or.

b.

III. Answer the following questions in about 500 words (4x15=60)

3 a.
Or
b.
2. a.

Or

b.

3. a.

Or

b.

4. a.

Or

b.

Course type: Research
Course Title: PROJECT DISSERTATION

Course Code:

Credits: 12

Course Description:

Students can opt for a research project in any area and submit the project report at the end of the semester.

Course Type: Major Discipline

Course Title: POSTMILLENIAL LITERARY TRENDS

Course Code:

Credits: 4

Course Description:

The course will introduce the literary trends dating from the last few decades of the 20th century to the 21st century. This course is meant to engage the students to do in-depth reading, critical enquiry, and research on the prevalent literary trends of the new millennium. It focuses on how literature has begun to mushroom and spread its tentacles drawing from various sources and fields as varied as ecology, environment, visual culture, mass media, physics, geography and so on. Thiscourse aims to update and inform the learners of the critical issues and research interests in emerging and contemporary literary trends.

Course Objectives:

- provide a comprehensive background to the emergence of contemporaryliterary trends and movements.
- explore a series of theoretical themes that have emerged due to the interaction of variousinterdisciplinary areas of studies.
- describe socio-cultural issues in the new millennium which have impact on the literary landscape
- familiarise the students with various literary resistances of the subjugated.
- enable the students to identify and analyze the significant events leading to the new millennium which Impacted literature

Course Learning Outcome:

Upon successful completion of the course, the learners will be ableto:

CLO1	Understand the increasing intersection of literature and other disciplines
CLO2	Learn about the literary transformation from reading to representation
CLO3	Understand the socio-political shifts of literary studies in the context of globalization
CLO4	Identify the timeline of history through different literary texts along with the major literary trends
CLO5	Examine the literary works of writers experimenting with new forms and genres.

Mapping of Programme Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□				
CLO2		□			□
CLO3			□	□	
CLO4		□	□	□	
CLO5		□			□

Unit 1- The New Aesthetics, Graphic Narratives and Digital Humanities

Hillary Chute and Marianne DeKoven:

"Introduction: Graphic Narrative"Marjane Satrapi: *Persepolis*

"The Digital Humanities and Humanities Computing:

An Introduction" *A Companion toDigital Humanities*

Michael Joyce: *Afternoon*

Unit 2- Trauma Studies and Memory Studies

Michelle Balaev: "Trauma Studies"

Maya Angelou: *I Know Why the Caged Bird Sings*

Michael Rothberg: "Remembering Back: Cultural Memory, Colonial Legacies, and Postcolonial Studies"

Elie Wiesel: *Night*

Unit 3- Pandemic Studies and Climate Studies

Giorgio Agamben: "The Invention of an Epidemic"Albert Camus: *The Plague*

Scott Slovic: "The Story of Climate Change: Science, Narrative, and Social Action"Amitav Ghosh: *The Hungry Tide*

Unit 4 - Asexuality Studies and Fat Studies

Esther Rothblum: "What Is Fat Studies?Sarah Dessen: *Keeping the Moon*

Ela Przybylo: "Introducing Asexuality, Unthinking Compulsory Sexuality"Maia Kobabe: *Gender Queer*

Unit 5 - Health Humanities and Posthuman Literature

Paul Crawford:	"Health humanities: the future of medical humanities?"
Stacy Alaimo:	"Bodily Natures" *Bodily Natures: Science, Environment, and theMaterial Self*
Virginia Woolf	*On Being Ill*
Tony Davies	"From Humanism to Antihumanism" *Humanism*
Kazuo Ishiguro	*Never Let Me Go*

Recommended Readings:

Alaimo, Stacy. *Bodily Natures: Science, Environment, and the Material Self.* Indiana UniversityPress, 2010.

Agamben, G. The invention of an epidemic. The European Journal of Psychoanalysis.https://www.journal-psychoanalysis.eu/coronavirus-and-philosophers/. Accessed 30 March 2020.

Balaev, Michelle. "Trauma Studies" *A Companion to Literary Theory. Ed. David H. Richter*.

Wiley Blackwell, 2018.

Caruth, Cathy. 1996. Unclaimed Experience. Baltimore: Johns Hopkins University Press.Caruth, Cathy. 2014. Literature in the Ashes of History. Baltimore: Johns Hopkins University Press.

Chute, Hillary and DeKoven, Marianne. "Introduction: Graphic Narrative", Modern FictionStudies, Volume 52, Number 4, Winter 2006, Johns Hopkins University Press.

Crawford, P., Brown, B., Tischler, V. and Baker, C. (2010), "Health humanities: the future ofmedical humanities?", Mental Health Review Journal, Vol. 15 No. 3, pp. 4-10. https://doi.org/10.5042/mhrj.2010.0654

Davies, Tony. *Humanism,* Routledge, 1997.

Felman, Shoshana and Dori Laub. 1992. Testimony: Crises of Witnessing in Literature,Psychoanalysis, and History. New York: Routledge.

Rothberg, Michael. "Remembering Back: Cultural Memory, Colonial Legacies, and PostcolonialStudies" *The Oxford Handbook of Postcolonial Studies.* Ed. Graham Huggan. OUP, 2018.

Rothblum, Esther and Sondra Solovay. *The Fat Studies Reader,* NYU Press, 2009.

Schreibman, Susan et al. "The Digital Humanities and Humanities Computing: An Introduction"

A Companion to Digital Humanities, Oxford: Blackwell, 2004.

Slovic, Scott. “The Story of Climate Change: Science, Narrative, and Social Action” *The Okinawan Journal of American Studies* (American Studies Program, University of theRyukyus, Nishihara, Okinawa, Japan) No. 2 (2005): 38-42.

Przybylo, Ela. Introducing the New Sexuality Studies (pp.35-46) Illinois State University, 2022.

Addlakha, Renu. *Disability Studies in India: Global Discourses, Local Realities.*

Routledge India, 2020.

Alaimo, Stacy. “Bodily Natures: Science, Environment and the Material Self. IndianaUniversity Press, 2010
Therese Jones, Delese Wear and Lester D.Friedman. *The Health Humanities Reader.*

Rutgers University Press, New Brunswick, New Jersey 2014.

Nayar, Pramod. *Eco precarity: Vulnerable Lives in Literature and Culture. Routledge Studies in the World Literatures and the Environment. Routledge:* New York: 2019.

Scott, Slovic. *Going Away to Think: Engagement, Retreat, and Ecocritical Responsibility*.p ed. University of Nevada Press, 2016.

Verma, Sreejith, and Sircar, Ajanta. Eds.*Contagion Narratives: Societies, Culture andEcology of the Global South*. Routledge Studies in the World Literatures and Environment. 2023.

Srilata K. *This Kind of Child: The Disability Story*. Westland Books, 2023.Wann, Marilyn, et al. The Fat Studies Reader. NYU Press, 2009.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

I. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words (4x5=20)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or.
b.

III. Answer the following questions in about 500 words (4x15=60)

1. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or
b.

Course Type: Major Discipline

Course Title: REGIONAL LITERATURES
Course Code:

Credits: 4

Course Description:

This course will introduce representative texts from a variety of Indian regions, languages and time periods. The selections include both canonical texts and texts that do not receive adequate attention. The selection is based on the significance of the individual text to the literature in question, its sociopolitical and cultural role in the canon, and the various regional elements it represents. The decision to include a particular text from a particular genre is also based on the text's contribution to the evolution of that genre in the concerned region. The objective of the course is to provide students with a comprehensive understanding of the diversity and vitality ofIndia's regional literatures.

Course Objectives:

- To enlighten learners about the rich variety of regional literatures in India.
- To provide a deeper understanding of the nuances of regional literatures.
- To sensitise the students about the specificity of human experiences beyond cultural and linguistic differences.
- To make the learners aware of the different literary and socio-politicalmovements of different regions.

Course Learning Outcome:

Upon successful completion of the course, the learners will be ableto:

CLO1	Have a thorough understanding of Indian literature across languages.
CLO2	Analyse literary terminology, components, and basic structures of novels, plays, and poems, using specific examples from works studied in the course.
CLO3	Trace the evolution of different genres across regions.
CLO4	Apply their own critical ideas in the exploration of literature.
CLO5	Become aware of the plurality of literature across regions and be equipped towrite critical essays and formal research papers on literary texts and topics.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□		□		
CLO2	□		□		
CLO3	□		□		□
CLO4	□		□	□	
CLO5			□	□	□

Course Content:

Unit 1 - Introduction Introduction to Indian LiteratureRegionalism in Indian Literature

Socio-Cultural and Literary background of Indian regional literatures.
R.K. Gupta and Priyalakshmi Gupta: "Towards a Concept of Indian Literature"
M.K. Naik: "Indian Pride and Indian Prejudice: Reflections on theRelationship between Regional Indian Literatures andIndian Writing in English.
MSS Pandian "One Step outside Modernity: Caste, Identity Politics andPublic Sphere" Economic and Political Weekly, Vol. 37, No. 18 (May 4-10, 2002), pp. 1735-1741

Unit 2 - Poetry

Kazi Nazrul Islam:	*Bidrohi* (Bengali)
G.M. Muktibodh:	*The Void* (Hindi)
Akhtar-ul-Iman:	*Compromise* (Urdu)
Gopalakrishna Adiga:	*This Land of Ours Now* (Kannada)
Namdeo Dhasal:	*Stone Masons- My Father and Me*
(Marathi)	
Sukirtharani:	*Portrait of My Village* (Tamil)

Unit 3 - Fiction

Mahaswetha Devi:	*Bashai Tudu* (Bengali)
Imayam:	*Beasts of Burden* (Tamil)
Easterine Kire:	*Rain Maiden and the Bear Man*
(Nagaland/English)	

Unit 4 - Drama

Habib Tanvir :	*Charandas Chor* (Hindi)
K. A. Gunasekaran:	*Touch* (Tamil)
K. J. Baby:	*Nadugadhikai* (Malayalam)

Unit 5 - Life Writings

A. Revathi:	*The Truth About Me* (Tamil)
Devaki Nilayamgode:	*Antarjanam* (Malayalam)
Manoranjan Byapari:	*Interrogating My Chandal Life: AnAutobiography* (Bengali)

Recommended Reading:

Adiga, Gopalkrishna. *This Land of Ours Now.* Translated by C.P. Ravikumar. *The World's Poetry Archive*, 2012. Chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.poemhunter.com/gopalakris hna-adiga/ebooks/?ebook=0&filename=gopalakrishna_adiga_2012_7.pdf.

Baby, K.J. *Nadugadhika*. Translated Shirly M. Joseph. Vistar: Bangalore, 1993.

Byapari, Manoranjan. *Interrogating My Chandal life: An Autobiography*. Sage, 2018.

Devi, Mahasweta. *Bashai Tudu*. Translated by Samik Bandyopadhyay. Thema Books, 2019.

Dhasal, Namdeo. *Stone Masons- My Father and Me*. Translated by Vinay Dharwadker chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.evidyarthi.in/a/wp-content/uploads/2023/04/class-11-chapter-24-english-read-think-enjoy-book-bihar- board.pdf

Imayam. *Beast of Burdens*. Translated by Lakshmi Holmstrom. Niyogi Books Pvt. Ltd.,2019.

Indra Goshwami. *The Blood of Devipeeth*. Translated by Dibyajyoti Sharma. Niyogi Books,2021.

Islam, Kazi Nazrul. *Bidrohi.* Translated by Sajed Kamal. International Centre for Nazrul. https://www.icnazrul.com/index.php/nazrul-s-work/poems/36-poetry-lyrics/49-the-rebel- bidrohi

Kire, Easterine. *Rain-Maiden and the Bear-Man and the Other Stories*. Seagull Books, 2021.

Muktiboth, G.M. *The* Void. Translated by Vinay Dharwadker. https://guidingliterature.com/2205-2/

Nilayamgode, Devaki. *Antarjanam: Memoirs of A Namboodiri Woman*. OUP, 2012.

Pritam, Amrit. *Empty Space*. Translated by Tracy, D.H. Mohan Tracy.chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://udrc.lkouniv.ac.in/Content/Depart mentContent/SM_7e57577a-1da2-4bb4-9b03-4badc78afb08_6.pdf

Ravikumar D. & R. Azhaajarasan, The (Oxford India) Anthology of Tamil Dalit Writing. Oxford. 2012.

Revathi, A. *The Truth About Me: a Hijra Story*. Penguins India, 2010. Sukirtharani. *Portrait of My Village*. Translated by Holmstrom, Lakshmi.

https://www.lyrikline.org/en/poems/portrait-my-village-13096

Tanvir, Habib. *Charandas Chor and Other Plays*. Seagull Books, 2019.

Aquil, Raziuddin. Partha Chatterjee. Editors. *History in the Vernacular.* Orient Blackswan,2010.

George, K.M. *Modern Indian Literature: An Anthology*. Sahitya Akademi,1992.Jussawala, Adil, editor. *New Writing in India*. Penguin, 1974.

Panikker, Ayyappa. "Towards an Indian Theory of Translation". *Translation: FromPeriphery to Centrestage*, Editor. Town Mukherjee. Prestige Books, 1996.

Srinivasan, K.S. and A.K. Ramanujan. "What is Indian Literature?".*Indian Literature*. Vol. 25 no. 4, 1982, pp. 5-15.

Vijayasree, C., Meenakshi Mukherjee, et al. editors. *Nation in Imagination: Essays onNationalism, Sub-nationalism, and Narration*. Orient Blackswan, 2007.

Kapse, Dhananjay. Editor. *Modern Indian Writing in English Translation, A MultilingualAnthology*. Worldview Publications, 2015.

End Semester Examination

Time: Three hours **Maximum: 100 marks**

1. Answer any TEN of the following in about 2-3 sentences each: (10x4=40)Or Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

II. Answer the following questions in about 200 words: (4x5=20)

1. a.
OR
b.

2. a.
OR
b.

3. a.
OR
b.

4. a.
OR
b.

III. Answer the following questions in about 500 words: (4x15=60)

1. a.
OR

b.

3. a.
OR

b.

3. a.

OR

b.

4. a.

OR

b.

Course Type: Major Discipline

Course Title: CULTURAL STUDIES

Course Code:

Credits: 4

Course Description:

This course will introduce major keywords, basic concepts and theoretical developments of Cultural Studies as a globally-relevant discipline. It provides a comprehensive knowledge and understanding of the history and development of Cultural Studies as an academic field in the West and in India.The learners will be introduced to key thinkers in Cultural Studies as well as the diverse ways identities are constructed and maintained through day-to-daypractices and engagement with material culture. The course will also help learners understand the formation and the expansion of popular culture, its characteristics in modern societies and its relationship to art, literature and consumer culture from the beginning of 20th century to the information era.

Course Objectives:

- To introduce the complex and diverse idea of culture and itstheories, particularly in everyday objects and practices.
- To understand the history of Western cultural studies forreading and analysing cultural industries
- To understand the intersection of culture and other categories such as race, caste, religion, nationalism, disability, body and sexual identity.

Course Learning Outcomes:

Upon successful completion of this course, the learnerswill be able to:

CLO1	Trace the intellectual movements, key texts and concepts that have shaped cultural studies
CLO2	Understand the origin and development of the core perspectives of cultural studies and their institutionalization in the Western and Indian contexts.
CLO3	Carry out cultural analysis of literary texts

CLO4	Examine how common identity markers like body, disability, sexuality, religion, and caste are used as cultural signs to privilege/stigmatize one's social identity.
CLO5	Develop a critical outlook in perceiving culture in relation to the power and historical contexts: local, regional, national and global.

Mapping of Program Outcomes with Course Outcomes:

CLO/PO	PO1	PO2	PO3	PO4	PO5
CLO1	□		□		□
CLO2	□		□		□
CLO3	□		□		□
CLO4	□		□	□	
CLO5	□		□	□	□

Course Content:

Unit 1 - Culture as a Concept

Matthew Arnold: Chapter I, II & III *Culture and Anarchy*

F.R. Leavis: "Mass Civilization and Minority Culture"

T S Eliot: *Notes Towards the Definition of Culture*

Raymond Williams: "'Culture', Keywords"

E.P. Thompson: "The Preface" *The Making of the English Working Class*

Unit 2 - Cultural Studies

Major Schools of Cultural Studies-Birmingham and Frankfurt
John Storey (editor): "Introduction: The Study of Popular Culture and Cultural Studies" *Cultural Theory andPopular Culture: A Reader*.

Stuart Hall: "Cultural Studies and its Theoretical Legacies"Simon During: "Introduction" *The Cultural Studies Reader*

Unit 3 - Culture and the Politics of Identity

Aloysius G: "Ideology and Indian Historiography" "Nationalism as Ideology" *Nationalism without a Nation in India*

Partha Chatterjee: "Whose Imagined Community?"

Prashant Ingole: "Intersecting Dalit and Cultural Studies: De-Brahmanising theDisciplinary Space"

Unit 4 - Culture and Technology

Raymond Williams: "Advertising: the magic system"Walter Benjamin: "The Work of Art in the Age of Technological Reproducibility"

Nicholas Mirzoeff: "Visualising Visuality" *The Right to Look*

Unit 5 - Culture, Body and Sexuality

Simi Linton: "What is Disability Studies?"

Tejaswini Niranjana: "Teaching Gender Studies as Cultural Studies"

"Reinventing Privilege: The New (gay) Man in Contemporary Popular Media." *Critical Studies inMedia Communication*, 67–91

Recommended Reading :

Agger, B. (2014). *Cultural Studies as Critical Theory*. New York: Routledge. (Originalwork published in 1992).

Aloysius, G. *Nationalism without a Nation in India.* OUP, 1998.Arnold, Matthew. *Culture and Anarchy.* OUP, 2009.

Barker, Chris. *The Sage Dictionary of Cultural Studies*. London: Sage, 2004.

Brooker, Peter. *A Glossary of Cultural Theory*. London: Arnold, 2003.

Butler, J. (1999). Gender trouble: *Feminism and the Subversion of Identity*. New York:Routledge.

Carey, J. W. (1992). Communication as culture. New York, NY: Routledge.

Chatterjee, P. (1991). Whose Imagined Community? Millennium, 20(3),521–525. https://doi.org/10.1177/03058298910200030601

Critical Studies in Mass Communication, March 2003, 20(1):67-91.DOI:10.1080/0739318032000067056

During, Simon. *The Cultural Studies Reader.* Routledge, 2007.

Eliot, T.S. *Notes Towards the Definition of Culture.* Faber & Faber, 1973.

Foucault, M. (1988–1990). *History of Sexuality* (R. Hurley, Trans., Vols. 1–3). New York,NY: Vintage Books.

Grossberg, L. (2010). Cultural studies in the future tense. Durham, NC: Duke University Press.Certeau, Michel de. *The Practice of Everyday Life*. Berkeley:

U of California P, 1984. Edgar, Andrew, and Peter Sedgwick, eds. *Key Concepts in Cultural Theory*. London: Routledge,

Hall, Stuart. *Essential Essays,* Vol. 1. Duke UP, 2018.

Hoggart, Richard, et al. *The Uses of Literacy: Aspects of Working-Class Life*. PenguinClassics, 2009.

https://doi.org/10.1215/9781478002413

Ingole, P. Intersecting Dalit and Cultural Studies: De-brahmanising the DisciplinarySpace. *CASTE / A Global Journal on Social Exclusion*, *1*(2), 2020, 91-106. https://doi.org/10.26812/caste.v1i2.177

Leavis, F.R. *Mass Civilization and Minority Culture.* Minority Press,Cambridge University, 1930.

Lewis, Jeff. *Cultural Studies -The Basics*. First edition, SAGE Publications Ltd, 2002. Linton, Simi. "What is Disability Studies?" *PMLA*, Vol. 120, No. 2 (Mar., 2005), pp. 518-522Mirzoeff, Nicholas. *The Right to Look,* Duke University Press, 2011.

Lippman, Walter. *Public Opinion*. Greenbook Publications, LLC, 2010.

Mulvey, L. (1975). Visual pleasure and narrative cinema. *Screen, 16*(4), 6–18.

Nayar, Pramod K. *An Introduction to Cultural Studies*. New Delhi: Viva, 2011.

Oswell, David. *Culture and Society: An Introduction to Cultural Studies*. 1st edition, SagePublications Ltd., 2007.

Shugart, Herman. "Reinventing Privilege: The New (Gay) Man in Contemporary Popular Media".

Storey, John. *Cultural Theory and Popular Culture: A Reader*. Longman, 2008. Niranjana, Tejaswini. *Teaching Gender Studies as Cultural Studies*, Inter-Asia CulturalStudies, 9:3, 2020, 469-477, DOI: 10.1080/14649370802184791

Storey, John. *Cultural Theory and Popular Culture: An Introduction*. London: Pearson, 2012. Strinati, Dominic. *An Introduction to Theories of Popular Culture*. London: Routledge, 1995.Tudor, Andrew. *Decoding Culture: Theory and Method in Cultural Studies*. London: Sage,

Thompson, E.P. *The Making of the English Working Class*. Penguin Books, 2013.Williams, Raymond. *Keywords: A Vocabulary of Culture and Society***.** OUP, 2013.

End Semester Examination

Time: Three Hours **Maximum Marks: 100**

III. Answer any TEN of the following in about 2-3 sentences each (10x2 = 20)

Or

Annotate any FIVE of the following passages in about 5-6 sentences each: (5x4=20)

IV. Answer the following questions in about 200 words (4x5=20)

2. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or.
b.

III. Answer the following questions in about 500 words (4x15=60)

2. a.
Or
b.

2. a.
Or
b.

3. a.
Or
b.

4. a.
Or
b.

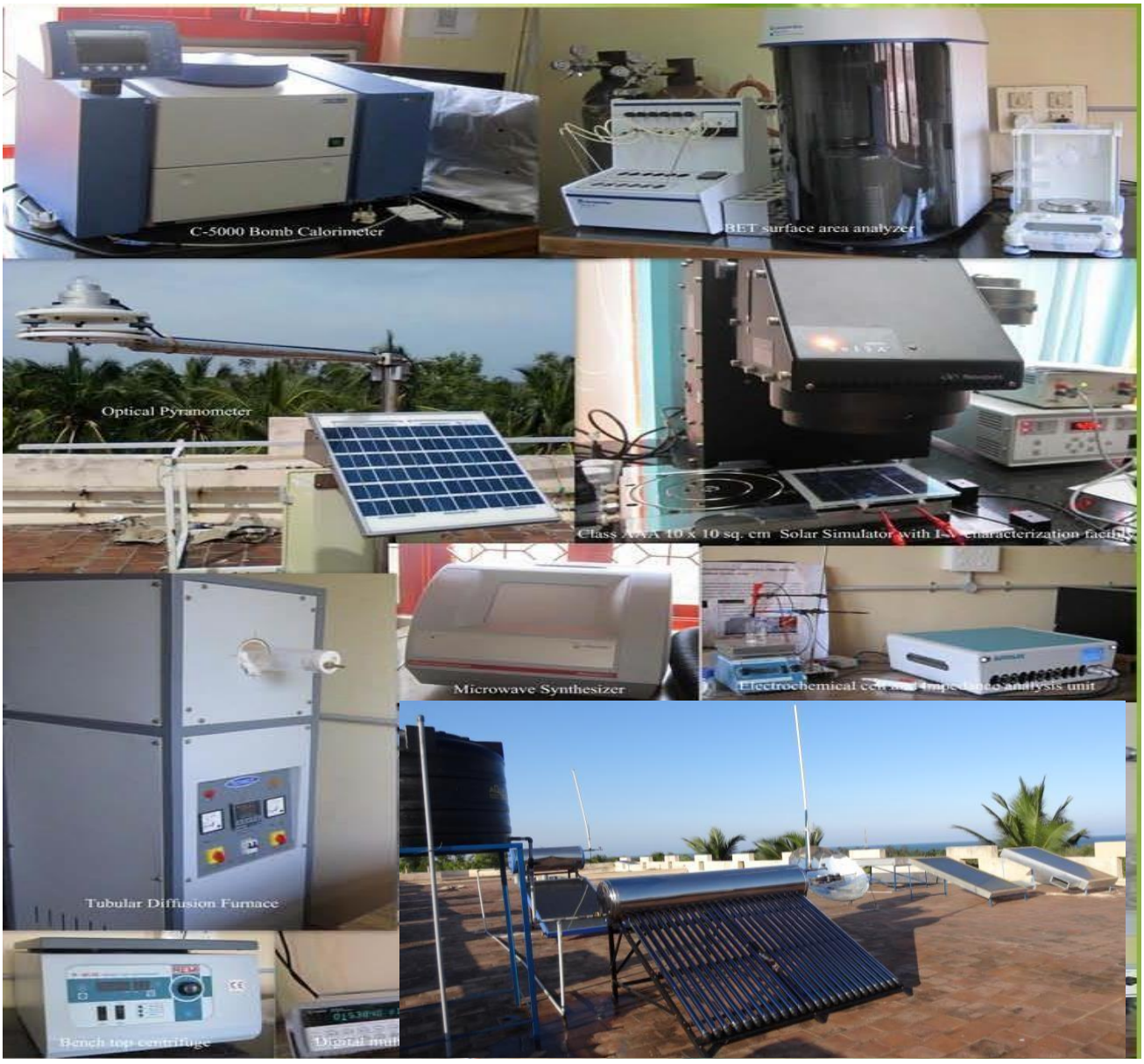
PONDICHERRY UNIVERSITY

(A Central University)

R.V. NAGAR, KALAPET, PUDUCHERRY – 605 014 INDIA

DEPARTMENT OF GREEN ENERGY TECHNOLOGY

MADANJEET SCHOOL OF GREEN ENERGY TECHNOLOGIES



SYLLABUS

M.TECH. GREEN ENERGY TECHNOLOGY

2022-2023

SEMESTER-I

DGET511: ENERGY, ENVIRONMENT AND RENEWABLE ENERGY TECHNOLOGIES

(Hard-core Course) **L T P C**

3 1 0 3 45L

Course Outcome:

- Understand the nexus between energy, environment and sustainable development
- Appreciate energy ecosystems and its impact on environment
- Learn basics of various types of renewable and clean energy technologies
- Serve as bridge to advanced courses in renewable energy

Unit I: Energy [8]

Introduction to the nexus between energy, environment and sustainable development, Energy sources over view and classification, sun as the source of energy, fossil fuel reserves and resources - overview of global/ India's energy scenario. Energy consumption models – Specific Energy Consumption.

Unit II: Ecology and Environment [9]

Concept and theories of ecosystems, - energy flow in major man-made ecosystems- agricultural, industrial and urban ecosystems - sources of pollution from energy technologies and its impact on atmosphere - air, water, soil, and the environment - environmental laws on pollution control, The environmental protection act: Effluent standards and ambient air quality, innovation and sustainability, eco-restoration: phyto-remediation.

Unit III: Renewable Sources of Energy [10]

Solar Energy: Solar radiation: measurements and prediction. Indian's solar energy potential and challenges, solar energy conversion principles and technologies: Photosynthesis, Photovoltaic conversion and Photo thermal energy conversion. **Wind Energy**: Atmospheric circulations, atmospheric boundary layers, classification, factors influencing wind, wind shear, turbulence, wind energy basics and power Content, wind speed monitoring, Betz limit, wind energy conversion system: classification, characteristics and applications. **Ocean Energy**: Ocean energy resources-ocean energy conversion principles and technologies: ocean thermal, ocean wave & ocean tide. **Bioenergy:** resources and types.

Unit IV: Other Energy Sources and Systems [9]

Hydropower, Nuclear fission and fusion-Geothermal energy: Origin, types of geothermal energy sites, site selection, geothermal power plants; hydrogen energy, Magneto-hydro-dynamic (MHD) energy conversion – Radioisotope Thermoelectric Generator (RTG), Bio-solar cells, battery & super capacitor, energy transmission and conversions.

Unit V: Energy and Economy [9]

Energy and Economics: gross domestic product (GDP) and energy – energy market and society – energy efficiency – energy – energy and economics – energy: security – equity – environmental sustainability index and global measure

Text Books:

1. Energy and Environment Set: Mathematics of Decision Making, Loulou, Richard; Waaub, Jean- Philippe; Zaccour, Georges (Eds.), 2005.
2. Energy and the Environment, Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A., 2nd Edition, John Wiley, 2006.

References:

1. Energy and the Challenge of Sustainability, World Energy assessment, UNDP, N York, 2000.
2. Solar Energy: principles of Thermal Collection and Storage, S.P. Sukhatme, Tata McGraw-Hill (1984).
3. D. Y. Goswami, F. Kreith and J. F. Kreider, Principles of Solar Engineering, Taylor and Francis, Philadelphia, 2000.
4. Wind Energy Conversion Systems, L.L. Freris, Prentice Hal 1990.
5. Geothermal Energy: From Theoretical Models to Exploration and Development by Ingrid Sober and Kurt Bucher, Springer, 2013.
6. Ocean Energy: Tide and Tidal Power by R. H. Charlier and Charles W. Finkl, Springer 2010

DGET 512: BIOENERGY AND CONVERSION SYSTEMS

(Hard-core Course) **L T P C**

3 1 0 3 **45L**

Course Outcome:

- Learn fundamentals of biochemistry and biological systems for energy application
- Realization of global bioenergy potential, and scenario of bioenergy in India.
- Understand various biofuel types and characteristics
- Understanding of various types of bioenergy conversion systems in practice
- Acquire basic knowledge on microbial culture, biomass harvest and biofuel production
- Know the national and international biofuel Standards.

Unit I: Biological Systems [10]

Introduction to Biomolecules: Classification of amino acids, carbohydrates and nucleotides; Structure and properties of carbohydrate polymers, proteins and nucleic acids; Classification and utility of lipids and fatty acids; Functional roles of biomolecules – energy carriers, enzyme cofactors and biochemical regulation. From biomolecules to cells - biological systems. Biomass mass resources.

Unit II: Biochemical Pathways and Chemical Kinetics: [8]

Biosynthesis and breakdown of carbohydrates- Lipids- proteins and nucleic acids TCA cycle - Glycolysis - Gluconeogenesis - Pentose phosphate shunt - Urea cycle - Interconnection of Pathways - Metabolic regulations. Biocatalysis by enzymes and pathways - Fermentation bioethanol and biobutanol – Rate limiting steps and conversion efficiency.

Unit III: Biomass Resources and Biochemical Conversions [10]

Microbial biomass. Large scale culture and harvest of photosynthetic organism - photo bioreactors; Microalgae for lipid and carbohydrate synthesis. Biodegradation and biodegradability of substrate; anaerobic digestion - Bioconversion of lignocellulosic feedstock to sugars - Bioconversion of sugars and starches to fuels - Difference of the technologies of starch ethanol and cellulosic ethanol.

Unit IV: Thermochemical & Chemical Conversions [9]

Thermochemical Conversion: Direct combustion, incineration, pyrolysis, gasification and liquefaction; Bio gasification: Biomethanation process, biogas digester types,. Waste to energy. Chemical Conversion: Hydrolysis & hydrogenation; solvent extraction of hydrocarbons; solvolysis of wood, bio crude, biodiesel production via chemical process; transesterification methods; Chemicals from biomass.

Unit V: Biofuels Standards & Power Generation [8]

Physical and chemical characteristics of biofuels – Biomass, wood gas, bio methane; ethanol, biodiesel, Wood oil; Bio blends - Indian and International standard specifications. Adaptation of biofuel in various applications. Biofuel economy; Biofuel roadmap of India - policy issues, regulatory issues and economic impact; Entrepreneurship in biofuel - Prospects & Challenges, Case studies.

Text Books:

1. Renewable Energy, Third Edition, Bent Sorensen, Academic Press August 2004
2. Lehninger's Principles of Biochemistry by David L. Nelson and Michael M. Cox, Macmillan Worth publisher, 2009.

Reference books:

1. Biochemistry 6th edition by Jeremy M Berg, Lubert Stryer, John L. Tymoczko, 2008.
2. Voet and Voet's Biochemistry, D. Voet and J. Voet 3rd Edition, John Wiley and Sons Inc., 2005.
3. Biochemistry, 5th Ed by Eric E Conn, Paul K Stumpf, George Bruening and Roy H Doi, 2009.
4. Biofuels - Securing the Planet's Future Energy Needs, Edited by A Demirbas Springer 2009.
5. Biomass Assessment Handbook - Bioenergy for a sustainable environment Edited by Frank Rosillo-Calle, Sarah Hemstock, Peter de Groot and Jeremy Woods, Earthscan November 2006.
6. Dictionary of Renewable Resources - 2nd Edition, Revised and Enlarged, Zoebelein, Hans, Wiley-VCH, 2001.

DGET 513: FUELS, COMBUSTION AND CLEANER TECHNOLOGY

	L	T	P	C	
(Hard Core Course)	**3**	**1**	**0**	**3**	**45L**

Course Outcome:

Students will learn about

- Basics of solid, liquid and gaseous fuels
- Conversion of solid fuels to liquid and gases fuels
- Petroleum refinery processes in detail
- Combustion stoichiometry and flue gases analysis and
- Industrial furnaces, advance clean coal technologies and carbon-di-oxide capture and storage.

Unit I: Solid Fuels [9]

Coal: Family, origin, classification of coal, coal rank-Hilts law analysis, physical and chemical properties of coal; Calorific value of solid fuels- Action of heat on coal; Liquefaction of coal, direct and indirect liquefaction, Fischer-Tropsch synthesis. Gasification processes of coal- Lurgi and Winkler. Manufactured fuels- hard and soft coke, Agro fuels-solid fuel handling and storage.

Unit II: Liquid and Gaseous Fuels [9]

Origin and classification of petroleum crude oil; recovery of crude oil, properties – flash/fire point, octane and cetane number. Oil refinery -physical, chemical and catalytic processes –distillation, vacuum distillation, catalytic reformer, catalytic hydrotreater, upgrading heavy oil, thermal cracking, catalytic cracking, dewaxing, deasphalting and catalyst rejuvenation. Liquid fuels from other sources; Storage and handling of liquid fuels. Types of gaseous fuels: natural gases, methane from coal mines, manufactured gases, producer gas, water gas, biogas, refinery gas, LPG; Cleaning and purification of gaseous fuels.

Unit III: Theory of Combustion Process [9]

Combustion: Concept, 3Ts, ignition, auto- and force ignition. Burners and basic features/design of burners for solid, liquid, and gaseous fuels. Combustion Stoichiometry and thermodynamics. Heat of reaction, of higher heating value (HHV), lower calorific value (LHV), determination of calorific value by Bomb Calorimeter and Boy's calorific methods.

Unit IV: Fuel stoichiometry and analysis [9]

Stoichiometry: Estimation of air required for complete combustion. Mass basis and volume basis, air to fuel ratio, rich and lean mixture, excess air calculation. Estimation of minimum amount of air required for a fuel of known composition. Estimation of dry flue gases and exhaust gases analysis, Orsat flue gas analyzer. Calculation of the composition of fuel & excess air supplied from exhaust gas analysis. Dew point of products; Flue gas analysis (O_2, CO_2, CO, NOx, SOx).

Unit V: Industrial furnaces and advance clean technology [9]

Industrial furnaces: Blast furnace and Open-hearth furnace for metal extraction. Heat distribution in furnaces and waste heat recovery: Recuperates and regenerators. Furnace insulation: Ceramic coating. Advance clean coal combustion and gasification and co-gasification: Pulverized, fluidized bed combustion, and recent advance technologies. Emission reduction and carbon-di-oxide capture and storage.

Text Books:

1. Fuels and Combustion, Samir Sarkar, Orient Longman Pvt. Ltd, 3rd edition, 2009
2. S.P. Sharma &Chander Mohan, Fuels & Combustion, Tata McGraw Hill Publishing Co.Ltd.,1984.

Reference Books:

1. K. Kanneth, "Principles of combustion", Wiley and Sons, 2005.
2. Liquid Fuels for Internal Combustion Engines: A Practical Treatise for Engineers & Chemists, by Harold Moore, ISBN: 9781146203067, Publisher: Nabu Press, 2008.
3. Cleaner Combustion and Sustainable World-HaiyingQi, Bo Zhao, Springer 2013.
4. Fuel Flexible EnergyGeneration, Solid, Liquid and Gaseous Fuels by John Oakey, Woodhead Publishing – Elsevier, 2016.
5. An introduction to combustion: Concept and applications – Stephen R Turns, Tata Mc. Graw Hill, 3rd edition, 2012
6. Modern Petroleum Technology, Vol 1, Upstream, Ed. by Richard A. Dave, IP, 6th ed.,John Wiley & Sons. Ltd

DGET 514: COMPUTATIONAL FLUID DYNAMICS FOR ENERGY ENGINEERING

(Hard-core Course) **L T P C**

3 1 0 3 45L

Course Outcomes

At the end of the course students should be able to:

- Describe the physical significance of each term in the governing equations for CFD.
- Effectively use a commercial CFD package to solve practical CFD problems.
- Quantify and analyze the numerical error in solution of the CFD, PDE's.
- Formulate explicit and implicit algorithms for solving the Navier Stokes Equations.
- Create and demonstrate verification strategies for evaluating CFD application in Energy Engineering.

Unit I: Governing Equations and Boundary Conditions [9]

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behavior of PDEs on CFD – Elliptic, Parabolic and Hyperbolic equations.

Unit II: Finite Difference & Finite Volume Methods for Diffusion [9]

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.

Unit III: Finite Volume Method for Convection Diffusion [9]

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

Unit IV: Turbulence Modelling [10]

Important features of turbulent flow, Vorticity transport equation, Statistical representation of turbulent flows: Homogeneous turbulence and isotropic turbulence, General Properties of turbulent quantities, Reynolds average Navier stokes (RANS) equation, Closure problem in turbulence: Necessity of turbulence modelling, Different types of turbulence model: Eddy viscosity models, Mixing length model, Turbulent kinetic energy and dissipation, The κ-ε model, Advantages and disadvantages of κ -ε model, More two-equation models: RNG κ-ε model and κ-ω model, Reynolds stress model (RSM),Large eddy Simulation (LES),Direct numerical simulation (DNS).

Unit-V: Application of CFD in WIND, PV and Battery/Fuel Cells Energy Syste [8]

Application of CFD in Wind Energy, Different load configurations (Aerodynamic load, gravity loads, centrifugal loads, wind Shear), Co-efficient of pressure, Kinetic Energy of wind, momentum in the wind, Power, Coefficient of Power. Application of CFD in Photo Voltaic Energy System. Application of CFD in Battery/Fuel Cells.

Text Books:

1. Computational Fluid Flow and Heat Transfer, K. Muralidhar, T. Sundararajan (Narosa Publication).
2. Computational Fluid Dynamics by Chung T. J., Cambridge University Press.

Reference Books:

1. Numerical Heat Transfer and Fluid Flow by S. V. Patankar
2. Essential Computational Fluid Dynamics by Zikanov. O., Wiley
3. Computer Simulation of Flow and Heat Transfer by P. S. Ghoshdastidar (4th Ed, Tata McGraw-Hill).
4. Computational Fluid Dynamics by Tapan K. Sengupta, University Press.
5. Numerical Computation of Internal and External Flows by Hirch C., Elesvier.

DGET 515: SOLAR THERMAL ENERGY CONVERSION

(Hard Core Course) **L T P C**

3 1 0 3 45L

Course Outcome:

- To acquire knowledge on solar radiation and its characteristics
- To develop understanding the importance of heat transfer in solar thermal energy studies
- To analyze the thermal characteristics of solar flat plate collectors
- To study solar concentrating collectors and its features

Unit I: Solar Radiation Geometry [10]

Solar angles; the earth and solar constant; day length; angle of incidence on the tilted surface; variation of extraterrestrial radiation; solar radiation at the earth's surface; solar radiation data; sunrise, sunset and day length local apparent time; instruments for measuring solar radiation and sunshine; solar radiation on tilted surfaces; analysis of Indian solar radiation data and applications.

Unit II: Heat transfer: Concepts and Definition [7]

Introduction; Heat transfer in engineering; Mechanism of heat transfer; Temperature field and temperature gradient; Conduction; Thermal Conductivity; Thermal insulation; Contact resistance; Convection; Thermal radiation; Combined mechanism of heat transfer, Thermal contact resistance; Critical thickness of insulation; Conduction in other shapes; Shape factor; Steady state heat conduction in solid/hollow cylinders with uniform heat generation

Unit III: Heat Transfer and Fluid Flow Correlation for Design of Solar Thermal Systems [8]

Heat Exchangers; Overall heat transfer coefficient; Log mean temperature difference; Heat exchanger performance: Effectiveness; Fins; Fin model; Temperature calculation; Heat flow calculation; Fin performance: Fin effectiveness, Fin efficiency; Application of fins in enhanced heat transfer; Mechanism of convection, Free convection (Laminar, Turbulent &Mixed) on horizontal, vertical and Inclined plates, cylinder and sphere; forced convection inside tube sand ducts; Forced convection over exterior surfaces; Dimensionless group of importance of heat transfer and fluid flow.

Unit IV: Solar Flat Plate Collectors [12]

Flat plate collectors; Basic flat-plate energy balance; Effective energy losses; Thermal analysis; Heat capacity effect; overall loss coefficient; Collector efficiency factor; Collector heat removal factor; efficiency of flat plate collectors; Effective transmittance-absorptance product; Evacuated tube collectors: Types, thermal analysis; Materials for solar flat plate collectors; Selective coating.

Unit V: Solar Concentrating Collectors [8]

Concentrating collectors: Designing and types; Acceptance angle; Geometric concentration ratio; Optical efficiency; Thermal efficiency; Classification, Types of concentrators; Materials for solar concentrators.

Text Books:

1. DuffleandBeckman,SolarThermalEngineeringProcess,JohnWiley&Sons,NewYork
2. J.S.Hsieh,SolarEnergy,PrenticeHall Inc.NewJerssey

Reference Books:

1. P.J.Lunde,SolarThermalEngineering,JohnWiley&Sons,NewYork
2. N.C.Harris, C.E.MillerandI.E.Thomas,Solar EnergySystemsDesign, JohnWiley&Sons,NewYork
3. Garg HP.,PrakashJ.,SolarEnergy:Fundamentals&Applications,TataMcGrawHill,NewDelhi,1997
4. S.P.Sukhatme,SolarEnergy,TataMcGrewHill CompanyLtd., NewDelhi
5. F.KreithandJ.F.Kreider,PrinciplesofSolarEngineering,HemispherePublishingCoro.
6. A.B.MeinelandM.B.Meinel,AppliedSolarEnergy,Addison– WileyPub.Co.,Reading

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DGET516: MODELLING AND SIMULATIONS OF GREEN ENERGY SYSTEMS

(Hard Core Course) **L T P C**

3 1 0 3 45L

Course Outcome:

- To provide a basic understanding of Probability Theory
- To provide a basic understanding of applied Linear Algebra and optimization problems, viz., their formulation, analytic and computational tools for their solutions,
- To learn about applications of Linear Algebra and Probability Theory in modelling and simulation environment.

Unit I: Introduction to mathematical modelling [9]

Introduction to mathematical modelling: Basic principles of modeling, Physical and mathematical models, Fundamentals of Programming: Introduction to computational softwares: Programming in computational software (with the help of a specific software Matlab or python), Elementary computer graphics, Numerical integration –Differentiation, Newton forward, backward and central difference, trapezoidal and Simpson methods, Newton-Raphson.

Unit II: Date, Script and Function Files [9]

Handling data files, Script files and Function files, User Defined Function files, physical model-Solar simulator, computer simulation of solar radiation, estimation of solar constant, ASHRAE radiation model and simulation of clear sky solar radiation.

Unit III: Scripts and Models [9]

Lab exercises to develop simple Scripts and models related to building energy systems involving applications of data analysis, solar cell I-V curve analysis, diode model and simulation, solar cell model, simple photovoltaic models and simulation, Flat Plate Collector (FPC) model.

Unit IV: Power Electronic System Modeling [9]

Power electronic system modeling, Model files, Basic elements-: blocks and lines.-Running Simulation-Building Systems- Block Libraries: Sources, Sinks, Discrete, Linear. Nonlinear, Connections, Defining Block Parameters Using Matlab, buck and boost converters, DC-AC inverter(with the help of any one of Simulink), implementation of MPPT.

Unit V: Modelling and Simulation of Solar, Wind and Hybrid systems [9]

Optimization and curve fitting techniques, least square methode, lagrange multiplier, interpolation techniques, newtons and lagrange interpolations, FPC optimization, Modelling of PV Solar Array: simulation of power output of PV systems, Wind TurbineTurbine/generator, Hybrid system modelling.

Text Books:

1. Modelling and Simulation: Exploring Dynamic System Behaviour, by Louis G. Birta Publisher: Springer, 2007
2. An Engineer's Guide to MATLAB: With Applications from Mechanical, Aerospace, Electrical, and Civil Engineering E. B. Magrab S. Azarm B. Balachandran J. H. DuncanbK. E. Herold G. C. Walsh Prentice Hall 2004

Reference Books:

1. Solar Photovoltaics, Fundamentals, Technologies and Applications, C.S. Solanki, Eastern Economy Edition, Third Edition, 2016, Academic Press 2007
2. G.M.Masters, Renewable and Efficient Electric Power Systems, Wiley, first edition, 2004.
3. Modeling of photovoltaic system using MATLAB: simplified Green Codes, Tamer Khatib, Wilfried Elmenreich, First Edition, Wiley, 2016

DGET 517: ELECTRICAL ENERGY SYSTEMS

	L	T	P	C
(Soft Core Course)	**3**	**0**	**0**	**3**
45L				

Course Outcome:

- To explain DC circuits, AC circuits and the behavior of R, L and C and their combinations in AC circuits.
- To discuss three phase balanced circuits.
- To explain principle of operation, construction and performance of electrical machines such as single-phase transformer, DC machines, synchronous generator and three phase induction motor.
- To introduce concepts of electrical wiring, circuit protecting devices and earthing, understand Electrical Equipment's used in Power Plants, Electrical Power System Analysis, Power Transmission

Unit I: Introduction to Basics of Electrical Systems [8]

D.C. Circuits: Analysis of series, parallel and series- parallel circuits excited by independent voltage sources. Power and Energy.

A.C. Fundamentals: Generation of sinusoidal voltage, frequency of generated voltage, definition and numerical values of average value, root mean square value, form factor and peak factor of sinusoidally varying voltage and current.

Single Phase Circuits: Analysis, with phasor diagram, of circuits with R, L, C, R-L, RC, R-L-C for series and parallel configurations. Real power, reactive power, apparent power, and power factor.

Three Phase circuits: Generation of 3-phase power, Three-phase balanced circuits, voltage and current relations in star, delta connections and Measurement of three phase.

Unit II: Transformers, DC Generators and Motors [8]

Single Phase Transformers: Construction and types of transformers, Principle of operation, emf equation, losses, variation of losses with respect to load, efficiency, Condition for maximum efficiency.

DC Generators: Principle of operation, Construction of D.C. Generators. Expression for induced emf, Types of D.C. Generators, Relation between induced emf and terminal voltage.

DC motors: Principle of operation, Back emf, Torque equation, Types of dc motors, Characteristics of dc motors (shunt and series motors only) and Applications.

Unit III: Synchronous Generators and Induction Motor [8]

Three Phase Synchronous Generators: Constructional details, Synchronous speed, Frequency of generated voltage, emf equation, Concept of winding factor.

Three Phase Induction Motors: Generation of rotating magnetic field, Three-phase induction motor, Slip and its significance. Necessity of starter, star-delta starter.

Unit IV: Electrical equipment used in Power Plants [6]

Electrical Equipment's used in Power Plants, Electrical Power System Analysis, Power Transmission.

Text Books:

1. Electrical Engineering Fundamentals, V. Del Toro, Prentice Hall of India, (2004).
2. Basic Electrical Engineering, K. Nagsarkar and M. S. Sukhija, Oxford University Press, (2005).

Reference Books:

1. Basic Electrical Engineering, D C Kulshreshtha, Tata McGraw Hill Revised First Edition.
2. Principles of Electrical Engineering & Electronics, V. K. Mehta, Rohit Mehta, S Chand Publications.
3. Basic Electrical Engineering, D P Kothari and I J Nagrath, Tata McGraw Hill, 2017
4. Power Generation, Operation, and Control by Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, 2003.
5. Power System Control and Stability by P. M. Anderson and A. A. Fouad, Wiley-IEEE Press, 2002.
6. Electric Energy Systems Theory: An Introduction by Olle I Elgerad, T M H Edition, 1982.

DGET518: NANOMATERIALS: PROPERTIES, SYNTHESIS, CHARACTERIZATION AND APPLICATIONS

	L	T	P	C	
(Soft Core Course)	**3**	**0**	**0**	**3**	**45L**

Course outcome:

- After studying this subject, students would be able to understand the nanomaterial's basics, synthesis, and characterizations
- Ability to modify or functionalize the surfaces of nanomaterials
- The student can design and fabricate the devices based on nanomaterials
- The student can perform testing of nanomaterials and apply for green energy applications

Unit I: Properties at Nanomaterials [9]

Comparison of properties at bulk and Nano, Nanomaterials, Nanostructures, chemical and physical properties-surface-to-volume ratio, the density of states, Quantum confinement and Bohr exciton radius, Quantum size effects, electrical, optical & magnetic properties, Origin of Surface Plasmon resonance in metallic nanoparticles, Absorption and emission properties of semiconductor nanocrystals, Carbon-based nanomaterials

Unit II: Nanomaterials by Physical and Chemical Methods [9]

Top-down and bottom-up approaches, Physical methods: Inert gas condensation, Arc discharge, Sputtering, Laser ablation, Chemical methods: reduction-precipitation, Hydrothermal, Solvothermal processes, Sol-gel, micelles, and microemulsions, Thermolysis, Chemical vapor deposition methods, Electrochemical synthesis, Chemical modification of nanomaterials, Functionalization.

Unit III: Green Synthesis of Nanomaterials [9]

General approach for green synthesis – principles - Green synthesis of metals and alloys – use of natural resources and biosynthesis of nanomaterials. Microwave synthesis of nanomaterials.

Unit IV: Structural and Morphological Characterization [9]

Powder XRD and crystallite size, Light scattering and particle size, Surface area and porosity, UV and IR studies, XPS, Raman, FTIR. Microscopy techniques, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Scanning tunneling microscopy (STM) , Atomic force microscopy (AFM) Principle and analysis.

Unit V: Applications of Nanomaterials and Societal Implications [9]

Nanomaterials and Nanotechnology General Applications, Green technology and green energy applications, Industrial manufacturing, materials and products, and clean environment, Implications for philosophy, ethics, and society.

Text Books:

1. Charles P. Poole, Frank J. Owens, Introduction to Nanotechnology, A John Wiley & Sons, inc.
2. Pradeep T., Nano:The Essentials: Understanding Nanoscience and Nanotechnology, Tata McGraw-Hill Publishing Company Limited, New Delhi,2008.

Reference Books:

1. Rao C.N.R, Müller, Cheetham, The Chemistry of Nanomaterials, Vol 1 and 2, Wiley-VCH VerlagGmBH& Co., Weinheim, 2004.
2. Nanotechnology: assessment and perspectives, H. Brune et al., New York, Springer, 2006.
3. Nano-hype: the truth behind the nanotechnology buzz, David M. Berube; Amherst, N.Y., Prometheus Books, 2006.
4. Edelstin A.S. and CammarataR.C..Nanomaterials: Synthesis, Properties and applications, Institute of Physics Publishing 1996.
5. M.C. Roco and W.S Bainbridge, Nanotechnology: Societal Implications II – individual Perspectives, Springer publishers, sponsored by National Science Foundation, Netherlands.

DGET 510: ENERGY LABORATORY – I

L T P C

(Hard-core Course) **0 2 4 3** **90L**

A. Course Outline:

- Basic concepts: Terminology used in experimental methods i.e. sensitivity, accuracy, uncertainty, calibration, and standards; experimental system design and arrangement.
- Analysis of experimental data: Analysis of causes and types of experimental errors, uncertainty and statistical analysis of experimental data.
- Data acquisition and processing: Data acquisition methods, data storage, and display, examples of application in typical energy system.
- Apparatus design and construction: Conceptual, substantive and detailed designs of experiments;

illustration of thermal energy equipment/devices and their accessories.

- Experiment plan and execution: Preparatory work for carrying out experiments; range of experimental study, choice of measuring instruments, measurement system calibration, data sheets and log books, experimental procedure, etc; applications.
- Technical Communication: Report preparation of experimental work, use of graphs, figures, tables, software and hardware aids for technical communication.

B. Laboratory:

S. No.	List of Experiments*
1	Measurement of global solar irradiance by using a Pyranometer.
2	To measure the efficiency of flat plate solar water heater.
3	To estimate the efficiency of the evacuated tube solar water heater.
4	To study the thermal performance of solar air heaters under natural convection.
5	To find out the efficiency of forced circulation solar air heater at a particular mass flow rate.
6	Simulation of diode characteristics.
7	Modeling and analysis of the solar cell.
8	Modeling and simulation of PV module.
9	Simulation of the DC-AC inverter.
10	Modeling and Simulation of DC-DC converter (buck and boost).
11	Simulation of standalone PV system.
12	Modeling of grid-connected PV system.
13	Modeling and Simulation of solar position using Sandia model.
14	Analysis of solar radiation using Sandia model simulation.
15	Simulation of I-V performance under clear sky (Sandia model).
16	Simulation of a solar inverter (Sandia model).
17	Application of CFD in the solar energy system.
18	Determination of flash and fire point of the given sample fuel/oil by using the Pensky Martin apparatus.
19	Characterization of Energy Materials using XRD, Microscope, FT-IR, and Raman.
20	Culture of microorganism: Media preparation.
21	Biomass harvest by various methods – a comparative study.
22	Extraction and quantification of photosynthetic pigments and biochemical components.
23	Extraction of bio-oil - chemical and physical methods and its characterization.

***Minimum of 15 practicals shall be offered**

Manuals:

1.Garg H.P., Kandpal T.C., Laboratory Manual on Solar Thermal Experiments, Narossa Publishing House, New Delhi, 1999.
2.Holman, Jack P. (1984) Experimental Methods for Engineers, McGraw-Hill Book Company.
3.Doebelin, Ernest O. (1995) Engineering Experimentation – Planning, Execution, Reporting, McGraw-Hill,

References:

1. Polak, P. (1979) Systematic Errors in Engineering Experiments, Macmillan Press Ltd.
2. Annual Book of ASTM standards, Section I – V, Vol. 05.01-05.05, 2002-2003.
3. Experiments with renewable energy-students guide- ISBN 1-928982-22-0
4. African journal of Biotechnology,vol 9(12), pp 1719 (2010)

SEMESTER-II

DGET 521: SOLAR PHOTOVOLTAIC ENERGY CONVERSION

L T P C

(Hard Core Course) **3 1 0 3 45L**

Course outcome:

- This course highlights about the solar energy, solar energy conversion principles, fundamentals about semiconductors and their application for solar cell fabrication and solar characterization
- Students will have complete understanding about the solar energy and their conversion principles – solar cell fundamentals – solar cell fabrication and characterization techniques.

Unit I: Properties of Semiconductor [9]

Semiconductors - crystals structures, atomic bonding, energy band diagram – e-k diagram, direct & indirect bandgap- p & n doping and carrier concentration - Hall Effect in semiconductors – Intrinsic & extrinsic semiconductor - compound semiconductors - diffusion and drift of carriers, continuity equation – optical absorption – carrier recombination -Effect of temperature.

Unit II: Semiconductors for Solar Cell [9]

Silicon: preparation of metallurgical, electronic and solar grade Silicon - Production of single crystal Silicon: Czokralski (CZ) and Float Zone (FZ) method – imperfections – carrier doping and lifetime - Germanium - compound semiconductors: growth & characterization - amorphous materials – Transparent conducting oxides-Anti-reflection principles and coatings – organic materials.

Unit III: Device fabrication [9]

Semiconductor junctions: Schottky barriers, MIS, P-N junction, p-i-n junction and its properties Homo & hetero junction solar cells, multi junction solar cells- Fabrication techniques: Diffusion, thin film technology- physical vapour deposition (PVD)- Electro-deposition-Molecular beam epitaxy (MBE)- Metal organic chemical vapour deposition (MOCVD)- Plasma enhanced chemical vapour deposition (PECVD)- Organic and Nano tech solar cells – contact & grid metalization.

Unit IV: Characterization and Analysis [9]

Device isolation & analysis - Ideal cell under illumination- solar cell parameters short circuit current, open circuit voltage, fill factor, efficiency; optical losses; electrical losses, surface recombination velocity, quantum efficiency - measurements of solar cell parameters; I-V curve & L-I-V characteristics, internal Quantum yield measurements – Effects of series and parallel resistance and Temperature - Loss analysis.

Unit V: Thermo-photovoltaics [9]

Thermo photovoltaic principles - thermophotovoltaic materials and device fabrication – thermophotovoltaic device characterization and analysis – Thermo-photovoltaic power systems.

Text Books:

1. Seminconductors for solar cells, H. J. Moller, Artech House Inc, MA, USA, 1993.
2. Fundamentals of Solar Cells: PV Solar Energy Conversion, Alan L Fahrenbruch and Richard H Bube , Academic Press, New York , 1983

Reference Books:

1. Solar Cells: Operating principles, Technology and Systems Applications, Martin Green, UNSW, Australia, 1997.
2. Solar Cells and their Applications, Larry D Partain (ed.), John Wiley and Sons, Inc, New York, 1995.
3. J. Nelson, The physics of solar cells, Imperial College Press, 2006.
4. Photovoltaic Materials, Richard H Bube, Imperial College Press, 1998
5. Practical Photo voltaics: Electricity from Solar Cells, by Richard Komp, ISBN:9780937948118, Publisher: Aatec Publications, Publication Date:February 2002.
6. Bauer, Thomas, "Thermophotovoltaics: Basic Principles and Critical Aspects of System Design" Springer (2012).

DGET 522: ELECTROCHEMICAL ENERGY CONVERSION AND STORAGE

L T P C

(Hard Core Course) 3 1 0 3 45L

Course Outcome:

- Enrich knowledge on basics of energy conversion & storage
- Gain know-how battery and fuel cell functioning
- Gain knowledge on fabrication technology of battery and fuel cells
- Aware about the storage of renewable energy using battery

Unit I: Introduction [9]

Electrochemical cell, electro motive force, free energy changes and emf, concentration of the reactants on EMF, effect of cell temperature, derivation of number of electrons involved in a cell reactions, thermodynamic calculations, electrochemical series-equilibrium potential, Nernst equation-Battery types – primary and secondary batteries and examples - theoretical voltage, capacity, energy & specific energy, power & specific power.

Unit II: Primary batteries [9]

Dry cells-zinc/carbon battery, alkaline primary batteries, Zn/air, Lithium batteries, reserve batteries-air and water activated: principle, components, construction, characteristics, applications, and problems associated with the systems.

Unit III: Secondary Batteries [9]

Principle, construction, components, merits and demerits of lead acid, nickel-cadmium, nickel- metal hydride, lithium-ion batteries-Possible applications.

Unit IV: Supercapacitors [9]

Introduction to supercapacitors, types of supercapacitors, Reagone plot, similarities and differences between supercapacitors and batteries, electrode interface & double layer capacitors-redox

capacitors-construction and performance evaluation, materials for supercapacitors and technology development – typical examples.

Unit V: Fuel Cells [9]

Introduction to fuel cells, merits and demerits, comparison to batteries & internal engines, types of fuel cells, EMF of fuel cells, Nernst equation, efficiency, current versus potential issues, fuel cell reaction kinetics, ORR, MOR, selection of fuel, electrode, electrolyte and membranes-fuel cell charge transport, fuel cell mass transport, fuel cell characterization, fuel cell losses, hydrogen - oxygen fuel cell, PEMFCs, DMFCs, PAFCs, molten carbonatate fuel cells,SOFCs and Biofuel cells.

Text Books:

1. Barak, Electrochemical Power sources, I.E.E. series Peter Peregrinus Ltd. Steverage, U.K 1980 reprint 1997.
2. J.O.M. Bockris& A.K.N. Reddy, Modern Electrochemistry, Plenum Press, 1996.

Reference Books:

1. A.J. Bard & L.R. Faulkner, Electrochemical Methods Fundamentals and Applications, John Wiley & Sons. 2nd Edition, 2001.
2. B.E. Conway, Electrochemical supercapacitors: scientific fundamentals and technological applications, Kluwer Academic / Plenum publishers, New York, 1999.
3. T.R. Crompton, Batteries reference book, Newners, 3rd Edition, 2002.
4. P. Elumalai & T. Maiyalagan, Reachable lithium-ion batteries: Trends and Trends and Progress in Electric Vehicle Technology, CRC Press, ISBN 9781138484092.

DGET 523: WIND ENERGY TECHNOLOGY

(Hard Core Course) **L T P C**

3 1 0 3 45L

Course Outcome:

- Understanding the fundamentals of wind energy technology
- Able to design and analyze the existing and innovative blade profile
- Able to assess the performance of the wind turbine
- Understanding about the selection of sites and installation of turbines

Unit I: Fundamentals of Wind Energy [9]

Nature of atmospheric winds- Wind resource characteristics and assessment– Anemometry, speed frequency distribution, effect of height, wind rose, Weibull distribution, atmospheric turbulence, gust wind speed, effect of topography. Influence of Reynolds's number, actuator disc, Betz coefficient.

Unit II: Conceptual and Component Design [9]

Classification of wind turbines, Rotor Diameter, Machine Rating, Rotational Speed, Blades, Power Control, Pitch Bearings, Rotor Hub, Gearbox, Generator, Mechanical Brake, Yaw Drive, Tower, Foundations. Tip Speed Ratio (TSR), Choice of the Number of Blades, Relationship of TSR and Coefficient of Performance (Cp), TSR in Field Conditions

Unit III: Mechanics & Dynamics [9]

Review of Fluid Flow Concepts, Airfoil terminology, Blade element theory, Blade design, General Principles Primer (stress, strain, vibrations), Rotor Dynamics, Sources of loads, Types of loads, Aero Servo Elasticity in Wind Turbines. Primer on Fatigue, Fatigue in Wind Systems

Unit IV: Wind Turbine Performance [9]

Power v/s Energy, Power Contained in Wind, Effective Useable Energy from Wind Turbine, Practical Limits of Energy Output, Net Power Output from the Turbine, Important Rules for Wind Turbines,

Power Curve, Wind-turbine Performance Measurement, Aerodynamic Performance Assessment, Dynamics, Estimation of Energy Capture, and The Performance Curves.

Unit V: Wind Farm and Wind Energy Economics [9]

Onshore, offshore wind energy, wind farms, design of wind farms, Project Development, Visual and Landscape Assessment, Noise, Electromagnetic Interference, Ecological Assessment, Finance Engineering Economics Basics, Wind Turbine Cost Analysis,

Text Books:

1. Steve Parker, "Wind power", Gareth Stevens Publishing, 2004.
2. Freris L.L., Wind Energy Conversion Systems, Prentice Hall 1990.

Reference Books:

1. Spera D.A., Wind Turbine Technology: Fundamental Concepts of Wind Turbine Engineering, ASME Press, NY 1994

DGET 524: BIOPROCESS ENGINEERING FOR BIOFUELS

(Hard Core Course) **L T P C**

3 1 0 3 45L

Course outcome:

- After studying this subject, students would be able to measure the extent of biochemical growth types of biochemical interactions for living processes.
- Ability to analyze the microbial growth kinetics
- The student can design a fermenter for the bioprocessing of different products.
- The student can scale up the bioprocess for large scale production
- The students can monitor the bioprocess for higher production efficiency

Unit I: Engineering Biology [9]

Overview of bioprocess engineering, Biological systems, Cellular components and cell growth, Bioenergetics and cellular metabolism, Metabolic pathways, Autotrophic metabolism, Anaerobic metabolism, Metabolism of hydrocarbons, Biosynthesis.

Unit II: Enzyme Kinetic [9]

Enzymes and its function, Enzyme synthesis, Mechanism of enzymatic action, Enzyme kinetics, Single enzyme kinetics, Michaelis–Menten kinetics, Model of complex enzyme kinetics, Immobilized enzyme systems, Enzymatic processes

Unit III: Cellular growth [9]

Building blocks of cellular components, Cellular growth and models, Growth curves, Kinetic of cell growth, Batch growth kinetics, Continuous growth kinetics, Determination of growth parameters, Stoichiometry of microbial growth, Yield coefficients for cell mass

Unit IV: Reactor design [9]

Principles of bioprocess, Batch, fed-batch, and continuous processes Chemostat systems, Operation and performance of the process systems, Types of bioreactors in bioprocesse, Instrumentation and control of bioreactors, Reactor design considerations, Scale-up and scale-down of bioprocesses, Immobilized cell system, Passive and active immobilization, Solid-state fermentation

Unit V: Bioprocess Applications and Product Recovery [9]

Anaerobic bioprocessing, Cellulosic ethanol production, Biological production of 2-butanol, Lactic acid production, Aerobic fermentation, Renewable chemicals production, Product separation process, Cell disruption and mechanical separation, Filtration, Centrifugation, Coagulation, Flocculation, Separation of soluble products, Biosafety and Bioethics

Text Books:

1. Bailey, J. E., & Ollis, D. F. (2018). Biochemical engineering fundamentals. McGraw-Hill.
2. Shuler, M. L., & Kargi, F., (2006). Bioprocess Engineering Basic Concept Pearson Education, Inc.

References:

1. Cornish-Bowden, A. (2013). Fundamentals of enzyme kinetics. John Wiley & Sons.
2. Liu, S. (2020). Bioprocess engineering: kinetics, sustainability, and reactor design. Elsevier.
3. Doble, M., Kruthiventi, A. K., & Gaikar, V. G. (2004). Biotransformation and bioprocesses. CRC Press.

DGET525: SOLAR THERMAL DEVICES AND THERMAL ENERGY STORAGE

(Hard Core Course) **L T P C**

3 0 0 3 45L

Course Outcome:

- To provide understanding about application of various low temperature solar thermal devices
- To study the importance of solar collectors for high temperature applications
- To give a detailed understanding on thermal energy storage and storage materials
- An extensive analysis on standard methods of testing of solar thermal collectors
- To gain knowledge on making economic analysis on solar thermal energy projects

Unit I: Low Temperature Solar Thermal Energy Systems [10]

Solar water heater- Flate plate type; Evacuated tube solar water heaters; Solar air heating systems: Description and classifications; Solar drying: Designing of solar drier; psychrometric chart; Energy balance equation. Solar distillation: Working principle; thermal efficiency; various designs of solar still. Solar pond: Description; Non-convective solar pond; Operational problems; Solar cookers-box type: Types of solar cookers; First figure of merit and second figure of merit; Solar refrigeration and air conditioning: Principle of absorption cooling; Lithium bromide-water absorption system; Vapor compression refrigeration.

Unit II: Medium and High Temperature Solar Thermal Energy Systems [8]

Solar concentrating systems: Types of concentrators, single axis and two axis tracking; Solar energy for industrial process heat: Hot water, hot air and steam based industrial process heat systems; Solar thermal power generation: Principles of solar engines; Solar thermal power plants: Parabolic trough, central receiver, parabolic dish, compact Fresnel linear reflector technology.

Unit III: Solar Thermal Energy Storage [16]

Low, Medium and High temperature thermal energy storage; Sensible heat storage: Types of sensible heat storage; energy analysis in a liquid stratified tank; design aspects; materials for latent heat storage; Latent heat storage: Phase change material (PCM) for latent heat storage; inorganic and organic PCM's; design of a solar thermal device with the provision of thermal storage; Thermo-chemical storage: Materials; merits and demerits of thermo-chemical storage; Potential of thermo-chemical storage materials for high temperature applications.

Unit IV: Testing of Solar thermal collectors [5]

Authorized testing protocols for solar water heater (flat plate type), Evacuated solar water heater, Solar box cooker, Solar air heater, Solar concentrating cooker, and solar concentrator for high temperature applications.

Unit V: Economic analysis for solar thermal engineering projects [6]

Annualized cost method: Annualized cost; annualized capital cost; salvage value; capital recovery factor; salvage fund factor; annualized maintenance cost; Life cycle savings: savings per day; present worth of annual savings; present worth of cumulative savings; Payback period.

Text Books:

1. Duffle and Beckman, Solar Thermal Engineering Process, John Wiley & Sons, New York
2. N.C. Harris, C.E. Miller and I.E. Thomas, Solar Energy Systems Design, John Wiley & Sons, New York

Reference Books:

1. P.J. Lunde, Solar Thermal Engineering, John Wiley & Sons, New York
2. S.P. Sukhatme, Solar Energy, Tata McGrew Hill Company Ltd., New Delhi
3. F. Kreith and J.F. Kreider, Principles of Solar Engineering, Hemisphere Publishing Coro.
4. Hafiz Muhammad Ali; Furqan Jamil; Hamza Babar, Thermal Energy Storage: Storage Techniques, Advanced Materials, Thermophysical Properties and Applications, Springer, Singapore.
5. G. Beghi, Thermal Energy Storage, Springer, 2012.
6. Garg H P., Prakash J., Solar Energy: Fundamentals & Applications, Tata McGraw Hill, New Delhi, 1997

DGET 526: GREEN BUILDING AND SUSTAINABLE DEVELOPMENT

(Hard Core Course) **L T P C**

3 1 0 3 45L

Course Outcome:

At the end of the course, the student will be able to

- Understand the concepts and factors influencing green building concepts, systems and energy management.
- Impact of indoor environmental quality on occupant well-being and comfort.
- Identify and compare existing energy codes, green building codes and green rating systems.

- Study about the fundamentals of energy and energy production systems pertaining to Residential, Commercial, Institutional and Public Buildings.
- Demonstrate the energy management of electrical equipment and appliances in buildings
- Use low embodied energy industrial and building materials and cost effective building technologies

Unit I: Introduction [8]

Conservation of Energy, Energy Utilization in Buildings, Sustainable construction, Need of energy in buildings, Study of climate and its influence in building design for energy requirement, Principles of energy conscious design of buildings, typical features of green buildings, benefits of green buildings towards sustainable development, Environment and Resource concerned of building, Implementation strategies related to Integrative design Strategies.

Unit II: Implications of Building Technologies Embodied Energy of Buildings [7]

Primary and Secondary Energy, Embodied Energy, Role of Materials, Emission and pollution, Resources for Building Materials, Life Cycle Assessment, Life Cycle Costing, Key considerations regarding sustainable materials, High-Performance Building Energy Design Strategy and Goal Settings Methods to reduce embodied energy in building materials, Energy efficiency in a green building.

Unit III: Comforts in Building [10]

Thermal comfort in Buildings – Issues, Passive Cooling concepts, Heat transfer, Characteristic of Building Materials and Building Techniques, Properties of Atmospheric air, Psychometric properties of Air, Chart, Analyzing Air-conditioning Processes; Heating, Cooling, Dehumidification and Humidification, Evaporative Cooling, Adiabatic mixing of two moist air streams, Cooling towers, energy efficient appliances for heating and air conditioning systems.

Unit IV: Alternative Building Materials [10]

Fibers- metal and synthetic - Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic - Properties and applications. Building materials from agro and industrial wastes, construction and demolition wastes and mine wastes.

Unit V: Green Composites for buildings and ratings [8]

Concepts of Green Composites. Water utilization in Buildings, Low Energy approaches to Water Management. Urban Environment and Green Buildings. Green Cover and Built Environment. Rating systems for energy efficient buildings in India and other countries. Green building rating systems and certification such as LEED, GRIHA, ASOOCHAM GEM, BEE and ECBC.

Text Books:

1. K.S.Jagadish, B. U. Venkataramareddy, K. S. Nanjundarao. Alternative Building Materials andTechnologies. New Age International, 2007.
2. Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.

Reference Books:

1. Green My Home!: 10 Steps to Lowering Energy Costs and Reducing Your Carbon Footprint, by Dennis C. Brewer, ISBN:9781427798411, Publisher: Kaplan Publishing, Publication Date: October 2008. C. Givoni, Man, Climate and Architecture Elsevier, 1969.
2. T. A. Markus and E. N. Morris Buildings Climate and Energy. Pitman, London, 1980. Arvind Kishan et al (Ed.)

3. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004. Hill, 2001.
4. Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010. 8. Michael F. Ashby Materials and the Environment, Elsevier, 2009. 9. Jerry Yudelson Green Building Through Integrated Design. McGraw Hill, 2009.

DGETY 527: SOLID WASTE MANAGEMENT TO ENERGY CONVERSION

L T P C

(Soft Core Course) 3 0 0 3 45L

Course outcomes:

- Explain the basics of municipal waste and waste management challenges.
- To learn the waste treatment and disposal techniques/methods such as recycling, composting, landfills, and briquetting.
- Imparting in-depth knowledge of thermochemical and biochemical waste to energy techniques (WtE). In addition, it deals with environmental effects due to various WtE conversions and analyses case studies for WtE potential and challenges.
- To facilitate students to develop skills in integrated WtE management systems.

Unit I: Introduction to waste & waste processing [9]

Definitions, sources, types municipal solid waste (MSW), agro waste, forest waste, biomedical waste (BMW) and composition of various types of wastes. Characterization of municipal solid waste (MSW) and calorific values, fundamental elements and factors effecting MSW composition, waste stream assessment, waste collection and transportation, transfer station, waste processing-size reduction, separation; waste management hierarchy, waste minimization and recycling of MSW; life cycle analysis (LCA), material recovery facilities (MRF), 6Rs of recycling, recycling of paper, glass, plastics, ferrous and non-ferrous metals.

Unit II: Waste Treatment and disposal [9]

Composting- basics, types, aerobic, anaerobic and vermin-composting, essential elements of composting. Landfills for waste, types, typical landfill process, methods and sitting consideration, layout and preliminary design of landfills. Sanitary and Bio-reactor landfills, composition, characteristics, generation, movement and control of landfill leachate and gases, environmental monitoring system for land fill gases. Briquetting, utilization and advantages of briquetting

Unit III: Thermo-chemical conversion process for waste to energy [9]

Thermo-chemical process: Incineration, gasification, pyrolysis and its types, plasma arc technology, Hydrothermal Gasification, Liquefaction and Carbonization and advanced processes, -environmental and health impacts of incineration, dioxins and its impact on health, pollution control devices, waste heat recovery, strategies for reducing environmental impacts. Gasification: syngas utilization via F-T syntheses for fuels, plastic to bio-oil *via* pyrolysis.

Unit IV: Bio-chemical Conversion process for waste to energy [9]

Anaerobic digestion of sewage and municipal waste to biogas production, typical process, types of bio-digesters, and purification of bio-gas. Organic waste to biodiesel via transesterification, fermentation for bio-alcohols, bio-hydrogen and its processes. Bio-hydrogen processes: direct/indirect photolysis, photo fermentation, and microbial electrolysis-cell. Integration of bio-chemical conversion processes.

Unit V: Environmental and health impacts-case studies [9]

Integrating waste management system, present status of technologies for conversion of waste into energy, design of waste to energy plants for cities, small townships and villages. Environmental and health impacts of waste to energy conversion. Carbon credits: carbon footprint calculations. Case studies of commercial waste to energy plants- success and failure, waste to energy- potentials and constraints in India, eco-technological alternatives for waste to energy conversions - Rules related to the handling, treatment and disposal of MSW and BMW in India.

Text Books:

1. Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable omparisons, by Gary C. Young, ISBN:9780470539675, Publisher: John Wiley & Sons, Publication Date: June 2010.
2. Waste-to-Energy. Technologies and Project Implementation by Marc J. Rogoff And Francois Screve (Auth.)Publisher:William Andrew, 2011/2019

References:

1. Waste to Energy (WTE) Conversion Technology by Klinghoffer, N. B. (Hrsg.), Castaldi, M. J. (Hrsg.). ISBN 13:9780857090119 Woodhead Publishing Ltd, 2013.
2. Recovering Energy from Waste Various Aspects Editors: Velma I. Grover and Vaneeta Grover, ISBN 978-1-57808-200-1; 2002.
3. Sustainable food waste-to-energy systems by Babbitt, Callie W., Trabold, Thomas, ISBN 13:9780128111581,Publisher:Academic Press, 2018.
4. Shah, Kanti L., Basics of Solid & Hazardous Waste Management Technology, Prentice Hall, 2000.
5. Advances in Waste-to-Energy Technologies by Rajeev Pratap Singh (Editor), Vishal Prasad (Editor), BarkhaVaish (Editor), ISBN 10:1138390429, CRC Publishing, 2019.
6. Waste-to-Energy, Second Edition: Technologies and Project Implementation by Marc J. Rogoff, Francois Screve, Publisher:William Andrew, 2011.

DGET 528: NANOTECHNOLOGY FOR SOLAR ENERGY SYSTEMS

(Soft Core Course) **L T P C**

3 0 0 3 45L

Course outcomes:

- This course helps students to learn Nano electronics and Physical properties of Nano systems
- Learners are immersed in discussions about green energy technologies, Challenges in energy conversion, role of nanostructures & materials and the impact of sustainability on society, energy consumption.
- To learn students exposed to Nanotechnology for energy storage and energy efficient devices

Unit I: Nano-electronics [9]

Concept of wave-matter duality, phase and group velocities, electron state in solids, uncertainty principle, operators, quantum mechanical postulates, Schrödinger's Wave Equation, free electron gas, spherical, electron in spherical potential (hydrogen atom), Hydrogen molecule, Atom by Atom arrangements, band structure formation, E-k diagram, electronic states of 2-D, 1-D, 0-D nanosystems.

Unit II: Physical Properties of Nanosystems [9]

Light absorption in Nano systems, size dependence and material dependence of absorption, band gap engineering, Fermi-level, ballistic and diffusive transport in nanosystems, coulomb blockade, resonant tunnelling, carrier separation techniques

Unit III: Nanotechnology for Solar Energy Conversion [9]

Challenges in energy conversion – role of nanostructures & materials – nanomaterials in solar Photovoltaic Technology: quantum well solar cell, quantum wire solar cell, quantum dot solar cell – quantum dot sensitized solar cell, photo-current calculation. Tandem structures –nanotechnology for solar thermal fuels, nanotubes for solar energy harvesting, Concept of photo-electro chemical cell.

Unit IV: Nanotechnology for energy storage [9]

Nanostructured electrodes fabrication, nanotubes for energy storage, electrochemical storage, Conversion of solar energy to hydrogen.

Unit V: Nanotechnology for energy efficient devices [9]

Energy efficient devices –fabrication and applications of quantum well LED as light device, – optical amplifiers, quantum well lasers, optical switch, Quantum dot luminescence materials.

Text books:

1. Physical principles of micro Micro-electronics, G.Yepifanov, Mir Publishers
2. Semiconductor device-basic principles-Jasprit singh, Wiley

References:

1. Quantum Chemistry, Levine, Prentice Hall
2. Statistical Mechanics and properties of matter, E.S.R Gopal,Ellis Horwood
3. Introduction to solids, Azaroff, Tat Mc-Graw Hill.

DGET529: CARBON SEQUESTRATION AT THE LANDSCAPE LEVEL

L T P C

(Soft Core Course) **3 0 0 3 45L**

Course Outcome:

- Learn the concept of CO2 generation and fixation in the globe.
- Familiarize the international laws, convention and regulation on carbon sequestration
- Develop basic understanding on biomass synthesis, available energy potential, its exploitation, current scenario in India.
- Develop basic understanding on available technological options for CO_2 sequestration

Unit I: Climate change and International agreements [8]

The green-house effect. The United Nations Framework Convention on Climate Change (UNFCCC). The Intergovernmental Panel on climate change (IPCC), the Kyoto Protocol, the Clean Development Mechanism (CDM). Afforestation and Reforestation projects, Reduced Emissions from Deforestation and Degradation (REDD). CDM projects, finance, project development. Conservation of natural carbon sinks. National inventory management system in India (NIMS)

Unit II: Primary productivity: mechanisms and assessment [10]

Photosynthesis, absorption and yield. C3, C4 and CAM pathways. Laboratory measurement of primary productivity: cell, plant, ecosystem. Direct field measurements of biomass and primary productivity: allometric models, harvest methods for forests, grasslands and ocean. Indirect measurements of biomass and primary productivity: remote sensing and other methods. The CDM methodologies for measurement of stocks and fluxes.

Unit III: Biogeochemistry [9]

Role of soil in the carbon balance: decomposition and sequestration in soils. The carbon cycle: plant, soil and atmosphere. Impact of soil degradation. Conditions for the formation of fossil stocks of carbon. Carbon balance of ecosystems: forests, grasslands and oceans. Impact on the global carbon balance. Soil Organic Carbon (SOC) and biodiversity and climate change. SOC global stock – hot spots and bright spots. Measurement, reporting and verification of SOC. SOC for sustainable development.

Unit IV: Remote sensing and spatial analysis [10]

Sensors. Reflectance of vegetation. Measuring biomass with remotely sensed data. Measuring primary productivity with remotely sensed data. High resolution satellites, use and limitations to measure biomass and primary productivity. Low resolution satellites use and limitations to measure biomass and primary productivity. Regional and global assessments of biomass and primary productivity. Introduction to Geographic Information Systems (GIS). Land-use and land-use changes assessment. The Clean Development Mechanism (CDM) methodologies for measurement of stocks and fluxes at the landscape level.

Unit V: Carbon Sequestration Technologies [8]

Post, Pre and Oxy combustion capture – Sequestration in geological formation: Oil-Gas, Deep sea and unmineable coal seams. CCS programmes, issues and challenges. Clean Technology Scenario and CCS. CCS an international policy strategy and legal perspective.

Text Books:

1. Bhatta, B. 2009. Remote sensing and GIS. Oxford UniversityPress.
2. Monteith, J. L., and M. H. Unsworth. 1990. Principles of environmental physics, Second edition. EdwardArnold.

References:

1. Neteler, M., and H. Mitasova. 2008. Open Source GIS. A GRASS GIS approach, Third edition.Springer.
2. Pachauri, S. and L. Jiang, 2008. The household energy transition in India and China. Interim Report, International Institute for Applied SystemsAnalysis.
3. Walker, B. and W. Steffen (eds.) 1996. Global change and terrestrial ecosystems. International geosphere-biosphere programme book series. Cambridge University Press.
4. Lefèvre Clara, Rekik Fatma, Alcantara Viridiana, Wiese Liesl, (2017), Soil Organic Carbon, the hidden potential. Food and Agriculture Organization of the United Nations.
5. A policy document on 'Exploring the clean energy pathways, the role of CO_2 storage' Published by International Energy Agency, July 2019. www.iea.org .
6. CRS report by Peter Fogler on 'Carbon capture and sequestration', June 2009.

DGET530: MICROBIAL TECHNOLOGY FOR BIOFUEL PRODUCTION

(Soft-core Course) **L T P C**

3 0 0 3 45L

Course outcome:

- Attain knowledge on fundamental of Microbial resources for biofuels production
- Acquire insight about the value added products of microbial resources
- Understanding the tools and advancement in microbial engineering
- Acquisition of skill on fermentation technology of biofuels

Unit I: Microbial resource [9]

Significance of microbes, Microbes from different source: soil, water, air, food, waste, degraded materials, heterotrophic, autotrophic, characterization of microbes, classification, identification of microorganisms: morphology, biochemical, molecular, cultivation, reproduction and growth, pure culture, contamination, bacteria, fungi, actinomycetes, algae, etc.

Unit II: Value added products from Microbes [9]

Enzyme production, Microbes for enzymatic deconstruction of biomass: cellulase, β-glucosidase, xylanase, ligninolytic enzymes, Microbial fermentation to biofuels: ethanol, butanol, hydrogen, methane, biooil.

Unit III: Biochemical processes [9]

Terrestrial bioresource, marine bioresource, C3 and C4 energy plants, microbial resource, proximate analysis of biomass: Cellulose, Hemicellulose, Lignin, Protein, pretreatment process: physical, chemical, biological, hydrolysis, enzyme production: solid state, submerged fermentation, downstream processing, enzyme activity.

Unit VI: Microbial Engineering Technology [9]

Generation of biofuels production, Microbial genetics, Synthetic microbiology, development of industrial strain, tools in microbial engineering, Genetically Modified microbes for biofuel production.

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Unit V: Fermentation Technology for Biofuel [9]

Fermentation process, fermenter, types of fermenter, hybrid fermenter, sterilization, fermentation media, precursor and inhibitors, buffers, types of fermentation, upstream process, downstream process, troubleshooting mechanism.

Text books:

1. Ivanov, V. (2020). Environmental Microbiology for Engineers (3rd ed.). CRC Press. https://doi.org/10.1201/9780429317156
2. Handbook of Research on Bioenergy and Biomaterials, Consolidated and Green Processes, ISBN:9781000210736, 1000210731, Apple Academic Press, 2021

Reference books:

1. Advances in Biofuels and Bioenergy, ISBN:9781789232868, 1789232864, Intech Open, Editors:Jaya Soneji, Madhugiri Nageswara-Rao, 2018
2. Varma, A., Kumara Behera, B. (2017). Microbial Biomass Process Technologies and Management Germany: Springer International Publishing, ISBN:9783319539133, 3319539132.
3. Microbial Resources for Sustainable Energy, Basanta Kumara Behera, Ajit Varma, Springer, 2016, ISBN 3319337785, 9783319337784.

DGET531: GREEN CHEMICAL TECHNOLOGIES

(Soft Core Course) **L T P C**

3 0 0 3 45L

Course Outcome:

- Understand the principles of green chemistry and engineering
- To become conscious of sustainability and environmental viability.

- Awareness of emerging catalytic chemical technologies
- Access to an expanding range of new green technologies and strategies

Unit I. Types of waste, waste minimization and recycling. [9]

Conventional chemical synthesis and environmental impact – generation of wastes and pollution - sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling. Pollution – types, causes, effects and abatement. Hazard identification, assessment and safety aspects at process development and design stage. Need for environmental mitigation and energy efficient processes.

Unit II. Green chemical technologies, metrics, Concept of energy and analysis [9]

Green chemical technologies – Concepts of Green Chemistry and green engineering with examples. Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium. Green chemistry metrics- atom economy, E factor, reaction mass efficiency and other green chemistry metrics, application of green metrics analysis to synthetic plans. Concept of energy and analysis. Energy system analysis, Energy efficient design of processes, Energy Policy and Management

Unit III. Catalysis in green synthesis [9]

Catalysis in green synthesis: TON, TOF, energetic of catalysis. Catalysis using solid acids and bases: Zeolites, mesoporous materials and clays as catalysts, shape selectivity. catalysis by metals, metal oxides. application in bulk and fine chemical synthesis chemicals, environmental applications. Phase Transfer catalysis – basic concepts in phase transfer catalysis- basic steps in PTC. Single-atom catalysis.

Unit IV. Catalytic technologies - principles, synthesis, advantages and applications [9]

Photo catalysis - principles, synthesis, advantages and applications. Conventional Batch and Continuous-Flow Chemistry. Reactor Concepts for Flow Photochemistry. Electrocatalytic synthesis, photo electrochemistry and other environmentally benign and cost-effective integrated approaches.

Unit V. Green processes, concepts and design: Life cycle analysis [9]

Designing green processes- safe design, process intensification, in process monitoring. Life cycle analysis. Safe product and process design – Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention. Case studies

Text books:

1. Green Chemistry – An introductory text - M. Lancaster, RSC
2. Environmental chemistry - Stanley E Manahan, Lewis Publishers

Reference books:

1. Catalysis- concepts and green applications- Gadi Rothenberg-Wiley VCH, 2017.
2. Visible Light Photocatalysis in Organic Chemistry- Corey R.J. Stephenson, Tehshik P. Yoon, David W.C. MacMillan, Wiley, ISBN: 978-3-527-33560-2; 2018.
3. Sustainable Flow Chemistry: Methods and Applications- Luigi Vaccaro- Wiley, 2017.

DGET 520: ENERGY LABORATORY – II

L T P C

(Hard Core Course) **0 2 4 3 90L**

List of Experiments

S. No.	List of Experiments*
1	Study I-V Characteristics of Si-based Solar module
2	Effect of Solar Irradiance/ Inclination on the I-V Characteristics of a given Si-based Solar Module
3	Compare TWO given Solar Modules of Varied Specification (Si-based with thin-film modules)
4	Study of Solar Module I-V Characteristics with Series and Parallel Connection
5	Hand on-training on 500 W or 1 kW PV plant on-grid
6	Solar PV array design using bypass and blocking diode
7	Design and assembly of Solar PV battery charger and battery bank charge controller
8	Design and assembly of AC-DC and DC-AC power inverter
9	Study on the solar cell to the module assembly process and out-put characteristic
10	To evaluate the performance of direct solar dryer under forced circulation
11	To evaluate the performance of solar tunnel dryer under forced circulation
12	To study the thermal performance of concentrating collector
13	To find F_1 of a solar box cooker
14	To calculate the heat efficiency factor for solar cooker
15	Performance analysis of PEM fuel cell using battery/solar cell
16	Performance analysis of PEM fuel cell using solar cell
17	Evaluate Charge-discharge Characteristics of a Secondary Battery
18	Determination of Free Fatty Acid and Iodine Value
19	Quantitative analysis of cellulose (Filter paper assay) by spectrophotometer
20	Biomass briquetting with pure and blended agricultural residues
21	Monoculture of algae by streak-plate method and biomass growth curve study
22	Isolation of hydrolytic bacteria from biodegradable sources by serial dilution technique
23	Microbial production of Hydrogen
24	Microbial production of bioethanol
25	Anaerobic digestion of biomass for biogas production

***Minimum of 15 practical shall be offered**

Manuals:

1. Garg H.P., Kandpal T.C., Laboratory Manual on Solar Thermal Experiments, Narora Publishing House, New Delhi, 1999.
2. Holman, Jack P. (1984) Experimental Methods for Engineers, McGraw-Hill Book Company. [3] Doebelin, Ernest O. (1995) Engineering Experimentation – Planning, Execution, Reporting, McGraw-Hill,

References:

1. Polak, P. (1979) Systematic Errors in Engineering Experiments, Macmillan Press Ltd.
2. Annual Book of ASTM standards, Section I – V, Vol. 05.01-05.05, 2002-2003.
3. Experiments with renewable energy-students guide- ISBN 1-928982-22-0, African Journal of Biotechnology, Vol. 9 (12), pp 1719 (2010).

SEMESTER – III

DGET611: RESEARCH METHODOLOGY & MINI-PROJECT

(Hard Core Course) **L T P C**

0 2 4 3 90L

Course Outcome:

- Through this course project work student shall get acquaintance in the selection of research problem, its analysis, carrying out relevant literature survey and reviewing. Also, they will learn how to analyse data and write a technical report.
- Students shall be imparted training on selection of research theme/problem, scientific approach, defining specific objectives, design of experiment, estimation of budget, estimation of time duration, execution, data collection, analysis & presentation and carry out experimental and/or theoretical studies.
- Students shall be exposed to classification of IPRs, identification of IPR values in the research and development work being carried out, processes of patent drafting and filing, institutional, national and international policies on IPR etc.

Unit I: Research Methodology [9]

Research, keywords, literature survey methods, research objectives, research design/plan, choosing experimental methods, data collections and analysis, Research ethics – conflict of interest issues, citation of prior art, plagiarism & permissible similarity in writing, Similarity checking tools.

Unit II: Thesis writing [9]

Components of thesis- title, abstract, introduction, objectives, methods, results, tables, figures, graphs, discussion, summary, acknowledgement, in-text citations, reference list, and appendix.

Unit III: Presenting and publishing research [9]

Focus of conferences and workshops - Oral presentation skills – Post presentation of research outcome – Abstracts & extended abstracts – Proceedings of technical deliberation - Publication in journals, conference proceedings and in book or as book chapters.

Unit IV: Research article & Research Proposals [9]

Components of research article - Title, abstract, key words, introduction, citations, introduction, objectives, methods, results, tables figures, graphs, discussion summary, and references. Instruction to authors by journal for writing a research paper. Components of proposal document- Title, aim, research background, project outline, research methodology & budgeting, time schedule, deliverables and references.

Unit V. Intellectual Property [9]

Classification of IPs - identification of IP values in research outcome – Prior art search – Open source and commercial search engines. Patents and Trade Marks - National and institutional IPR Policies – Patent filing procedures.

Text books

1. Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International, 4th Edition, 2018

2. Research Methodology a step-by step guide for beginners, Ranjit Kumar, SAGE Publications Ltd, 3rd Edition, 2011

Reference books

1. Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005
2. Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009

DGET612: SOLAR PHOTOVOLTAIC POWER SYSTEMS

	L T P C	
(Soft-core Course)	**3 0 0 3**	**45L**

Course Outcome:

- This course teaches about the solar photovoltaic power system from module assembly process to establishment and commissioning of solar photovoltaic power plant
- Students are expected to understand the technologies involved in the establishment and maintenance of solar photovoltaic power plant

Unit I: Solar PV Module [9]

Introduction: module and circuit design - identical and non-identical cells - module structuring and assembly - assembly materials – environmental protection – interconnect: types and assembly process – crystalline and thin film modules - issues with solar PV modules, bypass diode and blocking diode – module testing and analysis- thermal considerations - electrical considerations and output conditioning - mechanical protection & module testing and evaluation.

Unit II: SPV Systems & Components [9]

Introduction to PV systems - system components: module and array – Charge controllers – Inverters – Batteries – power conditioning and Regulation – Mechanical assemblies – Balance of System Components

Unit III: SPV Power Systems [9]

Types of SPV power systems: MW general power systems – Grid connected power systems – Remote area power systems – Specific purpose Photovoltaic systems: Space – Marine – Telecommunication – water pumping – refrigeration etc., Concentrator solar cells and systems. Space quality solar cells and satellite power systems – Photovoltaic power system for electrical vehicles: BLDC motors: power, drives and controllers – Battery bank and charging strategies - vehicle and circuit design.

Unit IV: Power System Design and Installation [9]

Power considerations and system design – Array integration: mechanical integration – electrical integration – utility integration – Inspection and commissioning - SPV power system maintenance: cleaning, shadowing, stability etc., and troubleshooting – Economics.

Unit V: Space Power Systems [9]

Solar Photovoltaic Power systems – Thermophotovoltaic power systems - Deep space power systems: Nuclear fusion systems, Radio-isotope Thermoelectric Generator power systems - Stirling Radioisotope Generator (SRG).

Text Books:
1. Solid State electronic devices by Ben G. Streetman, Prentice-Hall of India Pvt. Ltd., New Delhi 1995.
2. Clean electricity from photovoltaics, M. D. Archer, R. Hill, Imperial College Press, 2001.

Reference books:
1. Photovoltaic Systems Engineering, Roger Messenger and Jerry Vnetre, CRC Press, 2003.
2. Generation Distribution and utilization of Electrical Energy, C.L.Wadhwa, Wiley Eastern Ltd., India(1989)
3. Electrical Power Systems Quality by Roger C.Dugan , Mark .F. Mc Granaghan, Surya Santaso, H.Wayne Beaty, Second Edition, Mc Graw Hill, 2002
4. Fundamentals of Photovoltaic Modules & Their Applications, by Gopal Nath Tiwari, SBN:9781849730204, Publisher: Royal Society of Chemistry, 2010.

DGET613: ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND DATA ANALYSIS FOR PHOTOVOLTAIC SYSTEMS

	L	T	P	C	
(Soft-core Course)	**3**	**0**	**0**	**3**	**45L**

Course Outcome
- The course will equip the participants for advanced technology development (R&D) with data analysis.
- Students are exposed to learn Artificial intelligence in the area of sustainable energy conversion

Unit I: Introduction to Artificial Intelligence and Machine Learnings [9]
Basic concepts of AI, linear regression, learning schemes, shallow and deep learning, Principal component analysis, t-Distributed Stochastic Neighbour Embedding (t-SNE), k-fold cross validation, classification, clustering-k-means, support vector machine, Multiple linear regression, ANN: perceptron, back propagation, CNN

Unit II: Data Representation [9]
Python for data analysis, NumPy, panda, data frame, data cleaning, data representation-Matplotlib Matlab ANN tool kit

Unit III: Sandia Model [9]
Sandia model: radiation model, radiation correction factors, PV model, inverter model, Pvlib data analysis tool kit

Unit IV: Data Analysis [9]
PV data analysis-excel sheet data, Big data analysis, data mining, missing values, normalization and standardization, split and data set, feature selection, dimension reduction, linear regression, support vector regression, mean score, mean absolute error, R^2 score

Unit V: ANN solar cell models [9]
Solar energy forecasting, ANN solar cell models, ANN based MPPT-PSO trained ANN MPPT, Fuzzy logic based MPPT

Text Books:
1. Artificial Intelligence in Energy And Renewable Energy Systems, ISBN-13: 978-1600212611,Nova Science Pub Inc

2. Introduction to Machine Learning with Python: A Guide for Data Scientists 1st Edition, Andreas C. Müller, Sarah Guido, ISBN: 9781449369415, Publisher: O'Reilly

Reference books:

1. MATLAB Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence1st ed, Phil Kim, publisher: ISBN-13: 978-1484228449, Apress

DGET614: ADVANCE POLYMERIC MATERIALS FOR RENEWABLE ENERGY SYSTEMS

	L	T	P	C	
(Soft-core Course)	**3**	**0**	**0**	**3**	**45L**

Course Outcome:

Students will learn about advanced materials such as composites, polymeric and hybrid materials: synthesis, characterization, properties, fabrication techniques, and applications in renewable energy systems. The paper encourages students to explore them in synthesizing advanced materials for renewable energy conversion and storage technologies.

Unit I: Fundamentals of Polymers and Composites [9]

Basics, classification, structures, nomenclature, polymer synthesis, properties– polymer length, molecular weight, amorphous and crystalline. Organic semiconductors, conjugated polymers, and charge transport in organic semiconductors. Introduction to composites-polymer matrix composites, polymer membranes, carbon nanocomposites, types, preparation and processing of composites, properties of composites.

Unit II: Polymers and Composites for Solar Energy [10]

Organic versus inorganic photovoltaics: Introduction- principles of organic, inorganic, polymeric, and hybrid photovoltaics. Organic photoactive material synthesis- low bandgap conducting polymers. Donor and acceptor organic molecules, and bulk heterojunction devices with focus on organic/polymeric materials. Processing and printed plastic solar cells and hybrid tandem cells. Stability and lifetime of organic, polymeric, and metal oxide–polymer bulk heterojunction solar cells. Polymers and composites as solar thermal materials for solar thermal -polymeric solar absorbers and polymer solar reflectors. Anti-reflection and absorbing coating material for solar energy application.

Unit III: Polymers and Composites for Wind and Biomass Energy [10]

Composite material synthesis for wind energy- glass, carbon, resins, aramid fiber-reinforced polymeric composites, natural fiber reinforced polymers- biocomposites, and nanocomposites for wind turbine blades. Composite manufacturing processes- Spary lay-up, press-forming, vacuum bagging and autoclave, resin infusion-vacuum process, reactive resin transfer molding ,and others. Testing- thermal analysis, tensile test, compression test, shear testing, rheology, fatigue, and recycling strategy for sustainability. Hybrid composites catalysis in biochemical/thermochemical biomass conversion to biofuels: hydrolysis, hydro treating, reforming, deoxygenation, hydrothermal liquefaction, gasification, pyrolysis, Fischer–Tropsch synthesis, steam reforming/cracking, and transesterification. Polymeric sorbents for biogas cleaning and separation.

Unit IV: Polymers and Composites for Fuel Cells [8]

Polymer electrolyte membrane synthesis and characterization for fuel cells: Structure-property relationships, membrane electrode, organic-inorganic membranes, and composites for bipolar plates. Design and development of proton exchange membranes fuel cell (PEMFC) based on Nafion, sulfonated poly (ether-ether ketone)s, sulfonated poly(aryl ether) for PEMFC and direct methanol fuel cell (DMFCs). Polymer composite membrane role (cation/anion/proton-exchange membranes) in bioelectrochemical systems (MFCs) –construction and performance of MFCs.

Unit V: Polymers/Composites for Battery and Miscellaneous Renewable Energy [8]

Polymer and composite-based lithium polymer battery. Preparation and fabrication of solid-state electrolytes. Polymer/composite-based thermoelectric materials synthesis and fabrication. Materials for energy conversion and efficiency in buildings. Natural materials for sustainable energy systems.

Text Books:

1. Gowariker and Viswanathan, Polymer Science, Wiley Eastern, 1986.
2. Bill Meyer, A Text Book of Polymer Chemistry, John Wiley & Sons, 1994.

Reference Books:

1. Composite Materials, Author by Deborah D.L.Chung, Springer, 2002.
2. Nanostructured Conductive Polymers, Editor. Ali Eftekhari, Wiley, 2010.
3. Organic Photovoltaics, CRC press-Taylor & Francis, Edited by Sam-Shajing Sun, Niyazi Serdar Sariciftci, 2005.
4. New and future development in catalysis, Elsevier Publication, edited by Steven L. Suib, 2013.
5. Catalytic for renewables, Wiley-VCH Verlag GmbH & Co. KGaA, Edited by Gabriele Centi and Rutger A. van Santen 2007.
6. PEM fuel cells- Material properties and performance, CRC press-Taylor & Francis, Editors: Hui Li, Shanna Knights, Zheng Shi, John W. Van Zee, Jiujun Zhang, 2010.

DGET615: INDUSTRIAL ENERGY AUDIT AND MANAGEMENT

L T P C

(Soft Core Course) **3 0 0 3 45L**

Course Outcome:

- To provide an understanding on ECA-2001 and its features
- Need for energy audit and method of its execution
- The role of energy and material balance calculation in energy auditing
- To study the energy conservation opportunities in various thermal utilities
- Energy conservation in electrical utilities

Unit I: ECA-2001 & Energy Audit and Management [10]

Salient features of the ECA-2001, Key definitions, Powers and functions of BEE, State designated agencies, Schemes of BEE under ECA 2001, Need for energy audit, Types of energy audit, Identification of energy conservation (ENCON) opportunities, Technical and economic feasibility, Classification of ENCON measures, Energy audit report, Understanding of energy costs, Benchmarking, Plant energy performance, Fuel and energy substitution, Instruments and metering for energy audit.

Unit II: Material and Energy Balance [5]

Introduction, Components of material and energy balance, Basic principles of materials and energy balance, Classification of processes, Levels of material balance, Material balance procedure, Energy balance, Facility as an energy system, Energy analysis and Sankey Diagram.

Unit III: Energy Conservation in Thermal Utilities: Furnace, Boilers, Steam Systems [11]

Furnaces: Classification, general fuel economy measures in furnaces, excess air and heat distribution losses, temperature control, draft control, case studies.

Boilers: Types, analysis of losses, performance evaluation, boiler blow down, energy conservation opportunities, FBC boilers, case studies.

Steam system: Properties of steam, assessment of steam distribution losses, steam leakages, steam trapping, condensate and flash steam recovery systems, identifying opportunity for energy saving, case studies.

Unit IV: Energy Conservation in Thermal Utilities: Insulation and refractories [7]

Insulation and refractories: Insulation type and application, economic thickness of insulation, heat savings and application criteria, refractory-types, selection and application of refractories, case studies.

Waste heat recovery: Availability and reversibility, first and second law efficiency, classification, advantages and applications, commercially viable heat recovery devices, saving potential, case studies.

Unit V: Energy Conservation in Electrical Utilities [12]

Electrical systems and bill analysis: Electricity billing, electrical load management, maximum demand control, Energy conservation opportunities in Lighting systems, Electric motors, VCR and VCR systems, HVAC & refrigeration system, Fans & blowers, Pumps, case studies.

Text Books:

1. Albert Thumann, Terry Niehus, William J. Younger, HandBook of Energy Audits, River Publishers, 9th Edition.
2. Larry C. Witte, Philip S. Schmidt, David R. Brown, Industrial Energy Management and Utilization, 1st Edition, Springer Publication,1988.

References:

1. Carig B, Saith, Energy Management Principles, applications, benefit and saving, Per n Presss, Newyork
2. D Patrick and SW Fardo, Energy conservation, Prentice Hall, INC Engleweek Cliffs (NJ) 7632
3. Davida, Fuels of opportunity, characteristics and uses in combustion systems, Edition-2004, Publisher-Elsevier Ltd., UK
3. Stephen A. Roosa, Steve Doty, Wayne C. Turner, Energy Management Handbook, River Publishers, 9th Edition, 2018.
4. Giuliano Dall'O', Green Energy Audit of Buildings, Springer Publication, 2013.
5. Ian M. Shapiro, Energy Audits and Improvements for Commercial Buildings, Wiley Publication, 2016.
6. 6. F W Pyne, P gm Energy Conservation Manual, Fairmount Proem, INC. P.O. Box 14227 Atlanta, A30224

DGET616: ADVANCED BATTERY AND FUEL CELL TECHNOLOGIES

L T P C

(Soft Core Course) **3 0 0 3 45L**

Course Outcome:

- Gain knowledge on components and working of lead-acid, lithium-ion batteries components
- Know-how on components and working of modern battery chemistries.
- Acquired know-how about fabrication and evaluation of lithium-ion battery
- Acquire knowledge on fabrication and evaluation of PEMFC fuel cell
- Get basic knowledge on electric vehicle and their markets in India and globally.

Unit I: SLI and VRLA Batteries [9]

Advantages and disadvantages of lead acid batteries, electrochemical reactions, physical and chemical properties of active materials, characteristics and properties of sulphuric acid, constructional features, materials and manufacturing methods, SLI (Automotive) batteries, charge and discharge properties of lead acid batteries, sealed lead acid or maintenance free batteries fabrication technology and testing. Lead acid battery for PV and automotive applications.

Unit II: Lithium-ion Battery [9]

Advanced anodes and cathodes – theoretical capacity – merits and demerits - Nanomaterials for anodes: carbon nanotubes, graphene, Sn, Al, Si, SnO_2, NiO and LTO. Nanomaterials for cathodes: $LiCoO_2$, $LiMn_2O_4$, $LiFePO_4$, and doped cathodes. Fabrication of nanostructured $LiCoO_2$, $LiMn_2O_4$, $LiFePO_4$, Si, Sn and CNTs. Battery fabrication technology and testing, batteries for electric vehicles, hybrid vehicles and solar photovoltaic applications.

Unit III: Post Lithium-ion Batteries [9]

Metal-ion Batteries: Na^+, K^+, Mg^{2+}, Al^{3+} & Ca^{2+}-ion batteries – Anodes, Cathodes, Electrolytes-Challenges & Advantages - Metal-Air Batteries: Lithium-Air, Sodium-Air, Zinc-Air batteries – Principle & components – anodes, cathodes, catalysts - fabrication - evaluation–merits and demerits and applications - Metal-Chalcogenides Batteries: Lithium-Sulphur, Sodium-Sulphur, Lithium-Selenium & Sodium-Selenium Batteries: Cathodes - Reaction Mechanism – Advantages - Challenges - Gravimetric & Volumetric energy density- Organic Batteries.

Unit IV: Fuel Cell Technology [9]

Membrane electrode assemblies, fabrication, catalyst layer, fuel cell supports, GDL, bipolar plates, fuel cell catalysts – precious and non-precious metal catalysts, bi-functional catalysts – nanomaterials for low temperature fuel cells – reversible fuel cells. Fuel cell stacks and systems - fuel cells for vehicles and grid connected applications.

Unit V: Electric Vehicle Technology [9]

Conventional vehicle Vs Electric vehicle: Concept of EV – Types of EV – Battery Technology– Motor types, Hybrid Electric Vehicle, Battery Pack and Battery Management system, Charging Technology, Future trends in EV: Wireless charging of EV - On-road charging of EV - Battery swap technology - Charging EVs from renewable - Government Policies, E-mobility: Indian and Word perspectives.

Text Books:

1. Modern Batteries Colin A Vincent and Bruno Scrosati, 1997 Pub Arnold ISBN 0-340-66278-6
2. Electric Vehicle Battery Systems Sandeep Dhameja, October 2001, Pub Newnes ISBN 0750699167

References:

1. T. R. Crompton, Battery Reference Book, SAE International, 1996.
2. Edition: 2EV/Hybrid Batteries & Battery Material Suppliers: An Automotive Market Review
3. David Linden, Hand Book of Batteries, McGraw-Hill, Inc, New York.
4. Linden D and Thomas B. Reddy, Hand book on batteries and fuel cell", McGraw Hill Book Co., New York, 3rd Edition, 2002.
5. Fuel Cell System Explained James Larminie and Andrew Dicks, 2003, Pub Wiley ISBN:0-470-84857-X
6. Energy conversion and storage scientific journals.

DGET617: ELECTRIC VEHICLE TECHNOLOGY

L T P C

(Soft Core Course) **3 0 0 3 45L**

Course outcomes:

- Get know about need of Electric Vehicles and their various types.
- Know-how technology of EV Architectures and their components
- Acquire knowledge on battery features for EV applications
- Get know-how technology of EV charging including wireless charging
- Awareness on Governments policies on EV and India & Global market trends.

Unit I: Introduction to Electric Vehicles [9]

Conventional Vehicles: Basics – Fuel types - transmission characteristics, Conventional vehicle vs Electric vehicle: Electric vehicle fundamental - History of electric vehicles, components: Battery system, motors, battery management system, thermal management system, Electronic controllers and convertors.

Unit II: Electric Vehicles & Architectures [9]

Types of electric vehicles: Battery electric vehicle (BEV) - Plug-in hybrid vehicles (PHEV)- Hybrid electric vehicles (HEV), Tractive effort in normal driving, Energy Consumption –the concept of Hybrid Electric Drive trains, Architecture of Hybrid electric drive trains.

Unit III: Energy storage for EV [9]

Energy Storage requirements, Battery parameters, Types of energy storage/devices (Lead-acid battery – lithium-ion battery & fuel cells): Nominal Voltage and Capacity, C rate, Energy and Power, Cells in series & Parallel, Charging and discharging process, Challenges and advantages, Hybridization of energy storage devices, modeling of batteries, Comparison of different energy storage technologies for EV, Fuel cell and Hybrid fuel-energy storage system.

Unit IV: Battery Management system [9]

Introduction to Battery Management System, Battery Pack topology, Voltage sensing, Temperature sensing, Thermal control, State-of-Charge and State-of-Health estimation, Cell balancing, cause of imbalance, circuits for balancing, Effect of distance, load and force on battery life and BMS, Energy Balancing with multi-battery system.

Unit V: Charging Technology and Future scope of EV [9]

Charging Technology, Future trends in EV, Overcharge and Undercharge, Modes of charging: Wireless charging of EV - On-road charging of EV - Battery swap technology - Charging EVs from renewable, Government Policies: FAME 1 – FAME 2, E-mobility: Indian and Global perspective.

Text Books:

1. Reachable lithium-ion batteries: Trends and Trends and Progress in Electric Vehicle Technology, P. Elumalai & T. Maiyalagan, CRC Press, ISBN 9781138484092.
2. Electric Vehicle Battery Systems Sandeep Dhameja, October 2001, Pub Newnes ISBN 0750699167.

Reference Books:

1. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wiley and Sons, 2012. ISBN 978-1-119-94273-3
2. Plett, L. Gregory, "Battery Management Systems Volume 1", Artech House, 2015. ISBN 978-1-63081-023-8
3. Rui XIONG, Weixiang Shen "Advanced Battery Management Technologies for Electric Vehicles", John Wiley & Sons, 2019, ISBN 9781119481645.

DGET618: ADVANCED WIND ENERGY CONVERSION SYSTEM

	L	T	P	C
(Soft Core Course)	**3**	**0**	**0**	**3 45L**

Course Outcome

After completion of the syllabus student able to:

- Understand the energy conversion techniques.
- Learn about wind turbine generator components and their constructions.
- Understand the modern wind turbine control & monitoring.

Unit I: Introduction to WECS [9]

Rotor Selection, Annual Energy Output, HAWT, VAWT, Rotor Design Considerations-Number of Blades, Blade Profile -2/3 Blades and Teetering, Coning- Upwind/Downwind, Power Regulation, Yaw System- Tower, Synchronous and Asynchronous Generators.

Unit II: Wind Energy Conversion System: Fixed Speed Systems. [9]

Generating Systems- Constant speed constant frequency systems -Choice of Generators- Deciding Factors-Synchronous Generator-Squirrel Cage Induction Generator- Model of Wind Speed- Model wind turbine rotor – Drive Train model-Generator model for Steady-state and transient stability analysis.

Unit III: Wind Energy Conversion System: Variable Speed Systems. [9]

Need of variable speed systems-Power-wind speed characteristics-Variable speed constant frequency systems synchronous generator- DFIG- PMSG -Variable speed generators modelling – Variable speed variable frequency schemes.

Unit IV: Modern Wind Turbine Control & Monitoring System [9]

Stall Control, Pitch Control, Details of Pitch System & Control Algorithms, Protections used & Safety Consideration in Wind turbines, Wind Turbine Monitoring with Error codes, SCADA & Databases:

Remote Monitoring and Generation Reports, Operation & Maintenance for Product Life Cycle, Balancing technique (Rotor & Blade), FACTS control & LVRT & New trends for new Grid Codes.

Unit V: Grid Integration [9]

Integration of Wind Energy Converters to Electrical Networks, Wind interconnection requirements, low-voltage ride-through (LVRT), ramp rate limitations, and supply of ancillary services for frequency and voltage control, current practices and industry trends wind interconnection impact on steady-state and dynamic performance of the power system including modelling issue.

Text Books:

1. C-Wet : Wind Energy Resources Survey in India VI
2. Duffie A. and Beckmann W. A., "Solar Engineering of Thermal Processes, John Wiley, 1991.

Reference Books:

1. Freris L.L., "Wind Energy Conversion Systems", Prentice Hall, 1990.
2. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, 1996.
3. Kaldellis J.K., "Stand – alone and Hybrid Wind Energy Systems", CRC Press, 2010.
4. Mario Garcia –Sanz, Constantine H. Houpis, "Wind Energy Systems", CRC Press 2012.

DGET619: BIOREFINERIES

(Soft Core Course) **L T P C**
3 0 0 3 45L

Course Outcome:

Learn various methodologies to convert biomass to biocrude. Acquire knowledge on conversion of biomass feedstock to complex and value added biomolecules. Specifically gain understanding on developing end-to-end solution for biofuel production and commercially sustaining the process in algae based biofuel conversion process.

Unit I: Liquefaction of Biomass [6]

Biomass Feedstock -Thermochemical Conversion of Biomass – Liquefaction by Pyrolysis - Hydrothermal Liquefaction. Gasification -Biochemical Conversion- Pretreatment-Enzymatic Hydrolysis Fermentation.

Unit II: Biochemical Conversion & Metabolites [9]

Introduction -Primary Metabolites -Saccharides - Lignin
-Amino Acids, Peptides, and Proteins - Fatty Acids, Lipids -Organic Acids -SecondaryMetabolites -Simple Phenols and Phenolic Acids -Polyphenols -Terpenes -Alkaloids - Stability of Isolated Compounds.

Unit III: Bio-separation Processes [12]

Conventional Separation Approaches-Steam Distillation-Conventional Solid–Liquid Extraction - Ultrasound-Assisted Extraction -Microwave-Assisted Extraction - Pressurized Subcritical Liquid Extraction -Supercritical Fluid Extraction -Separation and Purification of Phytochemicals from Plant Extracts and Dilute Solution in Bio-refineries -Liquid– Liquid Extraction -Membrane Separation-Molecular Distillation

Unit IV: Bio-refinery Concepts [9]

Classification of Biorefineries – Whole crop, Oleochemical, and Lignocellulosic Feedstock Biorefineries – Adoptability of Biorefineries in Petrochemical Refineries. Case studies: Specific Feedstock Based Biorefinery Process Development.

Unit V: Algal Bio-refinery [9]

Micro algae and Macro algae -Microalgae Biomass Production –Directed Algae Production Techniques -Down Stream Processing –Integrated Bioprocess in Algae - Value Added Chemicals from Biomass - Algal Phytochemicals, Biodiesel, Proteins, Polyunsaturated Fatty Acids, Vitamins, Carotenoids - Industrial products: Phycobiliproteins, Phycocolloids and Phycosupplements.

Text Books:

1. Biofuels Engineering Process Technology by Caye M. Drapcho, Nghiem PhuNhuan, & Terry H. Walker, McGraw Hill Publishers.
2. *Bioprocess Engineering Principles*; Pauline M Dorass, Academic Press.

Reference Books:

1. Ladisch, M.R., (2001), Bioseparation Engineering: Principles, Practice and Economics, Wiley, Interscience.
2. Biochemical Engineering Fundamentals; James E. Bailey and David F.Ollis, Mc Graw Hill book company.
3. Pauline M. Doran. Bioprocess engineering principles. Academic press. 1995
4. Biofuels from Plant Oils published by ASEAN Foundation (2010).
5. Industrial Biorefineries and White Biotechnology, Ashok Pandy et al (Editors), Elsevier 2015, ISBN :9780444634535

DGET620: ANAEROBIC DIGESTION AND BIOGAS TECHNOLOGY

(Soft Core Course) **L T P C**
3 0 0 3 45L

Course Outcome:

- After studying this subject, students would be able to understand the process of anaerobic digestion, microbial growth, and generation of biogas.
- Ability to analyze the optimum conditions for biogas production
- Design biogas and construct a proper size of the biogas plant.
- Perform testing of biogas plants and scale up the bioprocess
- Monitor the problems in biogas plants and repair the process for higher production efficiency

Unit I: Introduction to Biogas Systems [9]

Overview of gaseous biofuels; Traditional use of biogas in India; Potential of biogas in the energy scenario; Merits and demerits of biogas; Biogas in relation to ecology, environment, agriculture, health, and sanitation.

Unit II: Feedstock and Characterization **[**9]

Biogas feedstocks and characteristics; Agricultural waste; Industrial Wastes; Municipal wastes; Agro and processing industry wastes; processing and segregation of waste biomass; estimation of feedstock potential.

Unit III: Anaerobic Digestion [9]

Anaerobic digestion; principal of anaerobic digestion; biochemical and microbial aspects; Kinetics of biochemical conversions; rate-limiting reactions; single-phase vs. two-phase digestions; Composition and characteristics of biogas.

Unit IV: Biogas Systems and Storage [9]

Biogas plants/systems; classification and models of biogas plant; Types of bio-digesters; floating/fixed dome reactors; Design concept and construction of biogas plant; Up-gradation of biogas plant-CO_2 scrubbing-H_2S removal; operation and maintenance of biogas plant; Biogas storage, distribution, and utilization.

Unit V: Applications and Case Studies [9]

Biogas program in India; economic, social, and environmental aspects of biogas fuels; electricity from biogas; biogas based transport; Biogas appliances-CDM-Case studies

Text Books:

1. Hobson, P. N., & Wheatley, A. D. (1993). Anaerobic digestion: modern theory and practice.
2. Nijaguna, B. T. (2006). Biogas technology. New Age International.

Reference Books:

1. Horan, N., Yaser, A. Z., & Wid, N. (2018). Anaerobic Digestion Processes (pp. 978-981). Springer.
2. Lichtman, R. J. (1983). Biogas systems in India.
3. Chawla, O. P. (1986). Advances in biogas technology. Advances in biogas technology.9780444634535

DGET621: ALTERNATE MATERIALS FOR SUSTAINABLE TECHNOLOGY

(Soft Core Course) **L T P C**
3 0 0 3 45L

Course Outcome:

- A key feature of this subject will be to discuss an integrated approach combining advanced materials, fabrication, analytical, and modeling techniques for energy efficiency and environmental monitoring.
- It includes Sustainable construction materials, innovative building materials, Indoor air quality monitoring, and modeling and new sensing solutions for harvesting materials.

Unit I: Introduction to Sustainable Technology [9]

Introduction and definition of Sustainability. Sustainable construction, Carbon cycle and role of construction material such as concrete and steel, etc. CO2 contribution from cement and other construction materials. Prefabricated and pre-engineered buildings, High-performance concrete, Contemporary innovative building materials and their applications in Architecture, Alternate building materials and construction technologies.

Unit II: Construction materials and indoor air quality [8]

Construction materials and indoor air quality. No/Low cement concrete. Recycled and manufactured

aggregate. Role of QC and durability. Life cycle and sustainability. Components of embodied energy, calculation of embodied energy for construction materials.

Unit III: Exergy concept and primary energy [8]

Embodied energy via-a-vis operational energy in conditioned building. Life Cycle energy use. Control of energy use in building, ECBC code, codes in neighboring tropical countries, OTTV concepts and calculations.

Unit IV: Structural Materials, Wall Systems and Flooring [10]

Natural /Conventional Building materials, Traditional and vernacular methods in India, Rammed earth construction, Hi-Tech Glass Polymers,Wall Systems: Framing, Insulation, Wallboards, Flooring, low VOC paints, materials & adhesives, building acoustics, Coating Materials, nanotechnologies for green buildings.

Unit V: Sustainable Material Measurement Properties [10]

Fibers- metal and synthetic, Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Building materials from agro and industrial wastes, measurement of building materials properties calculations and carbon footprint calculation.

Text Books:

1. Wu Chung, H. Advanced Civil Infrastructure Materials, First Edition, Woodhead Publishing Limited, 2006
2. Newman, J. and Choo, Ban Sang, Advanced Concrete Technology-Processes, 1st Edition, Elsevier, 2003.

Reference Books:

1. Newman, J. and Choo, Ban Sang, Advanced Concrete Technology-Constituent Materials, 1st Edition, Elsevier, 2003.
2. Sustainability of Construction Materials, A volume in Woodhead Publishing Series in Civil and Structural Engineering Edited by J. Khatib ISBN: 978-1-84569-349-7
3. Kubba, S, LEED Practices, Certification, and Accreditation Hand book, 1st ed. Elsevier, 2010.
4. Venkatarama Reddy, B. V., and. Jagadish, K., S. "Embodied energy of common and alternative building materials and technologies". Energy and Buildings., 35, 129- 137,2003.
5. Chani, P. S., Najamuddin., and Kaushik, S.K. "Comparative Analysis of Embodied Energy Rates for Walling Elements in India". Energy and Buildings., 84, 47-50. 2003.
6. Andrew, H., Buchanan., and Brian, G. "Energy and carbon dioxide implications of building construction", Energy and Buildings., 20, 205-217. 1994.

DGET622: BIOMASS FEEDSTOCK AND SOLID BIOFUEL PRODUCTION

	L T P C
(Soft Core Course)	**3 0 0 3 45L**

Course Outcome:

- Students shall able to assess regional biomass potential for energy conversion.
- Learn the process and technology to develop solid biofuels from available biomass
- Learn various solid biofuels processing technology and their commercial potential.

Unit I: Biomass Resources [9]

Agricultural produce and waste biomass, Biomass from forest produce and energy plantation, Aquatic weeds, Marine resources. Biomass yield, availability, energy potential. Industrial biomass, Biomass from urban and municipal wastes, Seasonal biomass feedstock.

Unit II: Resource Assessment of Biomass [9]

Interaction of biomass with electromagnetic spectrum –Principle of remote sensing and its application to biomass quantification – 3D remote sensing, Vegetation indices - Analysis of satellite imageries for biomass quantification, SAR, UAV based biomass estimation. Biomass feedstock potential in India - Regional biomass availability - Case studies.

Unit III: Processing of Biomass [9]

Physical properties of biomass: Moisture, bulk density, size, grindability, crushability. Chemical composition of biomass- estimation of volatile matter, cellulose, hemicellulose and lignin content. Properties of municipal solid waste – Segregation of paper and plastic waste – refuse derived fuels.

Unit IV: Solid Biofuel Production Processes [9]

Pelleting and briquetting of solid biomass – Process flow – factors influencing heat values. Pretreatment of biomass for energy enhancement – Torre faction, Fuel characteristics of solid biofuels - co-firing of solid biofuels in thermal power plants – application in industrial units, Industrial production of pellets and briquettes – Integrated process flow - feedstock andproduct portfolios – Securing feedstock supply chain.

Unit V: Energy Economy of solid biofuel [9]

Roll of biomass energy in energy security - energy economy of solid biofuel - regional biomass utilization- Entrepreneurships potential- International and national energy policies on solid biofuels – Integrated economy model in solid biofuel Production – Case studies.

Text books

1. Industrial briquetting: fundamentals and methods, Vol.13. Studies in Mechanical Engineering by Zygmunt Drzymała, Elsevier, 1993.
2. Biomass Briquetting: Technology and Practices by P.D.Grover & S.K.Mishra, published by FAO Regional WoodEnergy Development Programme in Asia, Bangkok, Thailand

Reference books:

1. Chakraverthy A, "*Biotechnology and Alternative Technologies for Utilization of Biomass Or Agricultural Wastes"*, Oxford & IBH publishing Co, 1989.
2. VenkataRamana P and Srinivas S.N, "*Biomass Energy Systems*", Tata Energy Research Institute, 1996.
3. Application and Problems of Biomass Briquetting Densification Fuel(BBDF) Technology in Chi na by Wang Xutao and Zhang Bailiang, Springer Berlin Heidelberg.
4. David Boyles, Bio Energy Technology Thermodynamics and Costs, Ellis Hoknood Chichester, 1984.
5. Mahaeswari, R.C. Bio Energy for Rural Energisation, Concepts Publication,1997
6. Best Practises Manual for Biomass Briquetting, I R E D A, 1997

DGET623: ORGANIC PHOTOVOLTAICS

(Soft Core Course) **L T P C**
3 0 0 3 45L

Course Outcome:

- To evaluate how these materials can be implemented successfully in established and emerging organic electronic modules.
- Able to link molecular transport phenomena with macroscopic device response to analyze and design the next generation of organic electronic materials and devices.
- Demonstrate ability to plan synthetic strategies at an advanced level in order to synthesize organic optoelectronic materials.
- Able to propose different synthetic routes in order to enrich the properties of the material through rational understanding of structure-property relationships.

Unit I: Introduction to organic materials [9]

Introduction to organic materials for energy as a class of materials of great potential. Different classes of organic electronic materials, namely small molecule semiconductors, conjugated polymers, and carbon nanostructured materials and the main concepts. Organic optoelectronic devices, structure, principles and performances.

Unit II: Molecular, Thermal, Structural and Optical Characterization [9]

Molecular, Thermal, Structural and Optical Characterization methods to analyze different material properties. Electronic Structure, Atomic and Molecular Orbitals, The Fermi Energy and The Density of States. Carrier Densities in Intrinsic Semiconductors. Charge Transport. Doping in Semiconducting Materials. Transport in Disordered Semiconductors.

Unit III: Organic Photovoltaic Devices [9]

Organic Polymer-based Solar cells, Plastic cells, perovskite solar cells, Field-Effect Transistors and Light Emitting Devices. Overview of Organic Photovoltaic Devices. Characterizing Device Parameters in OPVs. Nanostructural Impacts in OPV Devices. Interfacial Modifying Layers in OPV Devices. Emerging Trends in OPV Devices

Unit IV: Optoelectronics [9]

Photovoltaic and Emerging Devices. Introduction to Organic Light-emitting Devices. Design Considerations for OLEDs. Introduction to Polymer Thermoelectric Devices. State-of-the-Art in Polymer Thermoelectrics. Determination of figure of merit and device characteriazation.

Unit V: Development of organic Materials [9]

Structure-property relationship in organic electronic materials. Tuning of the chemico-physical properties by synthesis and functionalization of the molecular structure. Key aspects in the development of organic-based devices; material design, structure and properties, interfaces, solid state aggregation and morphology of the active layer, charge transport, device architecture and long-term stability.

Text books:

1. Organic Optoelectronics - Wenping Hu, Fenglian Bai, Xiong Gong, Xiaowei Zhan, Hongbing Fu, Thomas Bjornholm, Wiley, ISBN: 978-3-527-65345-4; 2013.
2. Solar Photovoltaics: Fundamentals, Technologies and Applications, C. S. Solanki, Prentice Hall of India, 2011.

Reference books:

1. Organic photovoltaics: Concepts and realization - C. Barbec, V. Dyakonov, J. Parisi, N. S. Saricifttci, Springer-Verlag 2003.
2. Advances in Carbon Nanomaterials: Science and Applications (1st ed.) - Tagmatarchis, N. (Ed.). (2012). Jenny Stanford Publishing.

DGET610: ENERGY LABORATORY – III
(VIRTUAL INSTRUMENTATION AND CASE STUDIES ON SUSTAINABLE ENERGY SYSTEMS)

LTPC

(Hard Core Course) **0 2 4 3 90L**

Course Outcome:

- Gain simulation and modeling skill.
- Apply computational and programming skill set to solve renewable energy technology related problem.
- Acquire basic concept of virtual instrument based programming and interfacing.
- Learn the programing skill to control and interact with devices in real-time.

List of Experiments

S. No.	List of Experiments
1	Simulation of wind turbine
2	Simulation of wind generator
3	Simulation of hybrid wind-solar system
4	Experimental study on effects of blade profiles on the Performance of the wind turbine
5	Experimental study on effects of loads on the energy output of a wind turbine
6	Experimental study on flow behavior over the wind turbine
7	Experimental study on solar – wind hybrid energy system performance
8	Computational study on effects of blade profiles on the Performance of the wind turbine
9	Computational study on effects of loads on the energy output of a wind turbine
10	Computational study on flow behavior over the wind turbine
11	Computational study on solar – wind hybrid energy system performance
12	The casting of eco-friendly concrete blocks for Green Buildings
13	Carbon Emission Test of construction Materials for Green Buildings
14	Thermal Properties of Green Building Materials
15	Evaluation of Mechanical Properties of residues for Green Building applications

Virtual Instrumentation and Case Studies

The trend engineering design today, is towards more digital prototyping and computer-based evaluation and testing before a time-consuming and expensive production of either scale models or full-size physical prototypes of components or systems. During this lab course, the student is expected

to gain practical experience on case studies related to alternate and green technologies. Students will be given the opportunity to develop a detailed prototype interactive virtual instrumentation system for a sustainable energy project that they can use as the basis of their final industrial project, to be pursued at the fourth semester. Students are expected to give two seminars and submit a system document that must include sufficient technical content along with resource assessment, economic appraisal, development schedule and plan as well as environmental, economic and social impact assessment.

Course Contents

Virtual Instrumentation basics: Front panel and block diagram- Dataflow programming model Modular Programming: Basics of modular programming with subVIs- Creating an icon and connector pane Graphing with LabVIEW: Using waveform charts to display data, XY graphs to display data Strings and File I/O: Creating string controls and indicators, Using File I/O Vis.

Data Acquisition: Plug-in DAQ devices, Performing analog I/O, Counters, Digital I/O, Instrument Control, Sensors and Transducers, PC Based Measurement Data Acquisition & Signal Conditioning., Intelligent Instrumentation.

Manuals & References:

1. LabVIEW for Data Acquisition (Paperback) Bruce Mihura Prentice Hall, 2001
2. LabVIEW for Electric Circuits, Machines, Drives, and Laboratories, by Nesimi Ertugrul, Prentice Hall 2002
3. LabView: Advanced Programming Techniques, SECOND EDITION Rick Bitter,
4. Taqi Mohiuddin, Matt Nawrocki CRC Press; 2 edition, 2006
5. LabVIEW for Everyone: Graphical Programming Made Easy and Fun (3rd Edition) (Hardcover)~ Jeffrey Travis,
6. Jim Kring Prentice Hall; 3 edition 6, 2006

The virtual instrumentation case studies investigated in this lab are expected to include Renewable /Non-Conventional Energy Systems- Solar, Wind, Small Hydro, Biofuels, Solar thermal & Solar PV systems. Types of Solar energy convertors, Wind Energy Conversion Systems, Wind data analysis, Grid connected systems, Mini/Micro/Pico hydel Systems-Turbines, Grid connected and stand-alone systems, Bio fuels- Biogas. Bio mass. Bio diesel, Gasifiers, Hybrid systems, Energy conservation and Energy Efficiency, Intelligent buildings.

Manuals & References:

1. Study of Electrical Power Systems Using LabVIEW Virtual Instruments (VI) Modules Paper 137, Proceedings of the 2008 IAJC-IJME International Conference ISBN 978-1-60643-379-9
2. A LabView Based Instrumentation System for a Wind-Solar Hybrid Power Station Journal of Industrial Technology • Volume 20, 2004, 1-8
3. Design and Simulation of an Automated System for Greenhouse using LabVIEW, American- Eurasian Journal and Environmental Science, 2008, vol 3, 279-284.
4. Using LabVIEW in a Mini Power System Model Allowing Remote Access and New ImplementationsInternational Conference on Engineering Education – ICEE 2007, September 3 – 7, 2007
5. A Matlab-Based Modeling and Simulation Package for Electric and Hybrid Electric Vehicle Design IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, VOL. 48, NO. 6, NOVEMBER 1999

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SEMESTER - IV

DGET640: GREEN TECHNOLOGY DISSERTATIONS

(Hard Core Course) Full-time Dissertation work

Course Outcome:

- Student shall specialize through industrial training and/or research work in the renewable energy field of their choice & basic degree specialization
- Learn to identify a research problem or industrial problem, devise a methodology to solve the same.
- Trained on design, fabrication and testing of energy products
- Learn the entrepreneurship potential in renewable energy technologies.

Course Code	Course Title	Course Type*	L	T	P	C
DGET640	Green Energy Technology Dissertation & Viva-voce	H				12
Total No. of Credits						**12**

To be carried out with due permission from the Chairperson / Coordinator for one semester (four months) in any industry or a research organization outside Pondicherry University and practicing green energy technologies

A thesis written for this project will be evaluated by an expert followed by viva-voce.

Minimum credit requirement = 72; All teaching, learning and evaluations will follow the Choice Based Credit System (CBCS) which is in vogue in Pondicherry University.

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OTHER SOFT-CORE COURSES

These courses will be offered in any of the first three semesters depending on the availability of the resource faculty.

DGET624: GREEN MANAGEMENT

(Soft Core Course) **L T PC**
3 0 0 3 45L

Unit I: [9]
The concept of green management; evolution; nature, scope, importance and types; developing a theory; green management in India; relevance in twenty first century

Unit II: [9]
Organizational environment; internal and external environment; Indian corporate structure and environment; how to go green; spreading the concept in organization; Environmental and sustainability issues for the production of high-tech components and materials, life cycle analysis of materials, sustainable production and its role in corporate social responsibility (CSR) and corporate environmental responsibility (CER).

Unit III: [9]
Approaches from ecological economics; indicators of sustainability; ecosystem services and their sustainable use; bio-diversity; Indian perspective; alternate theories

Unit IV: [9]
Environmental reporting and ISO 14001; climate change business and ISO 14064; green financing; financial initiative by UNEP; green energy management; green product management

Unit V: [9]
Definition; green techniques and methods; green tax incentives and rebates (to green projects and companies); green project management in action; business redesign; eco-commerce models

Textbooks:

1. Green Management and Green Technologies: Exploring the Causal Relationship by Jazmin Seijas Nogarida, 2008.
2. Green Marketing and Management: A global Perspective by John F. Whaik, 2005

References:

1. The Green Energy Management Book by Leo A. Meyer
2. Green Project Management by Richard Maltzman And David Shiden
3. Green Marketing by Jacquelin Ottman
4. Green and World by Andrew S. Winston

DGET625: BIO -INDUSTRIAL SKILLS

(Soft Core Course) **LT PC**
3 0 0 3 45L

Course outcome:

- Become aware of the practical issues when they enter the industry for employment
- Getting a sense of what industries expect for successful employment
- Understanding the problems analytical planning of hands on experience
- Acquisition of skills needed for decision making

Unit I: Demand of the Industry [9]

Contemporary industry's need of products, economical value, hard and soft expertise, does and don'ts, standard operating procedure (SOP), organization management, genuineness, hands on experience.

Unit II: Planning research proposal [9]

A well-defined sketch goal, state of art the technology, essential reachable objectives, designing vital methodology, procedural work plan, time line millstone, hindrance management, deliverable outcome, budget, revenue generation,

Unit III: Plan of action [9]

Task management, procedural knowledge, documentation (log note/observation note), result interpretation, managing problem, technology development, intellectual property rights (IPR), commercial production/scale up of production, and managing problem at scale up production.

Unit IV: Decision making [9]

Identification of the problem, analysis of problem, gather relevant information, development of alternatives, evaluation of alternatives, selection of best alternatives, implementation of alternatives, review of implementation.

Unit V: Mandatory skills [9]

Basic information about the mandatory skills required by the industry/organization includes technical skills, management skills, analytical skills, leadership skills, collaborative skills, learning skills, presentation skills, innovation/creative skills, dedication skills.

Text Books

1. Dinkar Pagare, Business Management, 2018
2. Ben-Daya, Mohamed; Duffuaa, Salih O; Raouf, Abdul; Knezevic, Jezdimir; Ait-Kadi, Daoud (2009). *Handbook of Maintenance Management and Engineering, 10.1007/978-1-84882-472-0(),* –. doi:10.1007/978-1-84882-472-0

Reference books

1. C. George Thomas, (2021) Research Methodology and Scientific Writing, Springer, Cham, 2nd ed, ISBN: 978-3-030-64865-7, https://doi.org/10.1007/978-3-030-64865-7.
2. Peters, G., & Svanström, M. (2019). Decision-Making. In *Environmental Sustainability for Engineers and Applied Scientists* (pp. 198-226). Cambridge: Cambridge University Press. doi:10.1017/9781316711408.010
3. B.Narayan (1999) Industrial Management, APH Publishing, ISBN 817648038X, 9788176480383, 280 pages.

DGET626: BIOPROSPECTING TECHNOLOGY FOR BIOFUEL PRODUCTION

(Soft-core Course) **L T P C**
3 0 0 3 45L

Course outcome:

- Gain the knowledge on bioprospecting of microbial stains for biofuels production
- Obtain insight about the merits and demerits of energy plants
- Familiarize the instruments used in biofuels estimation
- Understanding the goals of Zero waste management

Unit I: Bioprospecting of Microbial strains [9]

Biofuel strains, potential to utilize high substrates, high tolerance to inhibitors and end products, great metabolic efficiency, bioprospecting for wild strains with the target gene, fermentation with metabolically engineered strains.

Unit II: Bioprospecting of Energy plants [9]

Food versus Fuel, Reliability of Feedstock Supply, Shared Economic Prosperity, Environment-Water Availability, Nutrient Run Off, Land-use Change, Residue Diversion, Introduction of Invasive Species, Validity of GHG, Competitiveness

Unit III: Bioprospecting of Environmental samples [9]

Bioprospecting for Cellulose, hemicelluloses, lignin-Degrading Microbes- Filter Paper Assay method, xylanase assay, zymogram, High concentrations of cellulosic biomass, Evidence of decomposing cellulosic biomass, Moist conditions, warm conditions.

Unit IV: Instrumentation in biofuel [9]

High performance liquid chromatography- UV detector, PDF detector, HPLC columns for specific sample, solvent system, degasification, Gas chromatorgraphy, FID, TCD, carrier gases, ignition gas, GC columns.

Unit V: Zero waste management [9]

Bioprospecting of lignocellulose and starch waste to ethanol, butanol, bioprospecting organic waste into hydrogen, bioprospecting of microbial biomass as animal feed, bioprospecting of marine- fresh algal biomass for biofuel production

Text Books:

1. Bioprospecting, Russell Paterson, Nelson Lima (eds), Springer, Cham, 2017, https://doi.org/10.1007/978-3-319-47935-4.
2. Zero Waste Biorefinery, Yogalakshmi Kadapakkam Nandabalan, Vinod Kumar Garg, Nitin K. Labhsetwar, Anita Singh (eds), Springer, Singapore, 2022, ISBN: 978-981-16-8682-5, https://doi.org/10.1007/978-981-16-8682-5

Reference books:

1. Genetic and Metabolic Engineering for Improved Biofuel Production from Lignocellulosic Biomass, Arindam Kuila, Vinay Sharma (eds), Elsevier, 2020, 978-0-12-817953-6, https://doi.org/10.1016/C2018-0-02516-5.
2. Neha Srivastava, P.K. Mishra and S.N. Upadhyay, Industrial Enzymes for Biofuels Production: Recent Updates and Future Trends, Elsevier, 2020, 978-0-12-821010-9
3. Nikalje, Anna. (2017). A Handbook of Chromatography.

DGET627: MICRO HYDROPOWER ENERGY SYSTEM

(Soft-core Course) **L T P C**
Course outcome: **3 0 0 3 45L**

- To learn an idea of designing and selecting of civil components, mechanical components, electrical components, and transmission system.
- Students learn the basic components of a Micro Hydropower System to design an MHP System and able to select the suitable system components. Also, able to know how to transmit the power and to distribute in an efficient way.

Unit I: Introduction to Micro-Hydropower Technology (MHP) [8]
Introduction to MHP system design, Planning concepts, Evaluation of MHP requirements, Power from water, Classification of hydropower and end-users, System components of Mini and Micro Hydropower, Introduction of Hydropower plant in India, Micro Hydropower plant in India, Policy of India Government and concerned authorities, Potential Hydropower plant projects identified in India, Water management

Unit II: Layout design of civil components of MHP system [9]
Overview of civil components of MHP system, Intake, and weir. Headrace canal, Spillway, Settling basins, Fore-bay, Penstock, Anchor blocks, Support piers, Expansion joints, Powerhouse.

Unit III: Design and Selection of mechanical components of MHP system [10]
Selection of turbines and its components, Selection of the turbine based on load demand, Valves, Plant efficiency, Power output calculation, Turbine sizing
Selection of electro-mechanical equipment: Introduction of different belts: Vee belt, tooth belt, flat belt , Selection of belt, Pulley: Introduction of pulleys, Coupling :Introduction of different couplings, Selection of couplings, Gear box, Safety measures of MHP equipment, De-silting basin, Fore-bay structure, Water convey pipe line, Valves, Turbines, Belt and coupling

Unit IV: Selection of electrical components of MHP scheme [10]
Generator - type and size (a) Synchronous generator, (b) Induction generator; Selection of generator type; Determination of size of generator; Speed governing system-Conventional oil pressure mechanical governor, Electronic governor
Selection of Transformer: Introduction of transformer, Constructional details of transformer, Selection of transformer rating and specification, Operation and maintenance of transformer, Safety measures.

Unit V: Selection of Transmission and Distribution Lines [8]
Selection of transmission voltage, Selection of underground or overhead lines, Sizing of overhead transmission line conductor, Installation of transmission and distribution lines, Grid connection of MHP plant.

Text books:
1. Adam Harvey, “Micro Hydro design Manual”, Intermediate Technology Publication.
2. Win Hulsher and Peter Frankel, “The Power Guide, Intermediate Technology Publication.

Reference books

1. "Manuals on MHP for Installation and Commissioning, Maintenance and Repair, Operation and Management", ICIMOD.
2. Small hydroelectric engineering practice- Bryan Leyland, CRC Press
3. Hydropower Engineering- C.C. Warnik, Prentice Hall.

DGET628: SUSTAINABLE TECHNOLOGIES FOR VALORISATION OF WASTE CARBON FEEDSTOCKS

(Soft Core Course) **L T P C**

3 0 0 3 45L

Course Outcome:

- Able to understand and integrate circular economy for sustainable development.
- To understand the applications of newer technologies for the better process integration in waste-based refineries.
- To realize techno-economic considerations and challenges, for conversion of waste to value, and role of government policies.

Unit I: Circular Economy for Waste Reduction and Carbon Footprint [9]

Introduction: Carbon's critical role as life essential element and in non-renewable fuels and chemicals. Various sources of carbon waste eg., industrial emissions, biomass residue, manure, garbage which are of environmental concern. Circular economy as a new rational utopia. Integration of Circular economy and Sustainable Development. Requirements for Transition to a Circular Economy. Possible supply chain scenarios for conversion of waste carbon to valuable products.

Unit II: Carbon abatement technologies [9]

Emerging carbon abatement technologies to mitigate carbon footprint and convert to carbon-based chemicals and valuable products.

General approach for waste treatment and conversion to value-added products: biochemical, mechanical, and thermochemical. Valorisation of woody biomass, challenges therein. Process integration for waste-based biorefinery. Recovery of valuable products from anaerobic digestion of food waste. novel biotechnological processes and chemical transformations. Comparing various waste to energy (WtE) Technologies.

Unit III: Technologies for CO_2 conversion to valuable chemicals [9]

Overview of potential chemical pathways to use CO2 for the production of polymers. CO2 conversion technologies: Urea production, Sabatier synthesis, Fischer-Tropsch synthesis, hydrogenation to methanol, dry reforming, hydrogenation to formic acid, and electrochemical reduction. Potential of advanced catalytic materials such as metal organic frameworks, (MOFs), covalent organic frameworks (COFs), and technologies in photocatalytic, electrochemical, photoelectrochemical, biocatalytic and thermal reduction of CO2 to valuable chemicals.

Unit IV: Technologies for biomass volarization to value-added products [9]

Important reactions in biomass conversion include hydrolysis, isomerization, dehydration,

hydrogenation, hydrodeoxygenation, hydrogenolysis, oxidation, esterification, ketonization, condensation, Aldol reaction and others. Concepts in advanced catalytic materials and techniques such as thermochemical catalysis, photocatalysis, electrocatalysis, photoelectrocatalysis, and biochemical technologies biomass volarization and challenges. Catalytic machanisms in valorization of Lignin, and cellulose-based biomass to platform chemicals.

Unit V: Techno-economic challenges, government policies and case studies [9]

Techno-economic considerations and challenges which impede the conversion of waste into a more valuable product: advances in industrial biotechnology, production organic chemicals using renewable feedstocks such as agriculture and forestry residues and energy crops, including switchgrass among others, and the challenges/ drawbacks therein.

Factors that determine investments to use waste carbon as chemical feedstocks. Government Policies. Case studies. Potential business model.

Text books:

1. Green Carbon Dioxide: Advances in CO2 Utilization - Gabriele Centi, Siglinda Perathoner ISBN: 978-1-118-59088-1 March 2014.
2. Waste Valorisation: Waste Streams in a circular economy - Carol Sze Ki Lin, Guneet Kaur, Chong Li, Xiaofeng Yang, Christian V. Stevens, Wiley, ISBN: 978-1-119-50270-8; 2020.

References:

1. Sustainable Bioconversion of Waste to Value Added Products - Inamuddin, Anish Khan, Springer Cha, ISBN978-3-030-61839-1; 2021.

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PONDICHERRY UNIVERSITY
(A CENTRAL UNIVERSITY)

Five Year Integrated M.Sc. Programme

(Mathematics, Computer Science& Statistics)

(Choice Based Credit System)

Curriculum & Syllabus

2020-21 onwards

CSIG 111PROGRAMMING IN C

Prerequisite: - Basic knowledge of Mathematics and computers

Objectives:

- To learn the concepts of " C " Programming
- To develop software program using "C" language

Outcomes:

- In-depth understanding of various concepts of C language.
- Skill to write program code in C to solve real world problems and to debug a program

UNIT I

Basics of C: Structure of C program – Identifier – Keywords- Variables – DataTypes – Comments – Datatypes – User Defined Datatype (TypeDef) - Constants – Storage classes – Automatic variables – External variables – Static variables – Register variables – Scope Rules. Expressions- Type conversion – Operators – Control statements – Formatted data input and output functions – Header Files.

UNIT II

Arrays: Defining array- Initializing array- One Dimensional Array – Two Dimensional Array- Multidimensional array- Dynamic array. Character Arrays and String – Operations on characters and String functions. Functions – Defining a function- Accessing a function- function prototype- Function call- Library functions – User defined functions – Passing arguments to functions- Static functions – I/O functions – Recursion- Function and array.

UNIT III

Structures – Defining structure- Processing a structure- Passing structure to functions- Self-referential structure- Nested Structure- Array of structure. Union. Pointers – Declaration- Operations on pointers- pointer expressions- character pointer- pointer to pointer – pointer to function- pointer and function argument- pointer and array – address arithmetic- Structure and Pointers

UNIT IV

File- Opening closing a file – Input and output operations with files – special functions for working with files- Processing a data file- Unformatted data file- Concepts of binary files- Random access to files

UNIT V

Error handling during I/O operations. Command Line arguments. Dynamic Memory Allocation. Preprocessor- Directives

TEXT BOOKS

1. Byron S Gottfried, "Programming with C", 4th Edition, Schaum's Outlines, McGraw Hill, 2017.
2. E Balagurusamy, "Computing Fundamentals & C programming", 2nd Edition, McGraw Hill, 2017.

REFERENCES

1. E. Balagurusamy, "Programming in ANSI C", 7th Edition, McGraw Hill, 2017.
2. Stephen G Kochan, "Programming in C: A complete introduction to the C programming Language", 4th Edition, Pearson, 2015.
3. Brain W.Kernighan, Dennis M Ritchie, "The C Programming Language, 2nd Edition, Prentice Hall, 2015.

PRACTICAL I

CSIG 112C Lab

1. Simple programs to learn the various data type and control statements
2. String Manipulations
    a. Counting number of vowels, consonants, words, white spaces in a string
    b. Reversing a string and check for palindrome
    c. Finding the number of occurrences of a sub string in a given string
    d. Sub string replacing and removal
3. Recursion
    a. Factorial
    b. Reversing a string
    c. Fibonacci Sequence
    d. Tower of Hanoi
4. Matrix Manipulations using functions and Case structure
    a. Addition & Subtraction
    b. Multiplication
    c. Transpose
    d. Check if the given matrix is a Magic square
5. Searching
6. Sorting
7. Structures
8. Pointers
9. Files

CSIG121 PROBLEM SOLVING WITH DATA STRUCTURES AND ALGORITHMS

Pre-requisite: Knowledge of any programming language

O**bjectives:**

- To acquaint students with data structures used for programming and manipulation of data.
- To make students to understand the basics of algorithms.

Outcomes:

- Skill to analyze data and to determine appropriate data structure.
- Knowledge of various data structures and their implementations.
- Ability to implement algorithms to perform various operations on data structures.

UNIT I

Introduction, Basic terminologies, Linear and Nonlinear data structures. **Algorithm:** Definition, Pseudo code, Analysis, Design techniques. **Arrays:** One Dimensional Array, Two - Dimensional Array, Application: Sparse Matrices.

UNIT II

Stacks: operations on stack, implementation of stack as an array, Application- Maze Problem, Evaluation of Expression & Conversion.

Queues: Operations on Queues, Implementing the Queue, Application, Circular Queue.

Linked List: List representations, Anatomy of a node, Implementing the list operations, inserting into an ordered list, Doubly Linked List, Keeping a stack in a linked list, keeping a Queue in a linked list, Polynomial – Linked list representation.

UNIT III

Trees: Basic Terminologies, Binary Tree, Representation, Traversal, Binary Search Tree, Threaded Binary Tree, Application: Game Tree.

UNIT IV

Graph: Definition and Terminologies, Representation, Traversals, Shortest path, Minimum Spanning Tree – Kruskal's Algorithm and Prim's Algorithm. **Hashing:** Hash functions- Separate chaining- Open addressing- Rehashing-Extendible hashing.

UNIT V

Searching algorithms: Linear Search, Binary Search – **Sorting algorithms:** Selection, Exchange, Shell sort, Quick sort.

TEXT BOOKS

1. Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures”, Galgotia Book Source, 2004.
2.Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, “Fundamentals of ComputerAlgorithms”, 2nd edition, Galgotia Publications, 2008.
3. Jean Paul Tremblay and Paul G. Sorenson, “An Introduction to data structures with applications”, 2nd edition, Tata McGraw-Hill, 2017.

REFERENCE BOOKS

1. V. Aho, J. E. Hopcroft, and J. D. Ullman,“Data Structures and Algorithms”,1st edition, Pearson Education, 2002.
2. Gilles Brassard and Paul Bratley, “Fundamentals of Algorithmics”, 1st edition, Prentice-Hall of India, 1996.

PRACTICAL II

CSIG122 DS LAB

1. Linear Search & Binary Search
2. Sort by selection, exchange, quick sort
3. Stacks, Queues using Arrays & Linked List
4. Singly Linked List : Insertion & Deletion
5. Doubly Linked List: Insertion & Deletion
6. Binary Tree Traversal (Inorder, Preorder, Postorder)
7. Graph : BF Search, DF Search, Shortest Path & Minimum Cost Spanning Tree

CSIG 231 FUNDAMENTALS OF DIGITAL LOGIC AND MICROPROCESSORS

Prerequisite: Basic knowledge about computers

Objectives:

- To learn the fundamentals of digital logic and computer design.
- To learn combinational and sequential logic.
- To learn the fundamentals of microprocessor and instruction set.

Outcomes:

- Skill to use the methods of systematic reduction of Boolean expression using K-Map. Ability to interpret logic gates and its operations.
- Familiarization with combinational and sequential logic circuits in electronics.
- Knowledge about microprocessor architecture and addressing modes.

UNIT I

Review of Number Systems – Arithmetic Operations – Binary Codes – Boolean Algebra and Theorems – Boolean Functions – Simplification of Boolean Functions using Karnaugh Map and Tabulation Methods – Logic Gates – NAND and NOR Implementations.

UNIT II

Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations, Code Conversion – Decoders and Encoders – Multiplexers and Demultiplexers – Introduction to Sequential Circuit –flip flop – Shift Registers - Counters

UNIT III

Components of a computer system – Technology – Performance – Uniprocessors to multiprocessors; Instructions – Operations and Operands – Representation - Logical operations – Control operations – Addressing and Addressing modes. **Arithmetic Operations:** ALU - Addition and subtraction – Multiplication – Division – Floating Point operations

UNIT IV

Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, Associative memory - Input/output system, Programmed I/O, DMA - Interrupts and Interrupt Service Routines, I/O processors.

UNIT V

Introduction to 8086 – Microprocessor architecture – 8086 system bus structure-Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Procedures – Macros – Byte and String Manipulation. - Coprocessor

TEXT BOOK

1. Morris Mano M. and Michael D. Ciletti, "Digital Design", 4th Edition, Pearson Education, 2008.
2. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design", 2nd Edition, Prentice Hall of India, 2007.
3. David A. Patterson and John L. Hennessey, "Computer organization and design', 5th edition, Morgan Kauffman / Elsevier,2014.

REFERENCE BOOKS

1. John F. Wakerly, "Digital Design Principles and Practices", 4th Edition, Pearson Education, 2007.
2. Charles H. Roth Jr, "Fundamentals of Logic Design", 5th Edition, Jaico Publishing House, Mumbai, 2003.
3. V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation",
   6th edition, Mc Graw-Hill Inc, 2012.
4. William Stallings "Computer Organization and Architecture" , 7th Edition , PearsonEducation, 2006.
5. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd Edition, Pearson Education, 2011.

CSIG 232 INTRODUCTION TO OOP AND PROGRAMMING IN C++

Prerequisite: Basic knowledge of programming

Objectives:

- To learn the basic concepts of OOP.
- To develop C++ Program using inheritance and polymorphism.

Outcomes:

- Skill to write C++ application programs using OOP principles and proper program structuring.
- Ability to create programs implementing the concepts of Object Oriented programming.

UNIT I

Introduction to Object Oriented Programming: Software Evolution – OOP paradigm – Concepts, Benefits - Comparison to other programming paradigms -Object Oriented Languages – Applications of Object Oriented Programming.

UNIT –II

Introduction to of C++ language – Origin of C++ - Advancement over C - Tokens, keywords, Identifiers, Data Types, Variables - Expressions and control structures. Functions: Library functions - numeric functions – string functions - User defined functions: function prototyping – function definition - call by value - call by reference - function overloading - friend and inline functions.

UNIT III

Classes and Objects – General structure of a class: member variables, member functions, access specifiers- Constructors and Destructors – Abstract class – Nested classes -Operator Overloading – Type Conversions.

UNIT IV

Inheritance – Definition – Types - Single Inheritance – Multilevel Inheritance - Multiple Inheritance – Hierarchical, Hybrid Inheritance – Pointers – Virtual Functions - Console I/O Operations.

UNIT V

Files – Classes for File Stream Operations – File pointers - Opening and Closing files – Read and write operations – End of file detection – Updating a file – Error handling during file operations – Templates – Exception handling.

TEXT BOOK

1. E.Balaguruswamy, “Object Oriented Programming with C++”, 7th edition, Tata McGraw Hill, 2017.
2. Deitel and Deitel, “ C++ How to program”, 9th edition, Prentice Hall, 2014.

REFERENCE BOOKS

1**)** Yeswant Kanetkar , “Let us C++”, 2nd edition, BPB Publications, 2003.

2) Robert Lafore , “Object Oriented Programming in C++”, 4th edition, Pearson, 2008.

3) Herbert Schilt, “C++ - The Complete Reference”, 4th edition, Tata McGrawhill, Pub-ltd., 2017.

4) John R.Hubbard , “Programming with C++”, 3rd edition, Schaum’s Outline Series, McGraw Hill, 2017.

PRACTICAL III

CSIG 233 C++ LAB

1. Programs using decision and looping statements
2. Program using single, multidimensional arrays
3. Usage of library functions
4. Programs using user defined functions
5. Programs for function overloading
6. Usage of classes and objects
7. Constructors and Destructors
8. Programs for all inheritance types
9. Programs using pointers
10. Programs for operator overloading
11. Implementation of Virtual Functions, friend functions, this pointer and static functions
12. File manipulation operations with clear formatting
13. Programs using command line arguments
14. Implementing CPU scheduling algorithms in C++

CSIG 241 OPERATING SYSTEM AND SYSTEM SOFTWARE

Pre-requisite: Knowledge of computers & computer organization

Objectives:

- To learn OS management functions.
- To learn Memory management, Processor management, Device Management and I/O Management
- To learn various basic system software.

Outcomes:

- Understand how memory is utilized.
- Understand CPU scheduling algorithms to manage tasks.
- Knowledge of methods in prevention and recovery from a system deadlock, andmanagement of I/O devices.
- Knowledge of functions of system software.

UNIT I

Introduction - Early Operating Systems – Buffering & Spooling – Multiprogramming – Time Sharing – Protection – Operating System Structures.

Process Management: Process Concept – Hierarchy of Process – Critical Section Problem – Semaphores – Process Coordination Problems – Inter Process Communication

UNIT II

CPU Scheduling: Scheduling Concepts – Scheduling Algorithms – Algorithm Evaluation – Multiple Processor Scheduling

Deadlock: Deadlock Problem: Characterization – Prevention – Avoidance – Detection – Recovery – Combined Approach to Deadlock Handling.

UNIT III

Memory Management: Introduction – Multiple Partition – Paging – Segmentation – Segmentation with Paging – Virtual Memory Concept – Overlays – Demand Paging and Performance – Page Replacement Algorithms – Allocation Algorithms – Trashing.

UNIT IV

Secondary Storage Management: Physical Characteristics – Disk Scheduling – Disk Scheduling Algorithms – Sector Queuing **File Systems:** File Operations – Access methods – Allocation Methods – Directory Systems – File Protection -Implementation **Case Study:** Windows XP Operating Systems.

UNIT V

System Software: Assemblers- Design-functions- Interpreters- Virtual machine concept- Byte codes- Loaders-features-relocation- Linkers – dynamic linking-Macro processor Compilers-Phases

TEXT BOOKS

1. Abraham Silberschatz, Peter Baer Galvin & Greg Gagne, "Operating System Concepts", 7th edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2005.
2. John J Donovan, "Systems Programming", Tata McGraw Hill, 2004.

REFERENCES

1. William Stallings, “Operating Systems Internals and Design Principles”, 4th edition, PHI India, 2005.
2. H.M. Deitel, “Operating Systems”, 2nd edition, Addison-Wesley.

CSIG242 INTRODUCTION TO DATABASE CONCEPTS

Prerequisite: Knowledge of data structures and file-handling

Objectives:

- To learn the fundamental concepts of Database management systems.
- To learn SQL commands to manage data and PL/SQL.

Outcomes:

- Understand data modeling and database development process.
- Construct and normalize conceptual data models.
- Implement a relational database into a database management system.
- Become proficient in using database query language.

UNIT I

Introduction - DBMS Basic Concepts - Purpose of Database Systems – Database System Vs File system - Overall System architecture – DBA– Database Languages – Classifications – Data Models.

UNIT II

Entity relationship model: Basic concepts- Mapping constraints – Primary Keys – Foreign Keys –Structural Constraints. – ER notations - ER model examples – Enhanced Entity Relationship Model: EER Concepts like Generalization, Specialization, Union, Category, Disjoint, Overlapping etc. EER model examples

UNIT III

Relational DataBase Design – ER to Relational Mapping - Relational Model: Structure – Formal Query Languages – Relational Algebra – Informal Design Guidelines - Referential Integrity– Functional Dependencies – Normalization (I, II & III Third Normal Form)

UNIT IV

Relational algebra: Introduction, Fundamental Operations - Set operations- Natural Join, Division- Operators for grouping and ungrouping, relational comparison.

SQL – Basics of SQL –DDL – DML – DCL – TCL Commands in detail with examples - PL/SQL: Stored Procedure Concepts – Procedure – Functions – Cursors – Triggers- Creating & Manipulating views

UNIT V

Storage and File Structure- - File Organization - Overview of Physical Storage - Organization of Records in Files - Media - Data-Dictionary Storage - Magnetic Disks – RAID - Indexing and Hashing- Ordered Indices - Static Hashing - Dynamic Hashing.

Transaction Concepts – ACID Properties – Concurrent Executions – Basic Concepts of locking and Log Based Recovery.

TEXT BOOK

1. Abraham Silberschatz,Henry F. Korth, S. Sudarshan,"Database system concepts",6th edition, McGraw Hill Publication, 2011.

REFERENCE BOOK

1. Ramez Elmasri and B. Navathe , "Fundamentals of Database Systems", (Chapters 1, 2, 3, 4.1, 7, 8, 9, 14),7th edition, Addison-Wesley, 2012.

PRACTICAL IV

CSIG 243: DBMS LAB

1. Study of Oracle DDL commands
    a. To create a table
    b. To alter a table
    c. To drop a table
    d. To create a view
    e. To drop a view

2. Study of Oracle DML commands
    a. To insert, delete and update rows into a table
    b. To write a simple queries using SELECT
    c. To write queries using SELECT and WHERE clause
    d. To write queries using Logical operators
    e. To write queries using NULL
    f. To write queries using NVL function
    g. To write queries for pattern matching
    h. To write queries using order by clause
    i. To write queries using Distinct clause
    j. To write queries using Arithmetic Expressions
    k. To write queries using Arithmetic function
    l. To write queries using group function
    m. To write queries using Group By clause
    n. To write queries using Having clause
    o. To write queries using Character function
    p. To write queries using Date function
    q. To write queries using Sub queries
    r. To write queries using join

3. Program to learn Oracle DCL and TCL commands

4 Program to learn PL / SQL
    a. To create a cursor and trigger and work on that
    b. To create PL/ SQL code for expression
    c. To create PL/SQL code using control statement
    d. To create PL/SQL code using sub programs

CSIG 351 EVENT DRIVEN PROGRAMMING

Pre-requisite: Knowledge of any programming language

Objectives:

- To introduce the concepts of Event Driven Programming.
- To help the students to find solution to real life problems using Visual Basic.
- Students will learn about connecting and accessing databases.

Outcomes:

- Understand Forms, module, components, menu editor and its concepts. Usage of controls such as text box, buttons, checkbox etc. and control them through codes.
- Ability to develop simple project with database using data source.

UNIT I

Various programming methods: Introduction – Comparison. Event driven programming Concepts: Events – User defined – System defined – Keyboard Events – Mouse Events. Introduction to Visual Basic Language – Variables – Constants – Data Types – Scope – Conditional Statements – Looping - Declaring Arrays – Dynamic Arrays.

UNIT II

Introduction to Various GUI controls: Labels - Text Boxes – Command Buttons – List – Combo Boxes – Image and Picture Boxes. Scroll Bars – Option Buttons – Check Boxes – Frames – Form Properties – Timer Controls – Dialog boxes- Inbuilt functions: string, date and time and numeric.

UNIT III

Functions and procedures- Managing Forms – SDI and MDI - Control Arrays – Adding Multiple Forms – Startup Forms. Menu Management : Adding Menus – Access Keys – Separators – Disabling Menus .

UNIT IV

Rich Text Boxes : Alignment – Clipboard Operations – Font Manipulations – Search and Replace – Printing from a Rich Text.– Drive List – Directory List - File List Boxes – File Handling Techniques - Windows Common Dialog Controls.

UNIT V

Database Handling Techniques – DAO – RDO and ADO introduction – Data Controls – Database Operations: Adding – Deleting – Modifying – Retrieving Records - Case Study of database application development using ODBC.

TEXT BOOKS

1. Steven Holzner, “Visual Basic 6 Programming : Black Book”, Dreamtech Press, 2007.
2. Gary Cornell,“Visual Basic 6 from the Ground Up”, McGraw Hill Professional, 2017.

ONLINE RESOURCES

1. http://msdn.microsoft.com/en-us/vstudio/hh388573.aspx
2. http://visualbasic.freetutes.com/
3. http://www.learnerstv.com/Free-Computer-Science-Video-lectures-ltv556-Page1.htm

CSIG 352 SYSTEM ANALYSIS AND DESIGN

Pre-requisite: Basic knowledge of programming

Objectives:

- To gain knowledge about software development life cycle models, software design, implementation, and testing of software.
- To gain overall knowledge of how software is developed.

Outcomes:

- Understanding of various methods or models for developing a software product.
- Ability to analyze existing system to gather requirements for proposed system.
- Skill to design and code a software.

UNIT 1

People : Organisational Analysis- concepts of systems and subsystems- Management structures - including matrix techniques- Socio-technological analysis-MIS concepts- Workflow considerations Technology and Processes: Business process analysis- Information, data, and communications- Legacy systems- Network analysis- Software quality analysis- System Life Cycles: Life cycle models - descriptions of stages- Impact of changes on different life-cycle models- deliverables at each stage

UNIT II

Feasibility studies: Requirements analysis- Data Analysis - reality/data/metadata- Project proposals- Requirements grading- User interface requirements

UNIT III

Hard methodologies: structured (SSADM)- object oriented (Unified Process)- Soft systems methodologies (Soft Systems Methodology)- Hybrid approaches (Multiview)- Rapid Application Development (DSDM).

UNIT IV

Structured techniques: data (entity-relationship diagram or logical data structure)- process (data flow diagram) and time (entity life history) models- Object oriented techniques: UML analysis models such as use cases, analysis class diagram.

UNIT V

Walkthrough approaches: Steering groups- User groups- Project boards- Quality assurance techniques- Standards Structured English description methods: Organisation charts- Discussion records- Feasibility Study report- Requirements Specification.

TEXT BOOKS

1. Avison, D.E. & Fitzgerald, G. "Information Systems Development: Methodologies, Techniques and Tools", 4th edition, McGraw-Hill.
2. Bennett, S., McRobb, S. & Farmer, R., "Object-Oriented Systems Analysis and Design Using UML", 3rd edition, McGraw-Hill, 2006.

REFERENCE BOOKS

1. Roger. S. Pressman, "Software Engineering: A Practitioner's Approach" 7th edition, McGraw-Hill, 2014.

CSIG 353 COMPUTER NETWORKS

Pre-requisite: Basic Knowledge of Computers

Objectives:

- To educate the functions of various OSI layers in detail.

Outcomes:

- Knowledge of OSI Layers in Computer Network.
- Ability to identify transmission media, types and topologies of network.
- Familiarization with the techniques of error detection and congestion control

UNIT I

Introduction to Computer Networks- Communication basics – Topology – Uses: Business - Home - Mobile - Social – Network Types: Personal Area Networks – Local Area Networks – Metropolitan Area Networks – Wide Area Networks – Internetworks – The OSI Reference Model-TCP/IP reference model.

UNIT II

The Physical Layer: Transmission Media – Wireless Communication – The Mobile Telephone System – Wireless LANS – Bluetooth - RFID.

UNIT III

Data Link Layer: Services – Framing – Error Detection and Correction - Medium Access Control – CSMA/CD.

UNIT IV

Network Layer: Routing Algorithms – Congestion Control Algorithms – Quality of Service. Internetworking - IPv4 - IPv6.

UNIT V

Transport layer: Services- TCP and UDP. Application layer: Domain Name Systems – Electronic Mail- World Wide Web – HTTP.

TEXT BOOKS

1. Andrew S. Tanenbaum,"Computer Networks", 5th edition, Prentice Hall, 2011.

REFERENCES

1. Behuouz A. Forouzan, "Data Communication & Networking ", 4th edition, McGraw-Hill.
2. William Stallings, "Data and Computer communications",7th edition,PHI.

PRACTICAL V

CSIG 354 VB LAB

1. Working with standard controls
2. Design an application with image box, picture box, list box and combo box
3. Design an application with menu options, procedures and functions
4. Design an application with Common Dialog box
5. Design an application using FileListBox
6. Design a simple arithmetic calculator
7. Design a database application using data controls
8. Write a menu driven program to create a ADO database and perform the operations of insertion, modification, deletion and viewing
9. Design an employee payroll system

CSIG 361JAVA PROGRAMMING

Prerequisite: Basic knowledge of programming

Objectives:

- To learn the basic concepts of Java
- To develop Java programs, Swing and Applets

Outcomes:

- Skill to write Java application programs using OOP principles and proper program structuring.
- Ability to create packages and interfaces.
- Ability to implement error handling techniques using exception handling.

UNIT I

Java Evolution: History – Java features – Java Environment – JDK. Introduction to Java program – Creating and Executing a Java program – Java Tokens – Java Statements - Virtual Machine (JVM) – Command Line Arguments – Comments in Java program. Constants, Variables and Data Types – Operators and Expression – Decision Making, Branching and Looping – Arrays, Strings and Vector.

UNIT II

Class and objects and Methods – Constructors – Method overloading – Static members – Nesting of Methods– this keyword – command line input Inheritance: Defining a subclass – deriving a sub class – Single Inheritance – Multilevel Inheritance – Hierarchical Inheritance – Overriding methods – Final variables and methods – Final classes – Finalizer methods - Abstract methods and classes – Visibility Control. Interfaces: Multiple Inheritance. Packages: System Packages – User Defined packages.

UNIT III

Multithreading: Creating Threads – Life of a Thread – Defining & Running Thread – Thread Methods – Thread Priority – Synchronization – Implementing runnable interface – Thread Scheduling. Exception Handling: Advantages of Exception Handling - Types of Errors – Basics of Exception Handling – try blocks – throwing an exception – catching an exception – finally statement. Managing I/O Files

UNIT IV

Applets Programming - Graphics Programming: Drawing and filling lines – Rectangles – Polygon – Circles – Arcs – Line Graphs – Drawing Bar charts. **AWT Components and Event Handlers:** Abstract window tool kit – Event Handlers –Event Listeners – AWT Controls and Event Handling: Labels – Text Component –Action Event – Buttons – Checkboxes – Item Event - Choice – Scrollbars – Layout Managers- Input Events – Menus

UNIT V

JDBC: JDBC – ODBC Drivers – JDBC ODBC Bridges – Seven Steps to JDBC –Importing java SQL Packages – Loading & Registering the drivers – Establishing connection. Creating &executing the statement.

TEXT BOOK

1. E.Balagurusamy, “Programming with Java”, 2nd Edition, Tata McGraw-Hill publishing company Ltd.

REFERENCES

1. Herbert Schildt,“JAVA 2 (The Complete Reference)”, 4th Edition, TMH, Fifth Reprint, BPB Publications, 2002.
2. Cay S. Horstmann, “Core Java: Volume II-Advanced features”, 11th edition, McGraw Hill, 2019.
3. Ken Arnold, James Gosling, “Java Programming Language”, Addison Wesley.

CSIG 362 WEB TECHNOLOGY

Pre-requisite: Knowledge of Operating system, computer network, DBMS, and Java.
Objectives:

- To gain knowledge in HTML and DHTML.
- To design interactive web pages using Style sheets, Java-script and ASP.

Outcomes:

- Understand the various steps in designing Creative and dynamic website.
- Ability to write HTML, JavaScript and ASP.

UNIT I

Introduction to Internet – The World Wide Web – Web Browsers, Web Servers, Uniform Resource locators, Multipurpose Internet mail extensions. HTTP Request Message - HTTP Response Message.

UNIT II

Introduction to HTML – Elementary tags in HTML – List in HTML – Displaying Text in Lists – Using Ordered List – Using Unordered Lists- HTML Description Lists - Nested HTML Lists, Control List – Combining List Types – Graphics and Image Formats – Graphics and HTML document- image and hyperlink anchors – Image maps – Tables – Frames – Forms.

UNIT III

Introduction to DHTML – Introduction to style sheets – Setting the default style sheet language – Inline style information – External Style sheets – Cascading Style sheets.

UNIT IV

Introduction to Java script - script tag, interactive data, DOM, A simple document, Add a form, Add a text input element, Add a button element, properties, methods and event handlers. Scripts and HTML.

UNIT V

Introduction to ASP – Database Management with ASP: Database access with ADO, working with ADO's Connection object, Using Command objects, Working with ADO's Recordset Object.

TEXT BOOKS

1. Robert W. Sebesta, "Programming the World Wide Web", (Chapter 1 only),Addison Wesley, 2011.
2. Elisabeth Freeman and Eric Freeman, " Head First HTML with CSS & XHTML (Head First",O'Reilly, 2005.
3. A.Russell Jones, "Active Server Pages 3", BPB Publications, 2000
4. Danny Goodman, "JavaScript Bible", 7th edition, Wiley Publishing Inc, (Chapters 6,7 only), 2010.

PRACTICAL VI
CSIG 363 WEB TECHNOLOGY LAB

1. Usage of Simple HTML commands, Graphics and image formats and hyperlinks
2. Usage of Tables, Frames, Forms, Background Graphics and Color
3. Simple application using HTML
4. Simple application using DHTML and Cascading style sheet
5. Simple application using Java script
6. Simple application using ASP (Any Application Of Student's Choice)

SCHOOL OF LAW

PONDICHERRY UNIVERSITY

MASTER OF LAWS (LL.M.)

2-YEAR REGULAR PROGRAMME (4-SEMESTER PATTERN)

CHOICE-BASED CREDIT SYSTEM (CBCS)

REGULATIONS AND SYLLABUS

(2023-2024 ONWARDS)

I SEMESTER

COURSE 1

INDIAN CONSTITUTIONAL LAW: NEW CHALLENGES

LLM **4 Credits**

Course Objectives

- To understand the constitutional interpretation involves a technique of adapting the law to meet changing social mores.
- To understand new trends is essential for a meaningful understanding of the legal system and processes.

Course Modules

Module I – Federalism and the Democratic process

Allocation and share of resources – Distribution of grants – in – aid – The inter-state dispute on resources – Centre's responsibility and internal disturbance within states – Directives of the Centre to the State under Article 356 and 365 – Federal comity – Relationship of trust and faith between Centre and state- Electoral Reforms - Election Commission and its role in democratic process, Coalition Government- stability and durability, Grass root Democracy and its implementation

Module II – Separation of Power and Rule of Law

Doctrine of Separation of Powers and checks and balances - Constitutional framework - Judicial interpretation and practice, Judicial Activism, Judicial Restraint and Judicial independence - PIL: Implementation, Judicial autonomy and independence, accountability of Executive, Legislature and Judiciary, Appointment and Removal of Judges

Module – III The State, Rights, Remedies and Freedoms

Need for widening the definition in the wake of Liberalization – Right to equality- Privatization and impact on affirmative action – Empowerment of women. Freedom of press and challenges of new scientific development – freedom of speech and right to broadcast and telecast, Freedom of speech and expression, Right to broadcast and telecast, Impact of Information Technology Act, 2000, Right to strikes, hartal and bandh

Module – IV Emerging regime of new rights and remedies

Reading Directive Principles and Fundamental Rights into Fundamental Duties- Compensation jurisprudence – Right to Education – commercialization of Education and its impact – Right of Minorities to establish and administer Educational institutions and state control.

Module – V Indian Constitution: **Issues and challenges**

Good Governance – Judicial Governance, Issues in implementation- Balancing rights in judicial governance, Pendency of Cases, Challenges to Indian Democracy – Illiteracy- Poverty- Gender Discrimination - Role of Media and Press - Right to Privacy - Casteism, Communalism, Religious Fundamentalism – Corruption – Criminalization of Politics – Political Violence – Secularism and Religious Fanaticism

Learning Outcomes

In the successful completion of this course the student will reach out the following

- To analyze the role of Indian Constitution in transforming governance of social, economic and political justice.
- To understand the interrelationship in the golden triangle of Fundamental Rights, Directive Principles of State Policy and the Preamble.
- Understand the constitutional perspective of positive law and constitutional morality, the privileges of parliamentarian, and the procedure of amendments.
- To appreciate as to how the Indian Constitution has passed the test of time and provides the foundation for the effective functioning of Indian democracy and its polity.

Suggested readings

1. D.D.Basu, Commentary on the Constitution of India Lexis Nexis Butterworths, Wadhwa, Nagpur (2009)
2. M. P. Jain- Indian Constitutional Law- (Lexis Nexis2014)
3. H.M.Seervai, Constitutional Law of India, Vol.1-3,Universal Law Publishing - An imprint of LexisNexis; 4th edition (2015)
4. M.P.Singh (ed.), V.N.Shukla's Constitution of India (EBC, Lucknow,2017)
5. Constituent Assembly Debates Vol. 1 to 12 (1989)
6. Mahendra P. Singh, V. N. Shukla's Constitution of India (11th ed., 2008)
7. D.D.Basu, Commentary on the Constitution of India, Lexis Nexis, 9th Edition 2014
8. M.P.Jain Revised by Justice JastiChelameswar and Justice Dama Seshadri Naidu, Indian Constitutional Law, Lexis Nexis, 8th Edition 2018

I SEMESTER

COURSE 2

LAW AND JUSTICE IN A GLOBALISING WORLD

LLM **4 Credits**

Course Objectives:

This course is intended to familiarise postgraduate students with (a) select schools of legal theory and the rationales behind them; (b) multiple strata at which law, justice and society intersect; (c) the process of globalisation; and (d) the implications of globalisation on law and legal theory.

Course Modules:

Module I:

Fundamentals of Jurisprudence: Divine Law; Natural Law; Empiricist Philosophy and its Connection with Natural Science; Classical Positivism Modern Positivism – The Impact of HLA Hart; Judicial Thinking as a Consequence of Socialisation – Pound, Holmes, Cardozo; The Marxist View of Law

Module II:

What is Globalisation; Globalisation in Our Everyday Lives; Cultural, Economic, Social, Political Dimensions of Globalisation

Module III:

Law and Justice – An Overview; Theories of Justice; Dimensions of Justice; Plato's Concept of Justice; Aristotle's Concept of Justice; Distributive Justice and its Connection with Law; Modern Conceptions of Distributive Justice – A Comparison of Nozick and Rawls; Indian Judicial Thinking in the Light of Realist School: Judicial Activism; Public Interest Litigation; Judicial Lawmaking

Module IV:

The Impact of Globalisation on Law and Justice:Globalisation and Law; Transforming Notions of Sovereignty; Transforming Notions of Justice; Transforming Notions of Entitlement and Community Ownership, Community Rights, and Globalisation

Module V:

Law as the traditions and culture – Criticism and evaluation in the light of colonization and the introduction of common law system and institutions in India and its impact on further development of law and legal institutions in India; Need for social transformation; Non-legal strategies for social transformation (Gandhism, Sarvodhaya, Marxist etc.)

Caste as a 'divisive factor'; Regionalism as a 'divisive factor';

Gender injustice and its forms; Empowerment of women; Constitutional and legal provisions; Feminism;

Reform of court processes; Criminal law – Plea bargaining, compounding and payment of compensation to victims; Civil law–Concept of ADR, Mediation, conciliation and Lok Adalats

Social transformation in rural and urban societies of India – Local self-governments (Panchayats and Municipalities) and their contribution to social change; Impact of MGNREGA, BharathNirman, NRHM, JNNURM, Infrastructure project, Educationalprogrammes.

Learning Outcomes:

After undergoing the study, the student will be able to understand the following:

- To understand various perspectives of globalisation.
- To understand various perspectives of justice.
- To understand various perspectives of law and social change in India.

Suggested readings:

i. Marc Galanter (ed.) - Law and Society in Modern India (1957), Oxford.

ii. Robert Lingat - The Classical Law of India (1998), Oxford.

iii. U. Baxi - The Crisis of the Indian Legal System (1982), Vikas, New Delhi.

iv. U. Baxi (ed.) - Law and Poverty: Critical Essays (1988), Tripathi,Bombay.

v. H.M. Seervai - Constitutional Law of India (1996)

vi. D.D. Basu - Shorter Constitution of India (1996), Prentice Hall of India (P) Ltd,.

vii. Indian Law Institute - Law and Social Change: Indo – American Reflections,

viii. Ishwara Bhatt- Law and Social Transformation.

ix. Gandhi,J S, Ed.,Law and Social Change, Rawat Publications, Jaipur,1989.

x. Singh, S N, Law and social change: Essays on labour laws and welfare, Research methodology and environmental protection, P G Krishnan Memorial Foundation, Delhi,1990.

xi. Roach Anleu, Sharyn L, Law and Social Change, Sage Publications, London,2000.

II SEMESTER

COURSE 1

JUDICIAL PROCESS

LLM **4 Credits**

Course Objectives:

The Constitution, a living document is said to be always in the making. The judicial process of constitutional interpretation involves a technique of adapting the law to meet changing social mores. This course aims to study the nature of judicial process and the role of the judges as policy makers and as the participants in evolving political principles of governance in the comparative aspects. Another objective of this course is the study comparative view of how the Judiciary manages itself for its effective productive results.

Course Modules:

Module I: Nature of judicial process; Judicial process as an instrument of social ordering; Introduction Constitutional scheme and practice; Rule of law and its importance; Independence of judiciary; separation of powers and checks and balances; role and status of judiciary (Constitutional courts) in a democracy; jurisdiction and powers of the court; structure of judicial system in India; Alternative adjudication; NyayaPanchayats; Gram Nyayalayas Act,2008.

Module II: Nature of judicial process Methods of judicial interpretation; Legislative intent; rule making powers of the court; judges as legislators versus 'law declared' the Supreme Court of India; Constitutional provisions for judicial review; power to review; extra constitutional means and powers.

Module III: Management Selection and appointment of judges; transfer of judges; manpower planning; Judicial impact Assignment; Mounting arrears and the reasons; work load; patterns of court management; Major recommendations by the Law Commission of India; Use of Information and Communication Technology by courts, its problems and solutions; training of judges; role of national and state judicial academies.

Module IV: Process Interpretative techniques; judicial doctrines as tools of interpretation; Due process of law; procedure established by law; judicial discretion in judicial reasoning; judicial review; Judicial activism; self restraint; public interest litigation;*ratio decidendi*;*obiter dicta;* precedent;*stare*

decisis; prospective overruling; basic structure; colourable legislation; harmonious construction; jurimetrics; territorial nexus and the like compensatory jurisprudence Judicial creativity *vis-a-vis* the Constitution.

Module V: Judicial accountability; constitutional schem; subordinate judges; removal; disclosure of assets and liabilities; contemporary challenges to check judicial power of the courts and judges; transparency; Contempt power and issues relating to the exercise of contempt power; The judge as legislator; conscious and sub conscious elements in the judicial; process social philosophy of the judges and its impact on judicial divisions; committed judiciary.

Learning Outcomes:

After undergoing the study, the student will be able to understand the following:

- Nature of Judicial Process and its techniques.
- Role of Judges as Policy makers and as participants in evolving political principles of governance.
- Comparative aspects of Judicial Management and Administration.
- Legal progression and creativity through legal reasoning under statutory and codified systems.

Suggested readings:

i. Benjamin N. Cardozo, The Nature of Judicial Process, Universal LawPublishing.

ii. Henry J. Abraham – the Judicial Process (1998),Oxford.

iii. Julius Stone – The Province and Function of Law (2000), Universal LawPublishing.

iv. UpendraBaxi – the Indian Supreme Court and Politics (1980), Eastern BookCo.

v. Rupert Cross and J. W. Harris – Precedent in English Law, ClarendonPress.

vi. AbhinavChandrachud, Due Process of Law, Eastern BookCo.

vii. G. P. Tripathy, Judicial Process: Legal Aid and LokAdalats, CentralLaw Publications.

viii. S. P. Sathe, Judicial Activism in India, Oxford India Paper back.

ix. A. Lakshminath, Precedent in Indian Law, Eastern Book Co.,Lucknow.

II SEMESTER

COURSE 2

RESEARCH METHODS AND LEGAL WRITING

LLM **4 Credits**

Course Objectives

- To study the meaning, scope and significance of research
- To study various methods of research and methodology
- To acquaint the students with the use of empirical research methods and to encourage them to use such empirical methods in legal research
- To train them in proper legal writing and foot noting, editing etc.

Course Modules

Module I – Introduction to Research Methods

Research: Meaning, Objectives and Scope -Research Methods vis-à-vis Research Methodology Scientific Method – Meaning and Significance - Legal Research: Meaning, Scope and purpose - Law and Society and Law in Society

Module II – Types of Research

Kinds: Doctrinal and Non-Doctrinal (empirical); Field research and Laboratory research - Analytical and Descriptive - Participatory and Non-Participatory - Comparative, Historical Critical, Socio-Legal; Mono Disciplinary and Inter-Disciplinary (Multi-Disciplinary) - Quantitative and Qualitative - One time and Longitudinal - Social Sciences and Legal Research – Similarities and Differences. Legal Research for Professional Service - Legal Research in Absence of Law and for Scholarship - Legal Research for Law Reforms.

Module III - Research Design

Steps in Research: Research Process - Research Problem: Identification and Formulation – Hypothesis - Use of Library, Use of Modern Technology/Computer Assisted Research - Tools and Techniques for Collection of Data - Literature Review - Observation Method – Questionnaire - Interview - Case study. Sampling –Jurimetrics -

Compilation/Collating, Analysis and Interpretation of Data - Use of Deductive and Inductive Methods in Research - Preparation of Research Report and Writing of Research Report - Budgeting of Research

Module IV – Empirical Legal Research

Empirical Research - Research Design - Measurement: Measuring concepts, evaluation Measures and Measurement Methods - Collecting Data - Coding Data – Analyses and Interpretation: Analyzing Data - Summarizing Data – Variables - Tools for Summarizing Variables - Statistical Inference - The Logic of Statistical Inference - Confidence Intervals - Hypothesis Testing - Cross-Tabulation and Tests for Tables - Regression Analysis – Lines and Linear Relationships – Statistical Inference – Introduction to SPSS.

Module V – Legal Writing

Synopsis writing - Title, Research Question, Identifying Relevant Areas of Law - Identifying Literature including Case Laws, Analysis, Discussion - Recommendation and Conclusion - Bibliography: Organisation of Legal and Other Materials - Writing of Research Proposal -Writing of dissertation/thesis - Academic/Scholarly Writing - Publication of Reviews, Articles, Books etc. - Reference, Footnoting and Citation Formats -Editing and Proofreading - Ethical and legal Issues: Plagiarism and Copyright Violation.

Learning Outcomes

On successful completion of this course, the students will be able to:

- Demonstrate an understanding on the evolutionary principles relating to intellectual property law.
- Demonstrate a foundation International and National perspectives on Intellectual Property.
- Analyze the significance of Intellectual Property Jurisprudence.
- Understand and interpret the vary forms territorial aspects of Intellectual Property.

Suggested Reading

1. S.K. Verma and M. AfzalWani, Legal Research and Methodology, (2nd Ed. 2001, Reprint 2006), Indian Law Institute, NewDelhi.
2. Bikram Kumar Das, Legal Education and Research Methodology (2012)
3. C R Kothari, Research Methodology: Methods and Techniques – (2014)
4. D R Kapoor, Research Methodology: Methods and Techniques – (2013)
5. Ranjit Kumar, Research Methodology: A Step-by-step Guide for Beginners – 2013 (2013)
6. Berelson B: Content Analysis in Communication Research.
7. Beveridge WIR-Art of Scientific investigation.
8. Black & Champion-Research Methodology.
9. C. M. Coroll and Frederic Coroll: Methods of Sociological Research.
10. Campbell, Fox Kentey-Students guide to Legal writing.

IV SEMESTER

COURSE 3

DISSERTATION

LLM **8 Credits**

I. STYLE AND FORMATTING:

The dissertation should be the original work of the student. It should be clearly typed, with

- Font style- Times NewRoman,
- Font size-12,
- Headings-14,
- Line spacing- 1.5 line spacing on single side of paper
- Alignment-Justified,
- Citation format- ILI citation style
- Hardbound in White with black letterings
- The Dissertation shall contain a Certificate from the Guide assigned.
- The Dissertation shall contain a declaration by the student *qua* its originality.
- The word limit for the body of the Dissertation (excluding the title, acknowledgments, abbreviations, bibliography, etc.) shall be approximately 100 – 120pages.

II. WRITING A DISSERTATION:

For consistency, students are supposed to conform to the format approved by School of Law, Pondicherry University as follows:

i. COVER PAGE ANDSPINE:

The final copy of the thesis/dissertation must be hardbound in white with black. As for the cover, the title of the dissertation, author's name, name of institution, and year of submission must be printed in uppercase with font size of 14 pitch in Arial, and centrally aligned. The words in title must be arranged in the inverted pyramid shape.

As for the spine, the title of the thesis/dissertation, author's name, the Degree for which the thesis is submitted, and the year in upper case to be printed on the spine. If the title of the thesis cannot fit the space in the spine, smaller font is allowed.

The Cover Page of the Dissertation must contain the following

- Title of the Dissertation (as approved)
- Name of the Student, Registration No.
- Name of the Guide (with proper Designation)
- Name of the University and place with logo of the University
- Month and Year of Submission

ii. TITLEPAGE:

Same as Point No. i (above)

iii. CONTENTS:

Certificate
Declaration
Acknowledgment
List of Statutes
List of Cases
List of Abbreviations
Introduction
a. Scope of work and objectives
b. Research questions
c. Hypothesis
d. Review of literature
e. Limitations
f. Chapterisation
g. Conclusion & Suggestions
h. Bibliography

iv. BIBLIOGRAPHY:

There must be a Bibliography at the end. A Bibliography is a list of readings, ordinarily those which were used in writing the project assignment. However, there is no restriction as such to provide readings that were not used in writing the project. The Bibliography may be arranged with clear classification of various types of materials used in writing the project (E.g., primary, secondary, or documents and reports, books, articles, newspapers, etc.). There is nothing wrong if classification is not attempted at, but the references must be arranged in ALPHABETICAL order, and chronological order, if there are more titles of the same author.

III. PROGRESS REPORT

The students must submit a monthly Progress Report stating the details of the work progress and they are also supposed to meet once a week with the supervisors assigned.

IV. PRESENTATION ANDVIVA:

It is mandatory to present the dissertation with the help of Power Point presentation during the viva- voce.

SPECIALISATION ONE

CRIMINAL JUSTICE AND HUMAN RIGHTS

I SEMESTER

COURSE 3

GENERAL PRINCIPLES OF CRIMINAL JURISPRUDENCE

LLM **4 Credits**

Course Objectives:

Criminal Justice refers to the agencies of government charged with enforcing law, adjudicating crime, and correcting criminal conduct. The criminal justice system is essentially an instrument of social control: society considers some behaviour so dangerous and destructive that it either strictly controls their occurrence or outlaws them outright. It is the job of the agencies of justice to prevent these behaviours by apprehending and punishing transgressors or deterring their future occurrence. Although society maintains other forms of social control, such as the family, school, and church, they are designed to deal with moral, not legal, misbehaviour. Only the criminal justice system has the power to control crime and punish criminals. The central purpose of the Criminal Justice System is to deliver an efficient, effective, accountable and fair justice process for the public.

Course Modules:

Module I: Essential elements of a crime; Stages in the commission of crime; Exceptions to the rule of mens rea- strict liability; Principle of Legality-*Nulla Poena Sine Lege and nullum crimen sine lege*; Other Principles of liability: *the presumption of innocence; Burden of proof; Right against self-incrimination; right against Double jeopardy*.

Module II: General Principles of Joint and Constructive liability, common intention and Unlawful Assembly; General Principles of Abetment, Criminal Conspiracy and attempt under Indian Penal Code, 1860; Jurisdiction and challenges in International criminal law.

Module III: ***Trial Processes*-**Taking Cognizance by courts and committal proceedings – Hierarchy of Criminal Courts and types of trials; Framing of Charge and Discharge Proceedings; Acquittal or Conviction – Revision, Appeal and transfer of case for trial

Module IV: Concept, definition, nature, forms and purposes of punishments, Different Punishments under Indian Legal System; Capital Punishment: Constitutionality, Judicial Attitude and Law Reforms; Sentencing process – Process and Policies in India; Mitigating & Extenuating circumstances in the decision making of sentence , Plea Bargaining, Compounding of offences

Module V: Operation of section 6 of Indian Penal Code, 1860 and Chapter IV of Indian Penal Code, 1860; Excusable Acts; A mistake of Fact under section 76 and 79; Accident under Section 80;

Infancy – Section 82 and 83; Insanity – Section 84; Intoxication – Section 85 and 86; Justifiable Act: An act of Judge and Act performed in pursuance of an order under Section 77 and 78; Consent under Section 87 – 89 and Section 90 and 92;Communication under Section 93; Duress under Section 94;Trifles under Section 95;Private Defence under Section 96 – 106; Burden of Proof under Indian evidence Act, 1872: sections 101 to 117.

Learning Outcomes:

After undergoing the study, the student will be able to understand the following:

- To understand the jurisprudential basis of crime, criminal justice system and administration in India
- To acquire an understanding on correctional system and alternatives to imprisonment within the realm of criminal justice administration.
- To understand the role played by different functionaries in the criminal justice administration to meet the challenges of the modern India.
- The need for reforms and new challenges in the wake of growing importance and realisation of victim's rights and necessity to involve all the stakeholders for ensuring justice to all.

Suggestive readings:

i. Edwin H. Sutherland, Donald R. Cressey, David F. Luckenbill, AltaMira Press, 01-Jan-1992.

ii. Ahmed Siddiqui, Criminology: Problems and Perspectives, 4 l Edition, Eastern Book Co. Lucknow 2014.

iii. Van Ness, Daniel W., and Karen Heetderks Strong. Restoring justice: An introduction to restorative justice. Routledge, 2014.

iv. Ahmad, Dr. "A Brief Analysis of Theories of Punishment in India." Available at SSRN 3561458 (2020).

v. Maguire, Morgan and Reiner, The Oxford Handbook of Criminology, 3 IC Edition, Oxford Univ Pres, New York 2015

vi. Criminology and Penology , Rajendra K. Sharma , Atlantic Publishers and Distributors Pvt Ltd; 1st edition (19 December 2017)

I SEMESTER

COURSE 4

HUMAN SOCIETY AND CRIMES

LLM **4 Credits**

Course Objectives:

Criminal Justice refers to the agencies of government charged with enforcing law, adjudicating crime, and correcting criminal conduct. The criminal justice system is essentially an instrument of social control: society considers some behaviour so dangerous and destructive that it either strictly controls their occurrence or outlaws them outright. It is the job of the agencies of justice to prevent these behaviours by apprehending and punishing transgressors or deterring their future occurrence. Although society maintains other forms of social control, such as the family, school, and church, they are designed to deal with moral, not legal, misbehaviour. Only the criminal justice system has the power to control crime and punish criminals. The central purpose of the Criminal Justice System is to deliver an efficient, effective, accountable and fair justice process for the public.

Course Modules:

Module I: Introduction - Meaning and Concept of society, culture, informal means of social control (norms, mores, folkways, taboos), social deviance, groups, community, social organization and disorganization, social structure and process; Crime and criminology definitions, Historical development, Nature, origin and scope; Criminology and its relationship to other disciplines; Social construction of deviance and crime; Definition of victims of crime and victims of abuse of power.

Typology of Crime and Criminal Behaviors - Crime against person; Crime against property; White collar crime; Organized crime; Cybercrime; Environmental crime; Crime and media; Habitual offenders; Professional criminals; Violent offences; Recidivism; Crimes under IPC, 1860.

Module II: ***Organized Crimes*** **-**Definition & scope of organized crime; Types & characteristics of organized crime; Illicit trafficking of women & children, prostitution; Terrorism &Narco terrorism Close linkage between organized crime and terrorism; Maharashtra Control of Organized Crime Act, 1999 & Gujarat Control of Terrorism and Organized Crime Bill 2015; Issues & law related to Internal Security, The National Security Act, 1980, Armed Forces (Special Powers) Act (AFSPA) 1958

Economic Crimes - money laundering, scams, Hawala & Counterfeiting of Currency

Module III: ***Police Deviance*** - Indian Police Act, 1861; Structures of legal restraint on police power in India, Unconstitutionality of "third-degree" methods and use of fatal force by Police-Judicial decisions on "Encounter" killings, Custodial Violence and Custodial Deaths, Torture in Prison; Attributing Responsibility Police Violence, Defences including "Superior Orders", etc. Rape and related forms of gender-based aggression by police and para- Military forces

Professional Deviance by Doctors and Lawyers and Journalists -Medical Negligence and the law in India; The Lentin Commission Report-Malpractices and other Unethical practices at the Indian bar; Media Ethics, The Press Council on unprofessional and unethical journalism

Module IV: ***Narcotic Drugs and Psychotropic Substances (NDPS) Act*** - Its Legislative Intent; National drug control framework, National Crime Records Bureau (NCRB); United Nations Office on Drugs and Crime (UNODC); Criminal Justice System, Crime Control Institutions, National Coordination Scheme

Enforcement Mechanism: Drug Laws Enforcement - Judicial Response; Identifying and Tracing the forfeitable properties; International Narcotic Control Strategy Report; Special Narcotic Courts; Doctrine of Onus Probandi, Punitive or Reformative; Reformation of Narcotic Legislation (NDPS Act)

National Action plan for Drug Demand Reduction - Social Impact of Drug Abuse; The Role of Community in Combating Drug Addiction; Regulatory Systems; Law Reform Initiatives; Social justice

Module V: ***Gender Related Crimes*** -Child marriage; Prostitution and Trafficking; Female foeticide; Sexual harassment of Women at workplace; dowry; domestic violence; crimes under IPC etc.

Children and Crime - Definition; Nature and patterns of delinquency; Causes; Salient features of the Juvenile Justice (Care and Protection of Children) (amended) Act, 2006; Salient features of Protection of Children from sexual offences Act, 2012

Learning Outcomes:

After undergoing the study, the student will be able to understand the following

• To understand the jurisprudential basis of crime, criminal justice system and administration in India.

• To acquire an understanding on Meaning and Concept of society, culture, informal means of social control.

• To understand the various Typology of Crime and Criminal Behaviors.

• To understand Professional Deviance, Drug Control, Protection of women and Children Indian Legal System.

Suggested readings:

1. Ahmed Siddiqui, Criminology: Problems and Perspectives, 4 l Edition, Eastern Book Co. Lucknow 2014.
2. Criminology and Penology, Rajendra K. Sharma, Atlantic Publishers and Distributors Pvt Ltd; 1st edition (19 December 2017).
3. Polich, J. Michael. Strategies for controlling adolescent drug use. Publications Department, The Rand Corporation, 1700 Main Street, PO Box 2138, Santa Monica, CA 90406 – 2138, 1984.
4. Dorn, Nicholas, Karim Murji, and Nigel South. Traffickers: Drug markets and law enforcement. Psychology Press, 1992.
5. Jacobs, Bruce A. Robbing drug dealers: Violence beyond the law. Transaction Publishers, 2000.
6. Galeotti, Mark, ed. Global crime today: the changing face of organised crime. Routledge, 2014.
7. Allum, Felia, and Renate Siebert, eds. Organised crime and the challenge to democracy. Routledge, 2004.
8. Ellis, Stephen. This present darkness: A history of Nigerian organized crime. Oxford University Press, USA, 2016

II SEMESTER

COURSE 3

HUMAN RIGHTS IN INDIA

LLM **4 Credits**

Course Objectives:

The rights of every man are diminished when the rights of one man are threatened. Understanding Human Rights in National level is important. This course modules focuses on Human Rights in India, various policies in India with respect to its evolution through various social movement, identifying enforcement mechanism of the National and State Human Rights Commissions. The role of civil society and NGOs in the protection of human rights. Constitutional measures for the protection of human rights in India and Special Laws enacted under Positive discrimination. To Identify constitutional remedies, scope of judicial review in protection of human rights. Conceptualize basic structure of the Constitution. Constitutional orientation and response to social transformation. Identify affirmative actions necessary for social transformation. And to conceptualize modernization of law and social institutions.

Course Modules:

Module I: Historical and Constitutional Development of Human Rights in India; Poverty and Human Rights in India; Fundamental Rights under the Indian Constitution.

Module II: Protection of Human Rights through Directive Principles of State policy and Fundamental Duties under the Indian Constitution.

Module III: Protection of Vulnerable Sections of Society in India (Tribal, Women, Minorities, Children, Aged, Disabled, Prisoners etc.)

Module IV: Judicial Activism and Development of Human Rights Jurisprudence; Right to Human dignity, livelihood, Freedom from torture, Right to Food, Right to Education, Right to Health, Right to development, Right to clean environment and public safety.

Module V: Human Rights and Statutory Machinery; National Human Rights Commission; State Human Rights Commission; Law Commission; National Commission for women, SC/ST; minorities

and National Commission for the protection of Child Rights; Role of NGOs in protection of Human Rights in India.

Learning Outcomes:

After undergoing the study, the student will be able to understand the following:

- Understanding human rights in India
- Policies in India which promotes and protects human rights
- Commissions and their contribution in promoting human rights in national level.
- Constitutional protections and special enactments for promoting human rights.
- Need for social transformation.

Suggested readings:

i. JatindraKuman Das, Human Rights Law and Practice (PHI Learning, New Delhi) 2016.

ii. D.D. Basu, Commentary of the Constitution of India (Vol. 1,2&3), 8th Ed., (Lexis Nexis, Nagpur), 2007 & 2008.

iii. D.D. Basu, Human Rights in Constitutional Law‘, 3rd Ed., (Lexis Nexis, Nagpur), 2008

iv. K.P. Sakesena, Human rights & the Constitution: vision and the reality‘, (Gyan Publishing house), 2003.

v. Chiranjivi.J. Nirmal, Human rights in India: Historical, Social and Political perspectives‘, (Oxford University Press, New Delhi), 2002.

vi. J.S. Verma, The New Universe of Human Rights‘, (Universal Law Publications, New Delhi), 2011

vii. Gopal Bhargava, Meaning & sources of Human Rights‘, (Kalpaz publications, India), 2003.

viii. Corradetti Claudio (Ed.), _Philosophical Dimensions of Human Rights‘, (Springer publications), 2012.

ix. Michael J. Perry, _Toward a theory of Human Rights: Religion, Law, Courts‘ (Cambridge University Press), 2007.

x. Ishay Micheline, The History of Human Rights‘, (Orient Blackwan), 2008.

II SEMESTER

COURSE 4

INTERNATIONAL HUMAN RIGHTS LAW

LLM **4 Credits**

Course Objectives:

To make students to learn and understand the Legal Dimensions of Human Rights in International Law, Normative order in United Nations Charter. Distinguish between Charter based human rights and treaty-based human rights. To acquaint the students with Legal Framework relating with the Subject. To develop the vision and insight of Students about the Subject. Help students to apply the Law upon the ground realities. The concept of innovation in the Human Rights - ways to think innovatively liberally using thinking techniques. This course describes status of individual under traditional international law, Significance of International Bill of Rights. Implementation, functioning and obligation to promote and protect Human Rights. Define nature and basic principles of international humanitarian law. The problems and challenges of implementation of international humanitarian law. Distinguish between Hague and Geneva Rules. The idea of human rights as Jus Cogens. The course structure is designed to cover origins of IHL, law relating to protected persons and protected objects, means and methods of warfare within the framework of Geneva Law and The Hague Law, and contemporary issues such as war on terror, cyber warfare and drone attacks. The course content also includes literature which would help students to critically evaluate the origin, development, and application of IHL. The course is intended to offer students a comprehensive view of the subject of international humanitarian law (IHL) or the law of armed conflict and its broad interrelationship with some of the other branches of international law. It is also intended to lay a foundation for studying international criminal law.

Course Modules:

Module I: ***Introduction*** **-** The Historical Development of Human Rights Law, Human Rights Concepts and Discourse, Human Rights Movements, Rights-Duties and Dilemmas of Universalism. Normative Foundation of International Human Rights: Universal Declaration of Human Rights, International Covenant on Civil and Political Rights along with its optional protocols and International Covenant on Economic, Social and Cultural Rights along with its optional protocol.

Module II: ***International Human Rights Organisations*** - The UN Human Rights System, Treaty Bodies, Regional Arrangements (Comparison of Universal and Regional Systems, The European Convention System, Inter- American System and the African System, the Role of the High Commissioner for Human Rights.

Module III: International protection against Racial Discrimination, Discrimination against Women, The Rights of Child, The Right against Torture, Enforced Disappearance, The Right to Development and Rights of Persons with Disability. Vertical and Horizontal Interpretation to Human Rights Law and Its Enforcement; Human Rights, Development and Climate Change; National Security, Terrorism and Limitation on Human Rights; Indigenous Communities: IPR and Human Rights.

Module IV: ***Introduction to International Humanitarian Law*** - Nature and Definition of IHL; Inter-state resort to force and international law, Prohibition and Exceptions; Use of Force and International Humanitarian Law (IHL), Relationship between *jus ad bellum* and jus *in bello*; Development of the Geneva Conventions and Additional Protocols; Fundamental Rules of IHL Applicable in Armed Conflict; Concept of War, International and Non-International Conflicts; Relationship between IHL and International Human Rights Law (IHRL); The Problem of Applicability of Human Rights Law in Armed Conflict; Limitation on Means and Methods of Warfare: General Limitations on the Conduct of War, Limits on the Choice of Methods and Means of Warfare, Specific Weapons, Chemical, Biological, Nuclear etc.; Protection of Defenceless: The General Obligations of Humane Treatment, Role of ICRC, Wounded, Sick and Shipwrecked persons; Combatant Status; Protection of POW‘s; Women and Children and Other Vulnerable Groups including Refugees. Protection of Cultural Property and Natural Environment.

Module V: ***Implementation of International Humanitarian Law*** **-** National Implementation of IHL, Status in South Asia; Role of National Legislation; Role of Military Law; Representation of Breaches; International Implementation of IHL; Protecting Power Concept and Role; Other International Measures War Crime Tribunals and Developments in International Criminal Law; Law of Non-International Armed Conflicts: Historical Development and Conditions of Application-Article 3; Additional Protocol II to the Geneva Conventions of 1949; A Critical Evaluation; Situation of Internal Disturbances and Violence; IHL and Human Rights; Contemporary Challenges to IHL: Lethal Autonomous Weapons System and Cyber War.

Learning Outcomes:

After undergoing the study, the student will be able to understand the following

- Students will know the legal dimensions of human rights
- Knowledge in normative order
- International framework in human rights
- Implementation, functioning and obligation to promote human rights
- Differentiate between charter based and treaty based human rights
- Comprehensive view on International humanitarian law

Suggested readings:

i. Agarwal, H. O., Implementation of Human Rights Covenants with Special Reference of India (Kitab Mahal, Allahabad, 1983).

ii. Anand, R. P., Compulsory Jurisdiction of the ICJ (Asia Publishing House, New Delhi, 1986).

iii. Ram Prakash Anand, Development of Modern International Law and India (Nomos, Germany, 2005).

iv. Anand, R. P., Origin and Development of the Law of the Sea (MartinusNijhoff, The Hague, 1983).

v. New States and International Law (Vikas Publications, New Delhi, 1994).

vi. Dixit, R.K. & Jayaraj, C, Dynamics of International Law in the New Millennium (Manak Publications, New Delhi,

vii. Dixit, R.K., Shankardass, R.K.P., Jayaraj, C & Sinha, Manoj K., International Law: Issues and Challenges (ISIL & Hope India Publications, New Delhi, 2009)

viii. Mani, Bhatt and Reddy, Air Law and Policy in India (Lancers Books, New Delhi, 1994).

ix. Mani, V. S., Basic Principles of Modern International Law (Lancers Book, New Delhi, 1993).

x. Oppenheim‘s, International Law of Peace, vol. 1, 9th ed. (London, 1992).

xi. Verma, S. K., 50 Years of Supreme Court of India: Its Grasp and Reach (Oxford, 2008).

xii. Agrwal, H.O. International Law and Human Rights.

xiii. Kapoor S.K. International law

xiv. Basu, Durga Das, Human Rights in Constitutional Law (Prentice Hall, New Delhi, 1994).

III SEMESTER

COURSE 1

LAW RELATING TO EVIDENCE AND FORENSIC SCIENCES

LLM **4 Credits**

Course Objectives:

Forensic science is any kind of science used in the legal or justice system to support and uphold the law. When a crime has been committed and evidence is collected at the scene, scientists analyze it, arrive at scientific results and give expert court testimony about their findings. Forensic science concentrates on facts that prove something did or did not happen in a criminal or civil case. Regardless of their scientific specialty, all forensic scientists have the same goal: examining evidence from a crime scene using strictly scientific knowledge and principles in order to find facts about a criminal case. Because the outcomes are objective facts, forensic science can be useful both to the prosecution and the defense. Any discipline of forensic science can prove whether and how suspects and victims are linked to each other or to the crime scene itself. Criminalistic and scientific investigation has become one of the most important parts of any criminal case.

Course Modules

Module I:

Role of Evidence in Criminal Justice System-Relevancy and admissibility, of facts –Facts Ss 1-16 , Admissions and Confessions Ss 17-31, Statements by Persons who cannot be called as witnesses Ss 32-33, Statements made under special Circumstances Ss 34-38, How much of a statement is to be proved S- 39, Judgment of Courts of Justice when relevant Ss 40-44, Opinions of Third Persons when relevant Ss 45-51,Character Ss 52-55, Facts which need not be proved Ss 55-58

Relevancy and admissibility Of Oral Evidence Ss 59-60, Of Documentary Evidence Ss 61-90, Of the Exclusion of Oral by Documentary Evidence Ss 91-100, Of the Burden of Proof Ss 101-114-A, Estoppel Ss 115-117, Of Witnesses Ss 118-134, Of the Examination of Witnesses Ss 135-166, Of Improper Admission and Rejection of Evidence S- 167

Module II:

Forensic Science and Crime Scene Management - Forensic Science Unit; Tools and techniques in Forensic Science; Jurisprudence of Forensic Evidence and Constitutional Challenges; Human Rights

and Comparative Forensic Analysis; Forensic Photography; Crime Scene Management; Collection, Handling, Admissibility and Challenges

Forensic Dermatoglyphics and other impressions - Fingerprints and Palm prints; Biometrics; Foot / Footwear / Tyre impressions; Lip prints, Ear prints and their significance; Collection, Handling, Admissibility and Challenges

Forensic Chemistry and Toxicology - Forensic Chemistry; Explosives; Ballistics;Forensic Toxicology and Pharmacology – Drugs of Abuse; Collection, Handling, Admissibility and Challenges

Module III:

Questioned Documents-Introduction to Document Examination – Handwriting and Signature examination; Typewritten and Printed Documents – Forgery Detection; Collection, Handling, Admissibility and Challenges

Module IV:

Forensic Anthropology -Personal Identification; Human Growth and Development; Forensic Morphometry of Skeletal Remains; Forensic Odontology; Collection, Handling, Admissibility and Challenges

Forensic Medicine and Psychology- Medico legal aspects of death; Injuries and investigations; Forensic Entomology – Forensic Psychology; Collection, Handling, Admissibility and Challenges

Module V:

Forensic Biology and DNA Profiling-Serology and Immunology, Forensic Biology, DNA Profiling – DNA Polymorphism, Collection, Handling, Admissibility and Challenges

Digital Forensic and Cyber Crime - E – data analysis, Types of cyber crimes;Audio – video examination – Speaker Identification, Collection, Handling, Admissibility and Challenges

Learning Outcomes:

After undergoing the study, the student will be able to understand the following:

- Make students familiar with the field of forensic science which includes investigating a crime by applying forensic science principles.

- Enhance knowledge, in depth understanding and application of forensic science, policing and criminal investigation by teaching and research.
- Develop critical and analytical subject specific skills involving the principles, practices and techniques of specific field.
- Develop competence in research methods and presentation of information.

Suggested readings:

i. Houck, M.M & Siegel, J.A; Fundamentals of Forensic Science, Academic Press, London, 2006.

ii. Sharma, B.R; Forensic Science in Criminal Investigation & Trials, Universal Publishing Co., New Delhi, 2019

iii. J.P. Modi ,A Textbook of Medical Jurisprudence and Toxicology, Lexis Nexis Butterworth India 2019

iv. Nanda B.B and Tewari, R.K; Forensic Science in India – A vision for the Twenty First Century, Select Publisher, New Delhi, 2001

v. Saferstein; Criminalistics – An Introduction of Forensic Science, Prentice Hall Inc, USA,2007.

III SEMESTER

COURSE 2

VICTIMOLOGY AND PENOLOGY

LLM **4 Credits**

Course Objectives:

The law relating to the victims of crime has undergone drastic changes in the recent times. Though quite late, but yet the legislature has recognized the importance of the victims in the Indian Criminal Justice System and has, therefore, given them various rights by making amendments in the Cr P C 1973 from time to time. At the same time the Indian judiciary has become very sensitive towards the rights of the victims and has changed the interpretation of various important aspects of criminal jurisprudence to include the victims as a part of it such as right to "fair trial" of an accused. An important role has been played by various institutions and bodies such as Victimology and World Society of Victimology in the growth of Victimology in India.

Course Modules:

Module I: Philosophy of Crime and Criminal Justice System

Meaning, Nature, Scope and Characteristic features of crime; Essential elements of crime; Classification of Crime; Theories of crime; Factors / Causations leading to crime; Reactions to crime; Prevention of crime

The Constitution and Criminal Justice System; Challenges of Criminal Justice System; Reform Strategy; Ethics in Criminal Justice System; Issues in Criminal Justice System

Principles of criminal law; Criminal law and its role

Stages of criminal justice process; Judicial Approach in Criminal Justice System

Module II: Criminal Justice system – Its components and functions

Investigative agency; Police; Custodial torture; Police Public cooperation; Judicial opinions on police force; Modernization of police force; Role of police in International Issues; Role of police in administration of criminal justice system; Directions of the Supreme Court relating to police reforms.

Prosecution; Defence Counsel; Courts; History of the Prosecution of India; Nature, Scope and Role of Prosecution; Constitutional Provision of Role of Prosecution; Powers and Duties of Prosecutor; Role of Judiciary; Critical Analyses of Role of Prosecutor; Role of Prosecution in Other Countries

Prison Administration and Prison Management; Prison Reforms; Rights of Prisoners

Module III: Penology

Definition, objectives and scope of penology; Concept, definition, nature, forms and purposes of punishments; Different Punishments under Indian Legal System; Capital Punishment: Constitutionality, Judicial Attitude and Law Reforms

Sentencing process; Process and Policies in India; Mitigating & Extenuating circumstances in the decision making of sentence; Plea Bargaining; Compounding of offences

Therapeutic Response to Crime: Probation, Parole, Furlough and After-care; Alternatives to punishment- Community Service as a Punishment

Module IV: Victimology

Definition, nature and scope of victims and victimology; Categorization of the victims; Criminal and Victim Relations; Theories of victimology; Victim of crime and victim of Abuse

Victims in Indian Criminal Justice System; Rights to the Victims of Crime; Access to justice and fair treatment; Compensation and Assistance; The Right to Protection; Victim and Witness Rights through Assistance Programmes

Rights of Victims of Crimes in the United Nations Instruments

Module V: Restorative Justice Process in Contemporary Criminal Justice

History, Definition, Principles, Root and Values of Restorative Justice;

Compensation to Victims of Crime; Victim Compensation Scheme in United Kingdom & United States of America; The Criminal Injuries Compensation Authorities; Victim Compensation under the Code of Criminal Procedure, 1973;

Compensation to the Victim / Dependents in Heinous Crimes; Rehabilitation of Victims; Special Compensatory Provisions; The Probation of Offenders Act, 1958; – The Motor Vehicles Act, 1988; The Fatal Accidents Act, 1855; Victims of Medical Negligence

Learning Outcomes:

After undergoing the study, the student will be able to understand the following

- Basic knowledge in different theories of victimology.
- Understanding and knowledge of who is a victim of crime, their legal status, situation and needs

- Knowledge on social protection, support and redress for crime victims
- General knowledge and understanding of what distinguish and unites different types of crime victims.

Suggested readings:

i. *21st Century Criminology: A Reference Handbook,* Edited by J. Mitchell Miller (Sage Publication, 2009).

ii. Ahmed Siddique, *Criminology*, Edited by S.M.A. Qadri, 5th Edition (Eastern Book Company,2015).

iii. Bruce A. Arrigo & Dragan Milovanovic, *Revolution in Penology: Rethinking the Society of Captives (*Rowman& Littlefield Publishers, INC., 2009).

iv. *Criminology Theory: Past to Present: Essential readings*, Edited by Francis T. Cullen, Robert Agnew and Pamela Wilcox (Oxford University Press, 2014).

v. David Scott, *Penology* (Sage Publications, 2008).

vi. Eamonn Carrabine, Pam Cox, Maggy Lee Ken Plummer and Nigel South, *Criminology: A Sociological Introduction*,2nd Edition (Routledge, 2009).

vii. Edwin H. Sutherland, Donald R. Crassey and Davic F. Luckenbill, *Principles of Criminology*,11th edition (General Hall Inc., U.S., 1992).

III SEMESTER

COURSE 3

INTERNATIONAL CRIMINAL LAW AND CRIMINAL JUSTICE

LLM **4 Credits**

Course Objectives:

Since the inception of mankind, the egoistic patterns of human life unleashed violence resulted in the case of humans destructing fellow human beings itself. Exceptionally, the promotion of evil ideology to rule the world on the basis of artificial racist supremacy by the humans across time and space, to state, the Nazist led Germanisation, the European Colonial System and similar Statist led Nationalism and Regionalism based Ideologies have threatened the existence of human kind on earth itself. The criminal behaviour of such gross dehumanization and genocidal violence has resulted in the need for establishing a specific field of knowledge known as International Criminal Law (ICL). Thus, ICL is devoted to the study of the subjective element of international criminal behaviour aimed at the prevention of the commission of international crimes and thereby establish universal peace and justice amongst human societies. Hence, the course work will introduce to the students the foundational perspectives of international crimes, its evolutionary character, contemporary challenges and remedies towards re-humanisation.

Course Modules:

Module I: ***International Criminal Law*** - Meaning, History and sources; Objective and Principles; International crime and types (brief introduction) such as Criminal offenses against the world community, genocide, war crimes, crimes against humanity, crimes of aggression, act of terrorism and Transnational criminal acts, drug trafficking, trans-border organized criminal activity, counterfeiting, money laundering, financial crimes, willful damage to the environment, and cybercrimes.

Module II: ***Salient Features of important UN Conventions relating to International crimes*** - Genocide Convention 1948; the United Nations Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances of 1988; United Nations Convention against Transnational Organized Crime and the Protocols, 2000

Module III: ***International crime Investigating agency***- INTERPOL; Jurisdiction under International Criminal Law; Responsibility under International Criminal Law and Immunity to state officials as per Diplomatic Convention, 1961; Extradition and Mutual Legal assistance;

Module IV: ***International criminal Tribunals and Special courts***- Nuremberg Tribunal; Tokyo Tribunal; International Criminal tribunal for Yugoslavia (ICTY); International Criminal Tribunal for Rwanda (ICTR); Special Courts in Sierra Leone and Lebanon

Module V: ***International Criminal Court (ICC)*** **-** Rome Statute of ICC, Jurisdiction (genocide, war crimes, Crimes against humanity, Crime of aggression); Applicable Law; Composition, Mandate and Principles; Penalties; Appeal and Revision; Enforcement; Assembly of States Parties; Reservations; Amendments; Review of Statute; Important cases decided by ICC.

Learning Outcomes:

After undergoing the study, the student will be able to understand the following:

- The foundational perspectives on the international element of crimes vis a vis criminological pattern.
- The evolutionary jurisprudence on the substantive and procedural aspects of international crimes.
- The impact of ad hoc and permanent international criminal justice delivery systems.
- The need to develop preventive studies on international crimes especially, to combat the ever – increasing patterns of State criminality and promote welfare approaches for the human family.

Suggested readings:

i. Julius Stone, "Legal contract of International Conflicts"

ii. JG Starke "Introduction to International Law"

iii. Dr.S.KKapoor "International Law and Human Rights"

iv. Ian Brownli "principles of International Law"

v. Malcolm Shaw "International Law"

vi. L Oppenheim "Principles of International Law"

vii. Charles Fenwick "International Law"

viii. Phillip C Jessup "A Modern Law of Nations"

IV SEMESTER

COURSE 1

CRIMINAL JUSTICE RESEARCH AND POLICY DEVELOPMENT

LLM **4 Credits**

COURSE OBJECTIVES:

Criminal justice research and policy development will introduce research methods used in criminology and criminal justice. The nature of scientific inquiry, issues in research methods, and statistical concepts used in quantitative analyses will be explored. The content is designed to familiarize with the basic ideas, techniques, and problems associated with conducting criminological and criminal justice research. The study will provide with the analytical, critical thinking skills necessary to understand empirical research and the tools necessary to conduct research project. The subject should be of interest and benefit to the intended policymakers in assessing the benefits of investing in criminal justice research, and, to researchers and practitioners who wish to become familiar with major research findings and methods for improving the research – to practice link.

COURSE OUTLINE

MODULE – I: Scientific Inquiry and Field Research

a) Criminal Justice Inquiry – Personal Human Inquiry, Errors in Personal Human Inquiry – Foundations of Social Science – Purposes of Research – Differing Avenues for Inquiry

b) Field Research, Appropriate topics – The Various Roles of the Observer – Asking Questions

c) Gaining Access to Subjects – Recording Observations – Linking Field Observations and Other Data – Validity, Reliability, Generalizability of Field Research.

MODULE – II: General Issues in Research Design

a) Research Design – Causation in the Social Sciences – Criteria, Causes

b) Validity and Causal Inference – Introducing Scientific Realism – Units of Analysis – Social Artifacts – The Ecological Fallacy – Reductionism

c) The Time Dimension in Research – Designing a Research Project – Preparing a Research Proposal

MODULE – III: Concepts, Operationalization, Measurement and Survey Research

a) Conceptions and Concepts – Operationalization Choices – Measurement, types, Levels, Implications – Reliability, Validity – Composite Measures – Typologies, An Index of Disorder

b) Topics Appropriate to Survey Research – Guidelines for Asking Questions, Question types,

Statements, Biased Items and Terms, Designing Self – Report Items

c) Questionnaire Construction – Self – Administered Questionnaires – Software applications used – In – Person Interview Surveys – Role of Interviewer, General Rules, Software applications – Telephone Surveys, Video Conference – Specialized Interviewing, Focus Groups

MODULE – IV: Experimental and Quasi – Experimental Designs

a) Experimental and Quasi – Experimental Designs; The Classical Experiment, Variables, Pretesting and Post – testing, Experimental and Control Groups, Double – Blind Experiments, Selecting Subjects, Randomization – Experiments and Causal Inference – Experiments and Threats to Validity, Variations in the Classical Experimental Design – Variations in Time – Series Designs.

b) Variable – Oriented Research and Scientific Realism

c) AgencyRecords, Content Analysis, and Secondary Data; Types of Agency Records – Units of Analysis and Sampling – Reliability and Validity; Content Analysis – Units, Sampling, Coding, Illustrations – Secondary Analysis.

MODULE – V: The Influence of Criminal Justice Research

a) Role of Criminal Justice Researches conducted in India.

b) Policing – Patrol Operations, Criminal Investigation, Specialized Offender / Offense Operations – Prosecution – The Case – Attrition Problem, Dealing with Career Criminals – Sentencing – Reassessing Sentencing Objectives, Sentencing Reform – Corrections – Prison Crowding, Releasing Pretrial Detainees from Jail, Parole Issues, Attempts to Make Probation a Safer Sentencing Alternative

c) Product – Oriented Research – Products for Policing Applications, Technical Research for Prosecution and the Courts, Other Technical Research – Assessing the Benefits of Research and Increasing the Return on Research Investment.

Learning Outcomes:

• *To understand the basic principles, overview of scientific inquiry in criminal justice, identify scholarly research, and field research methods.*

• *To understand causation, operationalize, conceptualize, measure in research methods and different levels of measurement in research methods.*

• *To understand various research methods used to study criminology, including how to critically review criminological research*

• To recognize strengths and weaknesses of research designs.

Suggested readings:

1. Maxfield, M. G., & Babbie, E. R. (2014). Research methods for criminal justice and criminology. Cengage Learning.

2. Research Methods in Criminal Justice and Criminology Paperback, Callie Marie Rennison (Author), Timothy Christopher Hart (Author), SAGE Publications, Inc; 1st edition (20 February 2018)

3. Vito, G. F., Kunselman, J. C., & Tewksbury, R. (2014). Introduction to criminal justice research methods: An applied approach. Charles C Thomas Publisher.

4. Maxfield, M. G. (2015). Basics of research methods for criminal justice and criminology. Cengage Learning.

5. Dantzker, M. L., Hunter, R. D., & Quinn, S. T. (2016). Research methods for criminology and criminal justice. Jones & Bartlett Learning.

(ELECTIVE – 1)

GENDER AND CRIME

LLM **3 Credits**

Course Objectives:

Understanding Human Rights of women at International and National level is important. This course's modules focus on Human Rights of women in India with specific regard to crimes committed against them, To Identify constitutional remedies, scope of judicial review in protection of human rights of women in India and to conceptualize modernization of law and social institutions.

Course Modules:

Module I: ***Women: International Endeavours For Securing Rights of Women*** **-** Need for focused study; Magnitude of issues faced by women across the globe; Feminism and Women Empowerment; International Perspectives on the Protection of Rights of Women; Implementation mechanism: (Development until CEDAW and post CEDAW)

Module II:***Concept of Gender*****-**Biological Distinction**;** Constitutional Safeguards for women and Role of Judiciary in India; Role of National Commission for Women; Convention on Elimination of All Forms of Discrimination Against Women- Implementation Mechanism and Monitoring bodies

Module III:***Gender Related Crimes under Special Legislations*** The Immoral Traffic (Prevention) Act, 1956; The Dowry (Prohibition) Act, 1961; The Child Marriage Restraint Act, 1929; The Indecent Representation of Women (Prohibition) Act, 1986; The Commission of Sati (Prevention) Act, 1987; Protection of Women from Domestic Violence Act, 2005; The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013.

Module IV:***Gender Related Crimes under IPC*** **-** Acid Attack (Sections 326A and 326B); Rape (Sections 375, 376, 376A, 376B, 376C, 376D and 376E); Attempt to commit rape (Section 376/511); Kidnapping and abduction for different purposes (Sections 363–373); Murder, Dowry death, Abetment of Suicide, etc. (Sections 302, 304B and 306); Cruelty by husband or his relatives (Section 498A); Outraging the modesty of women (Section 354); Sexual harassment (Section 354A); Assault on women with intent to disrobe a woman (Section 354B) ; Voyeurism (Section 354C); Stalking (Section 354D); Importation of girls up to 21 years of age (Section 366B); Word, gesture or act intended to insult the modesty of a woman (Section 509)

Module V: ***Emerging areas in Gender Justice*** **-** Gender and Sexual Minorities; Understanding the LGBTQ+ community; Yogyakarta; Recognition of the Third Gender; Decriminalisation of Sec. 377 - The Transgender; Persons (Protection of Rights) Bill, 2016; Recognition of civil rights of the LGBTQ+ Community.

Learning Outcomes:

After undergoing the study, the student will be able to understand the following

- Understanding human rights of women in India
- Policies in India which promotes and protects their human rights
- Constitutional protections and special enactments for promoting human rights.
- Criminal Law in protecting women.

Suggested readings:

i. Aggarwal, Bina Patriarchy and the Modernizing State:An introduction, in Aggarwal Bina(ed.) Structures of Patriarchy, Kali for Women, New Delhi, 1988.

ii. Julia Cleves Mosse, half the World, half a Chance: An Introduction to Gender Development, What is Gender? Oxford, UK 1993.

iii. Myneni, S.R. Women and Law, Asia Law House, Hyderabad, 2005.

iv. Merry, Sally Engle, Human Rights and Gender Violence Translating International Law into Local Justice, Oxford University Press, New Delhi, 2009.

v. Tripathi, S.C., Law Relating to Women and Children, Central Law Publication Allahabad, 2008.

vi. Chakrabarti, N.K., Gender Justice, R. Cambray and Company, Kolkata, 2007 Towards Equality- Report of the Committee on the Status of Women (Govt. of India).

vii. Mamta Rao- Law relating to Women and Children.

viii. Monica Chawla - Gender Justice- Law Relating to Women in India

(ELECTIVE – 2)

CYBER CRIMES

LLM **4 Credits**

Course Objectives:

Cyber law is a branch pertaining to evidence found in computers and digital storage media. The goal of cyber law is to examine digital media in a forensically sound and constructive manner with the aim of identifying, preserving, recovering, analyzing and presenting facts and evidence in a court of law. The courses are designed with a focus on strengthening students' knowledge in all areas of cyber security and digital forensics. This course provides hands – on experience in different computer forensics situations that are applicable to the real world. Students will learn different aspects of digital evidence: ways to uncover illegal or illicit activities left on disk and recovering files from intentionally damaged media with computer forensics tools and techniques.

Course Modules:

Module I: ***Introduction*** **-**Overview of information technology, Law and Technology, Law and Technology, Digitization and Society; Origin of cyberspace; Significance of cyber law; Cyber jurisprudence at Indian and International level.

Regulating the Digital Environment **-**Protecting Human Dignity in the Digital Age; Human Right in Cyberspace; Information Technology Act, 2000: Scope, Objectives and Criticisms of the Act, Jurisdictional perspectives and challenges, Issue of jurisdiction in cyberspace, Types and perquisites of jurisdiction, Tests of jurisdiction, Jurisdiction under Information Technology Act, 2000, Dispute resolution authorities, Amendments and liabilities under the Act.

Module II: ***Cybercrimes*** **-** Hacking; cracking; DoS – Viruses, worms, malwares, bombs, email bombing, data diddling, salami attacks, phishing, steganography, cyber stalking, spoofing, cyber grooming and bullying; Morphing; web-jacking; phishing; Digital forgery; cyber pornography; Identity theft and fraud; cyber terrorism; cyber defamation; cyber warfare; crime in social media, social engineering, Credits card frauds and financial frauds, telecom frauds.etc.; offences under IT Act, 2000

Cybercrime – The present and the future **-**Cyber war – The present and the future; Cryptocurrency, Bitcoins, Ethereum, Blockchain; Ransomware; Deep Web and Dark Web – Counter measures to overcome challenges.

Module III: ***Cyber Forensic Investigation***

Cyber/Digital forensics – Cyber forensics life cycle; Chain of custody; Search, seizure and preservation of digital evidence; Forensic Examination Process, Methods in Forensic Analysis; Benefits of Cyber Forensics, Classification of Cyber Forensics.

Challenges of Digital Forensics in Cyber Security **-** Data privacy issues – Cryptography, Cybercrime cells, Cyber appellate authorities.

Module IV: ***Digital Evidence*** Duplication and Preservation of Digital Evidence; Acquisition and Handling of Digital Evidence; Analysis and Admissibility of Digital Evidence; Challenges with Digital Evidence

Module V:***Legal Issues, Information and Human Security***

Law Enforcement / Criminal Prosecutions – Evidentiary Issues, Organizations and Standardizations; Information security – Information processing, Secure program administration; Organizational and Human Security – Information security professionals; International Human Rights; Cybercrime a comparative analysis.

Learning Outcomes:

After undergoing the study, the student will be able to understand the following:

- To demonstrate foundational knowledge and skills in Cyber forensics.
- To explain the role of digital forensics and the relationship of digital forensics to traditional forensic science, traditional science and the appropriate use of scientific methods
- To learn investigation tools and techniques, analysis of data to identify evidence, Technical Aspects & Legal Aspects related to cybercrime.
- Describe the procedures for selecting appropriate security components in preventing cybercrimes.

Suggested readings:

i. Cyber forensics: A field manual for collecting, examining, and preserving evidence of computer crimes, Marcella A Greenfield R, CRC Press, 2002

ii. Cyber Forensics in India: A Legal Perspective, Nishesh Sharma, LexisNexis, 2017

iii. Christof Paar, Jan Pelzl, Understanding Cryptography: A Textbook for Students and Practitioners,2nd Edition, Springer's, 2010

iv. Ali Jahangiri, Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts, Ali Jahangiri, 2009

v. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec – Council Press Series: Computer Forensics), 2010

PONDICHERRY UNIVERSITY
(A CENTRAL UNIVERSITY)

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

Master of Technology
(Computer Science and Engineering)

(Choice Based Credit System)
(Effective from the academic year 2020-2021)

CURRICULUM & SYLLABUS

CSCE 611 MATHEMATICS FOR COMPUTER SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite:

- *Knowledge of functions and basic algebra*

Objectives:

- *To introduce the mathematical concepts fundamental to Computer Science.*
- *To illustrate the applications of mathematical concepts to Computer Science*
- *Learn permutations and combinations*
- *Understand Computer Science applications*

Course Outcome:

- *Capacity to explain mathematical induction and recursive definitions*
- *Analyse basic operations on matrices*
- *List problem solving skill and ability of counting and enumeration*
- *Design Computer Science applications*

Module-I: **9 hrs**

Basic Structures: Sets, Functions, Sequences, Sums, and Matrices: Sets – Set Operations – Functions – Sequences and summation – Matrices .

Module-II: **9 hrs**

Number theory: Divisibility and modular arithmetic – Integer representations and algorithms – Prime and GCD – Congruence and applications.

Module- III: **9 hrs**

Algebraic Structures: Groups – cyclic group - Homomorphism – Cosets and Lagrange's Theorem- Normal Subgroups –Rings and Fields (definition and examples)

Module-IV: **9 hrs**

Counting and Lattices: Basics – Pigeon hole principle – Permutations and combinations – **Lattices –** Partial order relation – Posets- Hasse diagram- Lattices- Boolean Algebra

Module-V: **9 hrs**

Relations and Induction: Relations and Their Properties - *n*-ary Relations and their Applications - Representing Relations – inclusion –exclusion- - Mathematical induction – strong induction and well ordering- applications

Text Book(s):

1. *Kenneth H.Rosen, Discrete Mathematics and its Applications, 2012, Seventh Edition, Jones & Bartlett Learning.*
2. *Trembley. J.P and Manohar .R." Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Com. Ltd., New Delhi, Reprinted in 2007*

Reference Book(s):

1. *Norman L Biggs, Discrete Mathematics, Oxford Press, 2nd Edition, 2002*
2. *Kenneth Bogart and Robert L Drysdale, Discrete Mathematics for Computer Science, Addison-Wesley; 1 edition2010*
3. *Thomas Koshy, Discrete Mathematics with Applications, Academic Press Inc, 2004.*

Web resources:

1. *https://www.geeksforgeeks.org/engineering-mathematics-tutorials/*MOOC
2. *NPTEL Course on Discrete Mathematics : https://nptel.ac.in/courses/111107058/#*

E 612 APPLIED PROBABILITY AND STATISTICS FOR ENGINEERS

Pre-requisite:

- *Set Theory and Calculus*

L	T	P	C
3	0	0	3

Objectives:

- *To learn and understand random variables that describes randomness or an uncertainty in certain realistic situation.*
- *To understand the types of sampling distributions and transformations*
- *To understand the framing and testing of hypothesis*
- *To learn and understand probability*

Course Outcome:

- *Describe randomness or an uncertainty in certain realistic situation.*
- *Explain the types of sampling distributions and transformations*
- *Recognize frame and test of hypothesis*
- *Define the rules and theorems of probability*

Module-I: 9 hrs

Probability: Combinatorial methods- Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' Theorem and independence, problems.

Module-II: 9 hrs

Random Variables: Discrete, continuous random variables, probability mass function, probability density function and cumulative distribution functions - mathematical expectation, moments, moment generating function, Joint, marginal and conditional distributions, product moments, correlation and regression, independence of random variables, Chebyshev's inequality, problems.

Module-III: 9 hrs

Discrete and Continuous Distributions: Bernoulli, Binomial, Poisson, Geometric, Negative binomial, continuous Uniform, Normal, Exponential, Gamma, Pareto, Beta distributions-Reliability and hazard rate, reliability of series and parallel systems, problems. Function of a random variable, problems.

Module-IV: 9 hrs

Sampling Distributions: The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions, problems. **Estimation:** Concepts of Unbiasedness, consistency and sufficiency, Methods of estimation -maximum likelihood estimation, Interval estimation, confidence intervals for mean and variance - problems.

Module-V: **9 hrs**

Testing of Hypotheses: Null and alternative hypotheses, the critical regions, two types of error, level of significance, power of the test, tests for mean for one sample and two sample problems from normal populations, Tests for single mean, difference of means using t, paired t test- tests for proportions - Chi-square goodness of fit test and its applications, Test for independence of attributes, One way ANOVA, simple problems

Text Book :

1. *Irwin Miller and Marlyees Miller (2002): John E Freund's Mathematical Statistics, 9e,2017, PHI,*

Reference Book(s):

1. *Gupta, S.C. and Kapoor, V.K.(2000): Fundamentals of Mathematical Statistics, 10/e, Sultan Chand and Sons*
2. *S.M. Ross, Introduction to Probability and Statistics for Engineers and Scientists,2009, 4th edition, Elsevier.*

CSCE 613 NETWORK CONFIGURATION AND MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite:

- *Knowledge in computer networks*

Objectives:

- *To implement and administer common operating systems environments.*
- *To gain experience in systems administration functions and issues as well as network services.*
- *To develop a conceptual understanding of each operating system function and network service*
- *To learn how to plan, implement, and administer each.*

Course Outcome:

- *Identify the common remote monitoring issues.*
- *List systems administration functions and network services.*
- *Perform operating system function and network service and plan, implement, and administer each.*
- *Implement network structure and services*

Module-I: 9 hrs

Introduction: Network Management goals, organization, and functions - Network Management System Platform, Current Status and future of Network Management - Network monitoring - Network control - SNMPv1 Network management organization and communication function models - structure of SNMP management information – standards - SNMPv2 system architecture- protocol - protocol specification - SNMPv3 architecture.

Module-II: 9hrs

Network Configuration: IPv4and IPv6 addressing, Network Interface Configuration, Diagnosing Network start-up issues, Linux and Windows Firewall configuration, Network troubleshooting commands, DNS principles and Operations, Basic Name Server and Client Configuration, Caching Only name server, Primary and Slave Name Server, DNS Zone Transfers, DNS Dynamic Updates, DNS Server Security.

Module-III: 9 hrs

Web, Proxy, Mail Server Configuration and Management: HTTP Server Configuration Basics, Virtual Hosting, HTTP Caching, Proxy Caching Server Configuration, Proxy Access Control List, Proxy-Authentication Mechanisms, Mail Domain Administration, Basic Mail Server Configuration (like Sendmail, qmail), SMTP, POP and IMAP principles, SMTP Relaying Principles, SPAM control and Filtering, Troubleshooting

Module-IV: 9 hrs

Remote Administration and Management: Remote Network monitoring-concepts - group management - RMON alarms and filters - packet capture group - practical issues - RMON2 protocol -practical issues - ATM network management- The ATM Network Reference Model, The Integrated Local Management Interface, The ATM Management Information Base - Telecommunication network management - TMN conceptual model - architecture - Network management applications.

Module-V: **9 hrs**

Techniques for Network Management : Techniques for Network Management – Policy based management– Artificial Intelligence Techniques – Expert systems, Machine Learning - Graph-Theoretic techniques – Causality Graph, Dependency Graph, Decision Trees – Probabilistic Approaches – Fuzzy logic, Bayesian Networks – Web-based Network Management - NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management, Embedded Web-Based Management – Distributed Object Computing - Bio-inspired Approaches.

Text Book(s):

1. *Thomas A. Limoncelli, Christina J. Hogan , Strata R. Chalup. The Practice of System and Network Administration, Third Edition , 2016.*
2. *Mani Subramanian, Network management: Principles and Practice, Addison Wesley, 2000.*
3. *Jianguo Ding, Advances in Network Management, Taylor and Francis Group, LLC, 2010.*

Reference Book(s):

1. *Advanced Linux Networking, Roderick W. Smith, Addison-Wesley Professional (Pearson Education), 2002.*
2. *Linux Network Administrator's Guide, Tony Bautts, Terry Dawson, Gregor N. Purdy, O'Reilly, Third Edition, 2005*
3. *William Stallings, Cryptography and Network Security: Principles and Standards, Prentice Hall India, 4th Edition, 2005.*

CSCE 614 ADVANCED DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

Pre-requisite:

Basic Knowledge in

- *Algorithm design and analysis techniques*
- *Data Structures*
- *Mathematical techniques*

Objectives:

- *To understand randomized algorithms*
- *To learn Graph algorithms*
- *To study Parallel algorithms*
- *To Learn string matching applications*

Course outcome:

- *Explain Randomized algorithms in problem solving*
- *Implement Graph algorithms in constraint satisfaction problems*
- *Perform Dynamic programming based algorithms*
- *Define Multithreaded algorithms*

Module-I: **9 hrs**

Introduction: Advanced data structures: B-Trees, Fibonacci heaps, data structures for disjoint sets, hash tables Role of Algorithms in Computing - Analyzing Algorithms – Designing Algorithms Growth Functions: Asymptotic Function - Standard Notations and common Functions.

Module II: **9 hrs**

Divide and Conquer: Maximum-subarray problem - Strassen's algorithm for matrix multiplication - Substitution method for solving recurrence - Recursion-tree method for solving recurrences - Master method for solving recurrences. **Randomized Algorithms:** Hiring Problem - Indicator Random Variables.

Module III: **9 hrs**

Advanced Design and Analysis Techniques: Dynamic Programming: Rod Cutting - Matrix-Chain Multiplication - Elements of Dynamic Programming - Longest Common Subsequence - Optimal Binary Search Trees. Greedy Algorithms: Elements of Greedy Strategy - Huffman Codes - Matroids and Greedy Methods Amortized Analysis: Aggregate Analysis - The Accounting Method

Module IV: **9 hrs**

Advanced graph algorithms: Johnsons Algorithm for Sparse Graphs Maximum Flow: Flow Networks - The Ford-Fulkerson Method - Maximum Bipartite Matching. **Multithreaded Algorithms:** Basics of Dynamic Multithreading - Multithreaded Matrix Multiplication - Multithreaded Merge Sort.

Module V: **9 hrs**

String matching and approximation algorithms: String Matching Algorithms: Naïve approach - Rabin-Karp Algorithm - String Matching with Finite Automata -The Knutt-Morris-Pratt Algorithm-NP Completeness.

Text Book(s):

1. *Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, MIT Press, 2009.*
2. *Ellis Horowitz , Sartaj Shani, Sanguthevar Rajasekaran, Computer Algorithms, Computer Science Press, 1998.*

Reference Book(s):

1. *S. Dasgupta, C. H. Papadimitriou, and U. V. Vazirani, Algorithms, McGrawHill, 2008.*
2. *G. Brassard and P. Bratley, Algorithmics: Theory and Practice, Prentice -Hall, 1988.*
3. *J. Kleinberg and E. Tardos, Algorithm Design, Pearson Education, 2006.*
4. *Rajeev Motwani and Prabhakar Raghavan, Randomized Algorithms, Cambridge University Press, 1995.*

CSCE 615 INTERNET AND WEB TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic Understanding of Computer Programming.*

Objectives:

- *To understand and become familiar with Full Stack of Web development.*
- *To learn the components of Web Design and Development.*
- *To acquire skills on developing effective web applications.*
- *To Learn client side scripting*

Course Outcome:

- *Implement Full Stack of Web development.*
- *Perform the components of Web Design and Development.*
- *Choose effective web applications.*
- *Develop applications securely.*

Module-I: **9 hrs**

The Internet Evolution – Protocols for the Internet – IP Subnetting and addressing - Name resolution – Web Browsers: Features – Comparative analysis; Markup languages – HTML5: Features – Multimedia handling – Canvas; Styling web pages: CSS3 – Types – Benefits – Design considerations.

Module-II: **9 hrs**

Client Side Scripting languages : Features – Comparative analysis; Dynamic pages using client side scripting – Client side storage through Cookies - Client side scripting frameworks : Case study with Jquery – Optimizing web pages for speed.

Module-III: **9 hrs**

Web servers : Features – Comparative analysis; Service side scripting languages: Features – Factors to consider in selecting Web Servers – Server Side Scripting case study with PHP : Introduction - Functions – Object Orientation – Error and Exception Handling – Internationalization and Localization – File Systems and the Server.

Module-IV: **9 hrs**

Databases for web applications : Features – Comparative analysis; Creating the web databases – Accessing databases from server side scripting – Database Administration – Non RDBMS Data Sources for Web applications.

Module-V: **9 hrs**

Web Application Security: risks – Building secure web applications. Rich Internet Applications: Design and Security issues – Mobile Web : Components and Security considerations.

Reference Book(s):

1. *Laura Thomson & Luke Welling :PHP and MySQL Web Development, Pearson Education; Fifth edition (2016)*
2. *Thomas A. Powell:HTML& CSS: The Complete Reference, Fifth Edition, McGraw Hill Education;5th edition (2017)*

Web Resources:

1. *https://github.com/MilanAryal/web-development-resources*
2. *https://github.com/bmorelli25/Become-A-Full-Stack-Web-Developer*
3. *https://github.com/JacobWylie/Web-Dev-Learning-Resources*
4. https://www.w3schools.com/**MOOC***NPTEL Course on Internet Technology : http://nptel.ac.in/courses/106105084/*

CSCE 616 NETWORK MANAGEMENT LAB

L	T	P	C
0	0	2	2

Skills to be acquired:

- *Basics of protocols*

Lab Software Requirements:

- *Open source network management tools*

Course Outcome:

- *Implement System Administration: User/Group management, File System Management*
- *Perform Network Configuration: Start/Stop network Service, network interface configuration*
- *Choose Firewall Configuration*

List of Exercises:

1. Server/Client Installation over VMware Environment
2. Packet Analysis by using TCPDUMP and WIRESHARK
3. Network Practice with Packet Tracer
4. System Administration: User/Group management, File System Management ….
5. Network Configuration: Start/Stop network Service, network interface configuration
6. Firewall Configuration
7. DNS and DHCP Configuration and Troubleshooting
8. Web and Proxy Server Configuration and Troubleshooting
9. Basic Mail Server Configuration and Troubleshooting
10. SAMBA, NFS, CUPS and FTP configuration and Troubleshooting
11. Webmin/ SSH configurations

CSCE 617 WEB TECHNOLOGY LAB

L	T	P	C
0	0	2	2

Skills to be acquired:

- *Designing and developing web pages / applications.*

Lab Software Requirements:

- *Open Source Web Development tools.*

Course Outcome:

- *Perform client side development skills.*
- *Implement server side development skills.*
- *Implement rich internet applications*
- *Develop secure applications*

List of Exercises:

1. Exercises to make the student acquire client side development skills.
2. Exercises to make the student acquire server side development skills.
3. Exercises to make the student acquire Rich Internet Application development skills.
4. Exercises to make the student acquire skills related with making the applications secure.

CSCE 621 GRAPH THEORY WITH APPLICATIONS TO ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic knowledge in graphs*

Objectives:

- *To introduce graphs as a powerful modelling tool*
- *To solve practical problems using graph theory*
- *To understand colouring and planar graphs*
- To learn network connectivity using graphs

Course Outcome:

- *Implement graphs as a powerful modelling tool*
- *Explain various algorithms*
- *Implement practical problems in various fields*
- *Perform matching and connectivity in many applications*

Module-I: **9 hrs**

Graph Theory Introduction: Introduction Of Graph and sub graphs - Graph Isomorphism – Representation – Degree- Paths and Connection, Cycles, Trees – Cut Edges – Cut vertices – Gayley's Formula- Connector Problem – Euler's and Hamiltonian Cycles.

Module-II: **9 hrs**

Matching and Connectivity: Matching – Covering in Bipartite graphs – Perfect Matching – Personal Assignment Problem – Optimal Assignment Problem. Connectivity- Blocks – Construction of Reliable communication Networks.

Module-III: **9 hrs**

Planar Graphs and Colouring: Planar Graphs – Dual Graphs - Euler's Formula – Kurotowski's Theorem - Applications. Edge Colouring- Vertex Colouring

Module-IV: **9 hrs**

Directed graphs: Concepts-Directed walks-paths-cycles-orientation of graph-Job Sequencing problem- Applications

Module-V: **9 hrs**

Network: Flows – Cuts- Max-Flow Min Cut Theorem – Feasible Flows.

Textbook(s):

1. *R J Wilson, Introduction to Graph Theory, 2010, 5th Edition, Pearson Education.*
2. *J.A Bondy and U.S.R Murthy, Graph Theory with Applications, Macmillan, 1976.*

Reference Book(s):

1. *Reinhard Diestel, Graph Theory ,2000, 2nd Edition, Springer- Verlag.*
2. *Jay Yellen, Jonathan L.Gross, Graph Theory and Its Applications ,3rd edition, CRC Press LLC.*
3. *NarsinghDeo, Graph Theory: With Application to Engineering and Computer Science,2003, Prentice Hall of India.*

CSCE 623 DATA MINING AND BIG DATA

L	T	P	C
3	0	0	3

Pre-requisite:

- *Knowledge in Artificial Intelligence*

Objectives:

- *To understand the computational approaches to Mining*
- *To understand the need and application of Map Reduce*
- *To understand the various search algorithms applicable to Big Data*
- *To analyse and interpret streaming data*

Course Outcome:

- *Identify the computational approaches to Mining*
- *Identify the need and application of Map Reduce*
- *Explain various search algorithms applicable to Big Data*
- *Analyse and interpret streaming data*

Module-I: **9 hrs**

Introduction to data mining: Data mining-KDD versus data mining, Stages of the Data Mining Process-task primitives, Data Mining Techniques, Data Pre-processing-Data Warehouse and OLAP.

Module-II: **9 hrs**

Association Rule Mining Algorithms and Classification: Basic Concepts- Frequent Itemset Mining Methods and Association Algorithms- Decision Tree Induction - Bayesian Classification – Rule Based Classification. Advanced Methods: Classification by Back propagation- Support Vector Machines – Associative Classification – Lazy Learners.

Module-III: **9 hrs**

Clustering: Clustering techniques, Partitioning methods- k-means- Hierarchical Methods – distance based agglomerative and divisible clustering, Density-Based Methods - Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis.

Module-IV: **9 hrs**

Introduction to Big Data and Hadoop: Big data Basics-Characteristics-Importance-Processing techniques- Big Data Analytics – computing Technologies-Applications. Hadoop: Analysing data with Hadoop, Hadoop Echo System. HDFS:basics-Architecture--no SQL-data ingest with Flume and Scoop. Mapreduce: Architecture, Anatomy of a map reduce job run, Job Scheduling, Shuffle and sort, Task execution, map reduce Types and Format.

Module-V: **9 hrs**

Applications: Mining complex data objects – Spatial databases – Temporal databases – Multimedia databases – Time series and sequence data – Text mining – Web mining –Case study- Mining social networks.

Text Book(s):

1. *Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, "Mining of Massive Datasets",*
   Cambridge University Press, Second Edition, 2014.
2. *Jiawei Han, MichelineKamber, Jian Pei, "Data Mining Concepts and Techniques", Morgan Kaufman Publications, Third Edition, 2011.*
3. *V.K. Jain, "Big data and Hadoop", Khanna Book Co.(P). LTD.Publishing,2017.*
4. *Tom White "Hadoop: The Definitive Guide" Third Edition, O'reily Media, 2012*
5. *Seema Acharya, Subhasini Chellappan, "Big Data Analytics" First Edition, Wiley 2015.*

CSCE 624 MOBILE AND PERVASIVE COMPUTING

L	T	P	C
3	0	0	3

Pre-requisite:

- *Knowledge of Computer Networks*

Objectives:

- *To Learn the underlying engineering principles*
- *To implement pervasive computing work.*
- *To get an in-depth understanding about the most dynamic technologies*
- *To understand security issues in mobile & pervasive computing.*

Course Outcome:

- *Identify the underlying engineering principles that make pervasive computing work.*
- *Define the most dynamic technologies like mobile computing, service discovery*
- *Explain computing and security issues in mobile & pervasive computing.*
- *Implement and analyse pervasive techniques.*

Module-I: 9 hrs

Introduction to Mobile Computing: Theory of Mobile Computing: Mobile Adaptive Computing – Adaptability – Mechanics of Adaptation – Mobility Management- Data Dissemination and Management – Challenges – Mobile Data Caching – Mobile Cache maintenance schemes – Mobile Web caching

Module-II: 10 hrs

Context Aware Computing: Context aware Computing – Ubiquitous Vs. pervasive Computing – Context aware computing and applications – Middleware support – Mobile middleware – Adaptation – Mobile Agents – Service discovery middleware.

Module-III: 8 hrs

Adhoc& Sensor networks: Introduction to Adhoc& Sensor networks- Properties of adhoc networks – Features of sensor networks – proposed application and challenges.

Module-IV: 9 hrs

Protocols: Protocols – Autoconfiguration – Energy efficient communications – Mobility requirements – Deployment and configuration - Routing – Fault Tolerance and Reliability- Energy efficiency.

Module-V: 9 hrs

Wireless Security: Mobile and Wireless security issues – problems in adhoc networks – additional issues: commerce , Types of attacks - Approaches to security – Limit the signal – encryption – integrity codes – IPSec - Authentication Protocols

Text Book(s):

1. *Frank Adelstein, Sandeep K.S. Gupta, Golden G Richard, Loren schwieber,, Fundamentals of Mobile and Pervasive Computing , Tata McGraw Hill edition , 2005.*

Reference Book(s):

1. *Asoke K. Talukar, Mobile Computing, Second Edition, Tata McGraw-Hill Publication, 2010*

CSCE 625 ADVANCED OPERATIG SYSTEM

L	T	P	C
3	0	0	3

Pre-requisite:

- *Knowledge On Operating System*

Objectives:

- *To study and understand the structure of OS*
- *To understand the design level issues of OS.*
- *To learn the trends in building Distributed and Mobile OS*
- *To understand mobile operating system*

Course Outcome:

- *Analyse the working of operating systems*
- *Explain the process and memory management*
- *Implement applications in mobile operating systems*
- *Define trends in building distributed OS*

Module-I: **9 hrs**

Operating System Architectures - Structures of OS - OS design issues - Process synchronization - Process Scheduling - Memory Management.

Module-II: 9 **hrs**

Distributed Operating Systems: System Architectures - Design issues - Communication models - Clock Synchronization - Mutual Exclusion - Election algorithms - Distributed Deadlock detection

Module-III: **9 hrs**

Distributed scheduling - Distributed shared memory - Distributed File System - Multimedia File Systems - File placement – Caching.

Module-IV: **9 hrs**

Database Operating Systems: Requirements of Database OS - Transaction process model - Synchronization primitives - Concurrency Control Algorithms.

Module-V: **9 hrs**

Mobile Operating Systems: ARM and Intel Architectures - Power Management -Mobile OS Architectures -Underlying OS -Kernel Structure and Native Level Programming -Runtime issues-Approaches to Power Management.

Text Book(s):

1. A.S.Tanenbaum, Distributed Operating Systems, Pearson Education Asia, 2001.
2. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts. Sixth edition. Addison-Wesley (2003)
3. Operating System Concepts (8th Edition)bySilberschatz, Peter B. Galvin and Greg Gagne, Wiley-Indian Edition (2010).
4.Modern Operating Systems (Third Edition) by Andrew S Tanenbaum, Prentice Hall India (2008).
5.Principles of Operating Systems by Nareshchauhan, Oxford Press (2014).
6.Operating Systems by D.M. Dhamdhere, Tata McGraw Hill 2nd edition.
7. Operating Systems (5^{th}Ed) –Internals and Design Principles by William Stallings, Prentice Hall India, 2000.

CSCE 627 DATA MINING LAB

L	T	P	C
0	0	2	2

Skills to be acquired:

- *Implementation of data mining algorithms*
- *Implementation of big data mining concepts*

List of S/W requirements:

- *Hadoop, spark*
- *Weka, R language, Python*

Course Outcome:

- *Implement data mining algorithms.*
- *Demonstrate working of clustering*
- *Implement classification algorithms.*

List of exercise:

- *Implementing classification and clustering algorithms*
- *Analysis of the algorithms*
- *Implementing mining algorithms on data streams*

CSCE 628 PERVASIVE COMPUTING LAB

L	T	P	C
0	0	2	2

Skills to be acquired:

- *To understand and use the fundamentals of programming for mobile devices.*
- *To apply event-driven programming and graphical user interfaces for mobile device*

Lab Software Requirements:

- *Open Source Development tools.*
- *J2ME*
- *NS3*

Course Outcome:

- *Explain the fundamentals of programming for mobile devices.*
- *Implement event-driven programming*
- *Implement graphical user interfaces for mobile device*

List of Exercises:

- Study of mobile application development platform and tools.
- Design and develop pervasive applications

CSCE 811 BIG DATA TECHNOLOGIES

L	T	P	C
3	0	0	3

Prerequisite:

- *Basic knowledge in programming concepts*

Objectives:

- *To provide practical foundation level training in big data projects.*
- *To provide grounding in basic big data technology*
- *To learn advanced methods and tool in big data*
- *To understand Hadoop architecture*

Course Outcome:

- *Recognize big data projects.*
- *Implement big data technology and tools*
- *Demonstrate MapReduce and Hadoop and its ecosystem*
- *Implement a sample system using Hadoop.*

Module-I: 9 hrs

Introduction to Big Data: Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

Module-II: 9 hrs

Introduction to Hadoop: Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

Module-III: 9 hrs

Hadoop Architecture: Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

Module-IV: 9 hrs

Hadoop Ecosystem and Yarn: Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New Features Name Node- High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

Module-V: 9 hrs

HIVE and HIVEQL, HBASE: Hive Architecture and Installation, Comparison with Traditional Database, HiveQL – Querying- Data - Sorting And Aggregating, Map Reduce Scripts, Joins &Subqueries, HBase concepts Advanced-Usage, Schema Design, Advance Indexing.

Reference(s):

1. *Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions",First Edition, Wiley, ISBN: 9788126551071, 2015.*
2. Chris Eaton, Dirk derooset al. , "Understanding Big data ", McGraw Hill, 2012.
3. Tom White, "HADOOP: The definitive Guide" , O Reilly 2012.
4. VigneshPrajapati, "Big Data Analytics with R and Haoop", Packet Publishing 2013.
5. Tom Plunkett, Brian Macdonald et al, "Oracle Big Data Handbook", Oracle Press, 2014.
6. http://www.bigdatauniversity.com/
7. JyLiebowitz, "Big Data and Business analytics",CRC press, 2013.

CSCE 812 STATISTICS FOR DATA ANALYTICS

L	T	P	C
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Prerequisite:

- *Basic Knowledge on probability and statics*

Objectives:

- *To teach fundamental concepts*
- *To tools needed for data analytics*
- *To understand the emerging role of business analytics in organizations.*
- *To Learn predictive analytics*

Course Outcome:

- *Explain hypothesis testing*
- *Define predictive analytics*
- *Implement fundamental concepts and tools*
- *Perform business analytics in organizations.*

Module –I: 9 hrs

Data Analytics Life Cycle: Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists- Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables for stakeholders.

Module –II 9 hrs

Statistics: Sampling Techniques - Data classification, Tabulation, Frequency and Graphic representation -Measures of central value - Arithmetic mean, Geometric mean, Harmonic mean, Mode, Median,Quartiles, Deciles, Percentile - Measures of variation – Range, IQR, Quartile deviation, Mean deviation, standard deviation, coefficient variance, skewness, Moments & Kurtosis.

Module –III 9 hrs

Probability and Hypothesis Testing: Random variable, distributions - Some special probability distribution - Binomial, Poison, Geometric, uniform, exponential, normal and gamma Multivariate normal distribution – Sampling distribuition – Estimation - point, confidence - Test of significance, 1& 2 tailed test, uses of t distribution, F-distribution, $\chi 2$ distribution.

Module –IV 9 hrs

Predictive Analytics: Predictive modeling and Analyisis - Regression Analyisis, Multicollinearity , Correlation analysis, Rank Correlation coefficient, Multiple correlation, Least square, Curve fitting and good ness of fit.

Module –V 9 hrs

Design Of Experiments: one way Classification, two way classification, ANOVA, Latin square, Factorial Design.

Reference book(s):

1. *Chris Eaton, Dirk Deroos, Tom Deutsch et al., "Understanding Big Data", McGrawHIll,2012.*
2. *Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014.*
3. *Eric Siegel, Thomas H. Davenport, "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die", Wiley, 2013.*
4. *James R Evans, "Business Analytics – Methods, Models and Decisions", Pearson 2013.*
5. *R. N. Prasad, Seema Acharya, "Fundamentals of Business Analytics", 2nd Edition, Wiley, 2015.*
6. *S M Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic Foundation, 2011.*
7. *David Hand, HeikiMannila, Padhria Smyth, "Principles of Data Mining", PHI 2013.*
8. *Spyros Makridakis, Steven C Wheelwright, Rob J Hyndman, "Forecasting methods and applications", Wiley 2013(Reprint).*
9. *David Hand, HeikkiMannila, Padhraic Smyth, "Principles of Data mining", PHI 2013.*

CSCE 813 MULTIVARIATE TECHNIQUES FOR DATA

L	T	P	C
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Prerequisite:

- *Basic knowledge in optimization techniques*

Objectives:

- *To introduce the students into the field of Multivariate Techniques*
- *To analyse large volumes of data*
- *To take decisions based on inference drawn.*
- *To learn linear programming problem*

Course Outcome:

- *Describe the field of Multivariate Techniques*
- *Explain large volumes of data*
- *Demonstrate decisions based on inference drawn.*
- *Implement linear programming problems*

Module-I: **9 hrs**

Introduction to Multivariate Analysis: Meaning of Multivariate Analysis, Measurements Scales - Metric measurement scales and Nonmetric measurement scales, Classification of multivariate techniques (Dependence Techniques and Inter- dependence Techniques), Applications of Multivariate Techniques in different disciplines.

Module-II: **9 hrs**

Factor Analysis: Meanings, Objectives and Assumptions, designing a factor analysis, deriving factors and assessing overall factors, Interpreting the factors and validation of factor analysis.

Module-III: **9 hrs**

Cluster Analysis: Objectives and Assumptions, Research design in cluster analysis, deriving clusters and assessing overall fit (Hierarchical methods, Non Hierarchical Methods and Combinations), Interpretation of clusters and validation of profiling of the clusters.

Module-IV: **9 hrs**

Linear Programming Problem: Introduction – Formulation of Linear Programming Model- Illustration on Mathematical Formulation of LPP – Graphical Solution – General LPP – Canonical and Standard forms of LPP **Optimization:** Introduction – Classification of Optimization Problems– Mathematical models in Optimization – Types of Optimization Models

Module-V: **9 hrs**

LPP Optimization: Graphical method, simplex method- Problems Applications simplex method, Big M Method, Transportation and Assignment problem. Problems - Applications

Reference(s):

1. Joseph F Hair, William C Black etal , "Multivariate Data Analysis" , Pearson Education, 8th edition, 2018.

2. T. W. Anderson , "An Introduction to Multivariate Statistical Analysis, 3rd Edition", Wiley, 2003.

3. William r Dillon, John Wiley & sons, "Multivariate Analysis methods and applications", First Edition, Wiley, 1984.

4. Naresh K Malhotra, Satyabhusan Dash, "Marketing Research Anapplied Orientation", Pearson, Seventh Edition, 2011.

5. Hamdy A Taha, "Operations Research", Pearson, Tenth Edition, 2012.

6. S R Yaday, A K Malik, "Operations Research", Oxford, 2014.

CSCE 814 DATA MINING AND DATA ANALYSIS

L	T	P	C
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Prerequisite:

- *Basic knowledge in statistics*

Objectives:

- *To learn data mining techniques.*
- *To understand Data mining techniques and algorithms.*
- *To comprehend the data mining environments and application.*
- *To learn prediction of quantitative variables*

Course Outcome:

- *Define data analysis techniques.*
- *Explain Data mining techniques and algorithms.*
- *Recognize data mining environments and application*.
- *Identify prediction of quantitative variables*

Module-I: 9 hrs

Introduction To Data Mining: Data mining-KDD versus data mining, Stages of the Data Mining Process Task primitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages- Integration of a Data Mining System with a Data Warehouse – Issues, Data pre-processing – Data cleaning – Data transformation - Feature selection – Dimensionality reduction – Discretization and generating concept hierarchies-Mining frequent pattern association - correlation.

Module-II: 9 hrs

Classification and Clustering: Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Clustering techniques – Partitioning methods- k-means- Hierarchical Methods – Distance based agglomerative and divisible clustering - Density-Based Methods – Expectation maximization -Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis.

Module-III: 9 hrs

Data Mining Software and Applications: Mining complex data objects - Spatial databases, temporal databases, Multimedia databases- Time series and Sequence data - Text Mining – Graph mining-Web mining-Application and trends in data mining.

Module-IV: 9 hrs

Prediction of Quantitative Variables: Prediction of quantitative variables – Non Parametric estimation – Logical regression – Projection pursuit – Inferential aspects – Regression trees – Neural networks – Case studies.

Module-V: **9 hrs**

Methods of Internal Analysis: Methods of Internal analysis – Cluster analysis – Association among variables – Web mining analysis. Data Analytics – Simulated data – Mathematical statistic analysis – Applications of probability theory – Linear models – Case study.

Reference Book(s):

1. *AdelchiAzzalini, Bruno Scapa, "Data Analysis and Data mining", 2nd Edition, Oxford University Press Inc., 2012.*
2. *Jiawei Han and MichelineKamber, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kaufmann Publishers, 2011.*
3. *Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", 10th Edition, TataMcGraw Hill Edition, 2007.*
4. *G. K. Gupta, "Introduction to Data Mining with Case Studies", 1st Edition, Easter Economy Edition, PHI, 2006.*

CSCE 815 MACHINE LEARNING

Prerequisite:

- *Basic knowledge in AI, algorithm design, basics of probability & statistics*

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Objectives:

- *To understand the machine learning theory*
- *To implement linear and non-linear learning models*
- *To implement distance-based clustering techniques*
- *To build tree and rule based models*

Course Outcome:

- *Evaluate machine learning theory in problem solving*
- *Implement linear and non-linear learning models*
- *Implement distance-based clustering techniques*
- *Demonstrate tree and rule based models*
- *Explain reinforcement learning techniques*

Module-I: **9 hrs**

Introduction – machine learning applications – Basic definitions- types of learning: unsupervised learning – Reinforcement Learning – Supervised Learning – Learning a class from examples – hypothesis space and inductive bias- Vapnik-Chervonenkis (VC) Dimension – Probably Approximately Correct (PAC) Learning – Noise – Learning multiple classes – Model selection and Generalization-Evaluation and Cross validation.

Module-II: **9 hrs**

Linear Regression-Introduction to decision trees-Learning decision trees-Issues-Pruning-Overfitting-k_Nearest neighbour-Feature selection: Metrics-Feature Reduction: Dimensionality reduction – Subset selection – Principal component analysis – Factor analysis – Multidimensional scaling – Linear discriminant analysis.

Module-III: **9 hrs**

Bayesian Learning-Bayes theorem-Maximum Likelihood-Bayes optimal classifier-Gibbs Algorithm-Naïve Bayes Classifier- Bayesian Belief networks-Clustering: Mixture Densities – K Means Clustering – Expectation Maximization – Hierarchical clustering.

Module-IV: **9 hrs**

Linear Discrimination – Linear Model – Geometry of the Linear Discriminant – Pairwise Separation – Gradient Descent – Logistic Discrimination – Discrimination by Regression – Multilayer Perceptrons: Introduction – Perceptron – Training a Perceptron – Learning Boolean Functions – Multilayer Perceptrons – Backpropagation Algorithm.

Module-V: **9 hrs**

Kernel Machines – SVM-Optimal Separating Hyperplane – kernel trick –Hidden Markov Models – Evaluation-Model selection –Introduction to Ensembles- Bagging – Boosting.

Reference Book(s):

1. *Ethem Alpaydin, Introduction to Machine Learning, Third Edition, PHI, 2014.*
2. *Tom M. Mitchell, Machine Learning, Mc Graw Hill, 2003.*

CSCE 816 DEEP LEARNING

L	T	P	C
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Prerequisite:

- *Basic knowledge in machine learning*

Objectives:

- *To provide knowledge about deep learning based solutions*
- *To introduce major deep learning algorithms*
- *To learn problem settings*
- *To learn deep learning applications to solve real world problems.*

Course Outcome:

- List deep learning based solutions.
- Define major deep learning algorithms
- Recognise the problem settings
- Implement deep learning applications

Module-I: **9 hrs**

Building Intelligent Machines: Limitations - Mechanics of Machine Learning - Neuron - Feed-Forward Neural Networks - Linear Neurons and Their Limitations - Sigmoid, Tanh, and ReLU Neurons – Softmax Output Layers. **Training Feed-Forward Neural Networks** - The Fast-Food Problem - Gradient Descent - Delta Rule and Learning Rates - Gradient Descent with Sigmoidal Neurons - Backpropagation Algorithm - Stochastic and Minibatch Gradient Descent - Test Sets, Validation Sets, and Overfitting - Preventing Overfitting in Deep Neural Networks.

Module-II: **9 hrs**

Implementing Neural Networks in Tensor Flow: Introduction – installation- creation and manipulation – operations – placeholder tensor – Sessions – Variables – Logistic Regression Model - Visualization – multilayer model. **Beyond Gradient Descent:** Challenges - Local Minima in the Error Surfaces of Deep Networks - Model Identifiability - Flat Regions in the Error Surface- Momentum-Based Optimization - Second-Order Methods - Learning Rate Adaptation – AdaGrad – RMSProp – Adam - Optimizer Selection.

Module-III: **9 hrs**

Convolutional Neural Networks: Neurons in Human Vision - The Shortcomings of Feature Selection - Filters and Feature Maps - Convolutional Layer- Max Pooling - Architectural Description - MNIST with Convolutional Networks. **Models for Sequence Analysis:** Recurrent Neural Networks - The Challenges with Vanishing Gradients - Long Short-Term Memory (LSTM) - RNN and GRU Models.

Module-IV: **9 hrs**

Deep Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines-Adversarial Generative Networks. **Deep Unsupervised Learning:** Autoencoders (standard, sparse, denoising, contractive)-Applications.

Module-V: **9 hrs**

Deep Learning research: Object recognition, sentiment analysis, computer vision, natural language processing. Deep Learning Tools: Caffe, Theano, Torch.

Reference Book(s):

1. *Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep learning, MIT Press, 2016.*
2. *Nikhil Buduma, Fundamentals of Deep Learning, Designing Next Generation Machine Intelligence Algorithms, O'Reilly publications, June 2017.*
3. *EthemAlpaydin, Introduction to Machine Learning,, Second Edition, PHI,2010.*
4. *Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995.*
5. *Bengio, Yoshua. Learning deep architectures for AI. Foundations and trends in Machine Learning, now publishers,2009.*

CSCE 821 SOFTWARE TESTING

L	T	P	C
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Pre-requisite:

- *Knowledge in Software Engineering*

Objectives:

- *To know the behaviour of the testing techniques to detect the errors in the software.*
- *To understand standard principles to check the occurrence of defects and its removal.*
- *To learn the functionality of automated testing tools.*
- *To understand the models of software reliability.*

Course Outcome:

- *Perform testing techniques to detect the errors in the software.*
- *Choose standard principles to check the occurrence of defects and its removal.*
- *Recognize automated testing tools.*
- *Choose software metrics.*

Module-I: 9 hrs

Testing Environment and Test Processes: World-Class Software Testing Model – Building a Software Testing Environment. **The Seven Step Testing process**: Overview of Software Testing Process – Organizing for Testing – Developing the Test Plan – Verification Testing – Analysing and Reporting Test Results – Acceptance Testing – Operational Testing – Post Implementation Analysis.

Module-II: 9 hrs

Testing Techniques and Levels of testing: Using White Box Approach to Test design - Static Testing Vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs –Using Black Box Approaches to Test Case Design – Random Testing – Requirements based testing –Decision tables –State-based testing – Cause-effect graphing – Error guessing – Compatibility testing – Levels of Testing - Unit Testing - Integration Testing - Defect Bash Elimination. System Testing - Usability and Accessibility Testing – Configuration Testing - Compatibility Testing - Case study for White box testing and Black box testing techniques.

Module-III: 9 hrs

Incorporating Specialized Testing Responsibilities: Testing Client/Server Systems – Rapid Application Development Testing – Testing in a Multiplatform Environment – Testing Software System Security - Testing Object-Oriented Software – Object Oriented Testing – Testing Web based systems – Web based system – Web Technology Evolution – Traditional Software and Web based Software – Challenges in Testing for Web-based Software –Testing a Data Warehouse - Case Study for Web Application Testing.

Module-IV: 9 hrs

Test Automation: Selecting and Installing Software Testing Tools - Software Test Automation – Skills needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Tracking the Bug – Debugging – Case study using Bug Tracking Tool.

Module-V: **9 hrs**

Software Testing and Quality Metrics: Testing Software System Security - Six-Sigma – TQM - Complexity Metrics and Models – Quality Management Metrics - Availability Metrics - Defect Removal Effectiveness - FMEA - Quality Function Deployment – Taguchi Quality Loss Function – Cost of Quality. Case Study for Complexity and Object Oriented Metrics

Laboratory Components:

Skills to be acquired:

- *Test generation from requirement*
- *Test generation from models.*
- *Test process and continuous quality improvement*

List of Exercises:

1. Cause Effect Graph Testing for a Triangle Program.
2. Boundary Value Analysis for a Software Unit
3. Cyclomatic Complexity for Binary Search
4. Data Flow Testing for Gregorian Calendar
5. State based Testing for an Assembler
6. Stress Testing of a Map-Aided Vehicle Tracking and Scheduling System
7. Model Based Testing
8. Web Application Testing for Student Grade System

Text Book(s):

1. *William Perry, "Effective Methods of Software Testing", Third Edition, Wiley Publishing 2007*
2. *Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2007.*

Reference Book(s):

1. *NareshChauhan, "Software Testing Principles and Practices" Oxford University Press, New Delhi, 2010.*
2. *Dale H. Besterfiled et al., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).*
3. *Stephen Kan, "Metrics and Models in Software Quality", Addison – Wesley, Second Edition, 2004*
4. *LleneBurnstein, " Practical Software Testing", Springer International Edition, Chennai, 2003*
5. *RenuRajani,Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques", Tata McGraw Hill,2004*
6. *Edward Kit, "Software Testing in the Real World – Improving the Process", Pearson Education, 1995.*
7. *Boris Beizer, " Software Testing Techniques" – 2 nd Edition, Van Nostrand Reinhold, New York, 1990*
8. *Adithya P. Mathur, "Foundations of Software Testing – Fundamentals algorithms and techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.*

CSCE 822 AGILE SOFTWARE PROCESS

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Pre-requisite:

- *Knowledge in Software Engineering*

Objectives:

- *To understand the basic concepts of Agile Software Process*
- *To gain knowledge in the area of various Agile Methodologies.*
- *To develop Agile Software Process*
- *To know the principles of Agile Testing*

Course Outcome:

- *Perform Agile Software Process development*
- *Implement various Agile Methodologies.*
- *List the Agile Software Process*
- *Explain the principles of Agile Testing*

Module-I: 9 hrs

Introduction: Iterative development- Risk-Driven and Client-Driven iterative planning – Time boxed iterative development – During the iteration, No changes from external stakeholders – Evolutionary and adaptive development - Evolutionary requirements analysis – Early "Top Ten" high-level requirements and skillful analysis – Evolutionary and adaptive planning –Incremental delivery – Evolutionary delivery – The most common mistake – Specific iterative and Evolutionary methods.

Module-II: 9 hrs

Agile and Its Significance: Agile development-Classification of methods – The agile manifesto and principles – Agile project management – Embrace communication and feedback –Simple practices and project tools – Empirical Vs defined and prescriptive process – Principle-based versus Rule-Based – Sustainable discipline: The human touch – Team as a complex adaptive system – Agile hype – Specific agile methods. **Motivation:** The facts of change on software projects – Key motivations for iterative development – Meeting the requirements challenge iteratively – Problems with the waterfall. **Evidence:** Research evidence – Early historical project evidence – Standards-Body evidence – Expert and thought leader evidence – A Business case for iterative development – The historical accident of waterfall validity.

Module-III: 9 hrs

Agile Methodology: Scrum-Method overview – Lifecycle – Work products, Roles and Practices values –Common mistakes and misunderstandings – Sample projects – Process mixtures– Adoption strategies – Fact versus fantasy –Strengths versus "Other" history.

Module-IV: 9 hrs

Case Study: Agile – Motivation – Evidence – Scrum – Extreme Programming – Unified Process –Evo– Practice Tips.

Module-V: **9 hrs**

Agile Practice: Project management – Environment – Requirements – Test – The agile alliances –The manifesto – Supporting the values.

Agile testing: Nine principles and sixconcrete/ practices for testing on agile teams.

Text Book(s):

1. *Craig Larman"Agile and Iterative Development – A Manager's Guide"Pearson Education – 2004.*
2. *Elisabeth Hendrickson, "Agile Testing" Quality Tree Software Inc 2008.*

Reference *Book(s):*

1. *Alistair "Agile Software Development series" Cockburn - 2001.*
2. *Robert C. Martin, Agile Software Development, Principles, Patterns, and Practices, Prentice Hall (2002).*

Web *Resources:*

1. ***www.****agileintro.wordpress.com/2008:Agile Introduction For Dummies*
2. *www.serena.com/docs/repository/solutions/intro-to-agile-devel.pdf:An Introduction to Agile Software Development*

CSCE 823 SOFTWARE RISK MANAGEMENT AND MAINTENANCE

L	T	P	C
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Pre-requisite:

- *Knowledge in Software Engineering*

Objectives:

- *To understand the various risk levels in software development.*
- *To gain expertise in discovering risk and usage of risk assessment tools*
- *To understand the risk plan, implementation and tracking risks*
- *To realize the software maintenance process, measurement and benchmarking*
- *To expertise in the SQA maintenance tools*

Course Outcome:

- *Explain the various risk levels in software development.*
- *Define risk plan*
- *Implement tracking risks.*
- *Demonstrate SQA maintenance tools*

Module-I: 9 hrs

Risk Culture and Management Process: Risk- Basic Terms- Risk Vocabulary – Risk-Driven Project Management- Controlling the Process, Environment and Risk- Maturity in Risk Culture – Risk Scale – Preparing for Risk – Risk Management- Paradigms- Five Models of Risk Management – Thinking about Less Risky alternatives – Risk Management at Different Levels – Risk Escalation – Risk Models- Risk Intelligence - Software Risk Management steps.

Module-II: 9 hrs

Discovering Risk and Assessment: Identifying software risk - Classification of Risks – Risk Taxonomy – Risk Mapping – Statements – Risk Reviews – Risk Ownership and stakeholder management – Risk Assessment Approach – Risk Assessment tools and techniques – Risk Probability, impact, exposure, matrix and Application Problem - Self - assessment checklist.

Module-III: 9 hrs

Responding to Risks and Tracking: Special Treatment for Catastrophic risks- Constraint Risks – Risk Mitigation Plan Case Study – Contingency Plans- Implementing Risk Response- Tracking Risk Response and Hazards – Trigger Levels- Tracking Project Risks and Operational Risks- Learning by Tracking and Risk Tracker Tool.

Module-IV: 9 hrs

Maintenance Process: Software Maintenance- Customer's Viewpoint- Economics of Maintenance- Issues in Maintenance- Software Maintenance Standard, Process, Activities and Categories – Maintenance Measurement – Service Measurement and Benchmarking – Problem Resolution – Reporting – Fix Distribution.

Module-V: **9 hrs**

Activities for Maintenance: Role of SQA for Support and Maintenance – SQA tools for Maintenance- Configuration Management and Maintenance – Maintenance of Mission Critical Systems – Global Maintenance Teams – Foundation of S3m Process Model-Exemplary Practices.

Text Book(s):

1. *C. RavindranathPandian, "Applied Software Risk Management: A guide for Software Project Managers", Auerbach Publications, 2007.*
2. *John Mcmanus, "Risk Management in Software Development Projects", Elsevier Butterworth- Heinemann, First Edition, 2004.*

Reference Book(s):

1. *Alian April and Alain Abran, "Software Maintenance Management: Evaluation and Continuous Improvement", John Wiley & Sons Inc, 2008*
2. *Gopalaswamy Ramesh and Ramesh Bhattiprolu, "Software Maintenance: Effective Practices for Geographically Distributed Environments", Second Reprint, Tata McGrawHill, 2009.*

CSCE 824 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
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Pre-requisite:

- *Knowledge in Software Engineering*

Objectives:

- *To provide the students with an overall view over Software Engineering*
- *To understand the various methods of Cost Estimation.*
- *To Study about Software Quality Management.*
- *To Study about Software Metrics*

Course Outcome:

- *Describe the various methods of Cost Estimation.*
- *Explain Software Quality Management.*
- *List the use software metrics*
- *Explain software cost estimation*

Module-I: 8 hrs

Project Concepts and Its Management: Project life cycle models-ISO 9001 model - Capability Maturity Model - Project, Planning-Project tracking-Project closure - Evolution of Software Economics –Software. **Management Process Framework:** Phases, Artifacts, Workflows, Checkpoints – Software Management Disciplines: Planning / Project Organization and Responsibilities / Automation / Project Control – Modern Project.

Module-II: 8 hrs

Cost Estimation: Problems in Software Estimation – Algorithmic Cost Estimation Process, Function, Points, SLIM (Software Life cycle Management), COCOMO II (Constructive Cost Model) – Estimating Web Application Development – Concepts of Finance, Activity Based Costing and Economic Value Added (EVA) – Balanced Score Card.

Module-III: 10 hrs

Software Quality Management: Software Quality Factors – Software Quality Components – Software Quality Plan– Software Quality Metrics – Software Quality Costs – Software Quality Assurance-Standard – Certification – Assessment.

Module-IV: 10 hrs

Software Management and Metrics: Software Configuration Management – Risk Management: Risk Assessment: Identification / Analysis / Prioritization – Risk Control: Planning / Resolution /Monitoring – Failure Mode and Effects Analysis (FMEA) –Defect Management-Cost Management. Software Metrics – Classification of Software Metrics: Product-Metrics: Size Metrics, Complexity Metrics, Halstead's Product Metrics, Quality, Metrics, and Process metrics.

Module-V: 9 hrs

Project Evaluation and Emerging Trends: Strategic Assessment–Technical Assessment–Cost Benefit Analysis–Cash Flow Forecasting–Cost Benefit Evaluation Technique–Risk Evaluation–Software Effort Estimation. Emerging Trends: Import of the internet on project Management –people Focused Process Models.

Text Book(s):

1. *Ramesh Gopalaswamy,"Managing and global Software Projects", TataMcGraw Hill Tenth Reprint, 2011.*

Reference Book(s):

1. *Demarco, T. and Lister, T. "Peopleware: Productive Projects and Teams, 2ndEd.", Dorset House,1999.*
2. *Royce, W. "Software Project Management: A Unified Framework", Addison-Wesley, 1998. Demarco, T. and Lister, T. "Peopleware: Productive Projects and Teams, 2ndEd.", Dorset House,1999.*
3. *Fenton, N.E., and Pfleeger, S.L."Software Metrics: A Rigorous and PracticalApproach, Revised" Brooks Cole, 1998.*
4. *Kaplan, R.S., Norton, D.P. "The Balanced Scorecard: Translating Strategyinto Action", Harvard Business School Press, 1996.*

CSCE 825 SOFTWARE ARCHITECTURE

L	T	P	C
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Pre-requisite:

- *Knowledge in Software Engineering.*

Objectives:

- *To understand software architectural requirements and drivers.*
- *To be exposed to architectural styles and views.*
- *To be familiar with architectures for emerging technologies*
- *To understand documenting architecture*

Course Outcome:

- *Describe software architectural requirements and drivers.*
- *Explain architectural styles and views.*
- *Demonstrate emerging technologies*
- *Describe documenting architecture*

Module-I: 9 hrs

Introduction and Architectural Drivers: Introduction – What is software architecture? – Standard Definitions – Architectural structures – Influence of software architecture on organization-both business and technical – Architecture Business Cycle- Introduction – Functional requirements – Technical constraints – Quality Attributes.

Module-II: 9 hrs

Quality Attribute Workshop: Quality Attribute Workshop – Documenting Quality Attributes – Six part scenarios – Case studies.

Module-III: 9 hrs

Architectural Views: Introduction – Standard Definitions for views – Structures and views – Representing views-available notations – Standard views – 4+1 view of RUP, Siemens 4 views, SEI's perspectives and views – Case studies.

Module-IV: 9 hrs

Architectural Styles: Introduction – Data flow styles – Call-return styles – Shared Information styles – Event styles – Case studies for each style.

Module-V: 9 hrs

Documenting The Architecture: Good practices – Documenting the Views using UML – Merits and Demerits of using visual languages – Need for formal languages – Architectural Description Languages – ACME – Case studies. Special topics: SOA and Web services – Cloud Computing – Adaptive structures.

Text Book(s):

1. *Len Bass, Paul Clements, and Rick Kazman, "Software Architectures Principles and Practices", 2nd Edition, Addison-Wesley, 2003.*
2. *Anthony J Lattanze, "Architecting Software Intensive System. A Practitioner's Guide", Auerbach Publications, 2010.*

Reference Book(s):

1. *Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers, Reed Little, Paulo Merson, Robert Nord, and Judith Stafford, "Documenting Software Architectures. Views and Beyond", 2nd Edition, Addison-Wesley, 2010.*
2. *Paul Clements, Rick Kazman, and Mark Klein, "Evaluating software architectures: Methods and case studies. Addison-Wesley, 2001.*
3. *RajkumarBuyya, James Broberg, and Andrzej Goscinski, "Cloud Computing. Principles and Paradigms", John Wiley & Sons, 2011.*

CSCE 826 SOFTWARE QUALITY ASSURANCE

L	T	P	C
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Pre-requisite:

•Knowledge in Software Engineering

Objectives:

- *To understand the basic tenets of software quality and quality factors.*
- *To expose to the Software Quality Assurance (SQA) architecture*
- *To understand how the SQA components can be integrated.*
- *To be familiar with the software quality infrastructure.*
- *To be exposed to the management components of software quality.*

Course Outcome:

- *Explain the basic tenets of software quality and quality factors.*
- *Demonstrate how the SQA components can be integrated into the project life cycle.*
- *Describe software quality infrastructure*
- *Explain the software quality management concepts*

Module-I: 9 hrs

Introduction to Software Quality & Architecture: Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall‟s quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.

Module-II: 9 hrs

Sqa Components and Project Life Cycle:Software Development methodologies – Quality assurance activities in the development process - Verification & Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management

Module-III: 9 hrs

Software Quality Infrastructure: Procedures and work instructions - Templates - Checklists – 3S development team - Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval.

Module-IV: 9 hrs

Software Quality Management & Metrics: Project process control – Computerized tools - Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model

Module-V: **9 hrs**

Standards, Certifications & Assessments: Quality management standards – ISO 9001 and ISO 9000-3 – capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – IEEE st 1012 & 1028 – Organization of Quality Assurance – Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems

Text Book(s):

1.Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009.

Reference Book(s):

1.Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 1997.
2.Mordechai Ben-Menachem "Software Quality: Producing Practical Consistent Software", International Thompson Computer Press, 1997.

CSCE 831 COGNITIVE SCIENCE

L	S	P	C
3	0	0	3

Pre-requisite:

•Exposure to AI

Objectives:

- *To learn the basics of Cognitive Science with focus on acquisition,*
- *To representation, and use of knowledge by individual minds, brains, and machines*
- *To study the mind and intelligence, embracing psychology, artificial intelligence, neuroscience and linguistics*
- *To understand the role of neuro science in the cognitive field*

Course Outcome:

- *List Cognitive Science with focus on acquisition*
- *Describe the representation, and use of knowledge by individual minds, brains, and machines*
- *Perform neuroscience and linguistics based experiments.*
- *Implement the knowledge of neuro science in the cognitive field*

Module-I: **9 hrs**

Introduction to Cognitive Science: The Cognitive view –Some Fundamental Concepts – Computers in Cognitive Science – Applied Cognitive Science – The Interdisciplinary Nature of Cognitive Science

Module-II: **9 hrs**

Cognitive Psychology: Cognitive Psychology – The Architecture of the Mind - The Nature of Cognitive Psychology- A Global View of The Cognitive Architecture- Propositional Representation- Schematic Representation- Cognitive Processes, Working Memory, and Attention- The Acquisition of Skill- The Connectionist Approach to Cognitive Architecture

Module-III: **9 hrs**

Language Acquisition, Semantics and Processing Model: Milestones in Acquisition – Theoretical Perspectives- Semantics and Cognitive Science – Meaning and Entailment – Reference – Sense – Cognitive and Computational Models of Semantic Processing – Information Processing Models of the Mind- Physical symbol systems and language of thought- Applying the Symbolic Paradigm- Neural networks and distributed information processing- Neural network models of Cognitive Processes

Module-IV: **9 hrs**

Integration Challenge: Cognitive Science and Integration Challenge – Tackling the Integration Challenge.

Module-V: **9 hrs**

Tools: Working with Concept Maps – Scribe Note making tools

Text Book(s):

1.José Luis Bermúdez, "Cognitive Science: An Introduction to the Science of the Mind", 2014, Cambridge University Press, New York.
2.Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein, "Cognitive Science: An Introduction", 1995, Second Edition, MIT press.

CSCE 832 KNOWLEDGE REPRESENTATION AND REASONING

L	S	P	C
3	0	0	3

Pre-requisite:

•Exposure to AI and formal languages

Objectives:

- *To explore various representation n and formalisms*
- *To understand algorithms for reasoning.*
- *To understand the problem solving in knowledge engineering tools*
- *To understand protégé tool*

Course Outcome:

- *Explain various knowledge representation formalism in real world problem solving*
- *Describe knowledge engineering tools in problem solving*
- *Implement a knowledge based system using Protégé*.
- *Explain algorithms for reasoning*

Module-I: **9 hrs**

Introduction: Key concepts – Need of knowledge representation and reasoning – Role of Logic – First order Logic – Syntax- Semantics- Pragmatics – Explicit and Implicit Belief – Expressing Knowledge.

Module-II: **9 hrs**

Resolution: Propositional Case – Handling Variables and Quantifiers – Dealing with Computational Intractability – Reasoning with Horn Clauses –Horn Clauses- SLD Resolution – Computing SLD Derivations.

Module-III: **9 hrs**

Reasoning: Procedural control of Reasoning – Facts and Rules – Rule formation and Search Strategy – Algorithm Design – Backtrack control – Negation as Failure – Rules in Production Systems.

Module-IV: **9 hrs**

Representation: Object Oriented Representation – Object and Frames – Frame Formalism – Structured Descriptions – Description Language – Meaning and Entailment – Computing Entailments – Taxonomy and classification.

Module-V: **9 hrs**

Languages and Tools: Working with LISP, Prolog – RDF Tools – Ontology tools.

Text Book:

1. *Ronald J.Brachman and H.J.Levesque, Knowledge Representation and Reasoning, Elsevier, Morgan Kaufman Publishers, 2004.*

Reference Book(s):

1. Deepak Khemani, A First Course in Artificial Intelligence, 2013, First Edition, McGrawHill.

2. Stuart J Russell and Peter Norvig, Artificial Intelligence – A Modern Approach, 2009, Third Edition, PHI.

CSCE 833 COMPUTATIONAL INTELLIGENCE

L	S	P	C
3	0	0	3

Pre-requisite:

- *Knowledge in Algorithms*

Objectives:

- *To understand the fundamentals of key intelligent systems technologies*
- *To understand hybrid intelligent systems*
- *To understand evolutionary computation*
- *To practice in an integration of intelligent systems technologies for engineering applications.*

Course Outcome:

- *Explain the fundamentals of key intelligent systems technologies*
- *Describe neural networks, fuzzy systems, and evolutionary computation.*
- *Explain the hybrid intelligent systems*
- *List the integration of intelligent systems technologies for engineering applications.*

Module-I: 9 hrs

Introduction: Computational Intelligence: Intelligence machines -Computational intelligence paradigms –History- Expert Systems: Rule-based expert systems – Uncertainty management - Fuzzy expert systems: Fuzzy sets and operations of fuzzy sets - Fuzzy rules and fuzzy inference - Fuzzy expert systems

Module-II: 9 hrs

Artificial Neural Networks: Fundamental neurocomputing concepts: artificial neurons, activation functions, neural network architectures, learning rules - Supervised learning neural networks: multi-layer feedforward neural networks, simple recurrent neural networks, time-delay neural networks, supervised learning algorithms - Unsupervised learning neural networks: self-organizing feature maps - Radial basis function networks - Deep neural networks and learning algorithms

Module-III: 9 hrs

Evolutionary computation: Representation: Chromosomes-fitness functions- selection mechanisms -Genetic algorithms: crossover and mutation - Genetic programming

Module-IV: 9 hrs

Hybrid Intelligent Systems: Neural expert systems -Neuro-fuzzy systems -Evolutionary neural networks

Module-V: **9 hrs**

Applications and case studies: Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction-Case studies

Laboratory Components:
Skills to be acquired:

- *Gain a working knowledge of knowledge-based systems*
- *Understand neural networks, fuzzy systems, and evolutionary computation*
- *Apply intelligent systems technologies in a variety of engineering applications;*

Lab Software Requirements:

- *Implement typical computational intelligence algorithms in MATLAB*

Text Book:

1. *A.P. Engelbrecht, Computational Intelligence: An Introduction, 2012,2nd Edition, John Wiley & Sons.*

Reference Books:

1. *S.Rajasekaran and G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy logic and Genetic Algorithms-Synthesis and Applications, 2003, PHI Learning*
2. *Marsland S, Machine Learning: An Algorithmic Perspective, 2009, CRC Press.*
3. *S. Russell and P. Norvig, Artificial Intelligence – A Modern Approach,2010, Prentice Hall.*
4. *. J.S.R.Jang, C.T.Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, 2004, PHI, Pearson Education.*

CSCE 834 ARTIFICIAL INTELLIGENCE FOR AUTOMATION

Pre-requisite:

- *Knowledge about data structures and algorithms*

Objective:

- *To understand the various problem solving approaches*
- *To Understand the knowledge representation and reasoning techniques*
- *To Understand the handling of uncertain knowledge*

Outcome:

- *Apply search techniques to solve real world problems*
- *Explain the importance of knowledge representation*

Module-I: **8 hrs**

Introduction To Problem Solving :Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search. Informed (Heuristic) Search Strategies, Greedy best-first search, A* search, Heuristic Functions, The effect of heuristic accuracy on performance.

Module-II: **8 hrs**

Beyond Classical Search: Local Search Algorithms and Optimization Problems, Hillclimbing search, Simulated annealing, Local beam search, Genetic algorithms, Local Search in Continuous Spaces, Searching with Nondeterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environments.

Module-III: **8 hrs**

Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Semantic networks, Description logics, Reasoning with Default Information, Truth maintenance systems.

Module-IV: **8 hrs**

Uncertain knowledge and reasoning :Quantifying Uncertainty, Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Bayes' Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks, Inference by Markov chain simulation, Relational and First-Order Probability Models.

Module-V: **8 hrs**

Probabilistic Reasoning over Time: Time and Uncertainty, Inference in Temporal Models, Hidden Markov Models, Kalman Filters, Dynamic Bayesian Networks, Keeping Track of Many Objects, Combining Beliefs and Desires under Uncertainty, The Basis of Utility Theory, Utility Functions, Multiattribute Utility Functions, Decision Networks, The Value of Information, Expert system architecture.

Text Book(s):

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", PEARSON 3rd ed,2009.

Reference Book(s):

1. DAN.W.Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI, 2nd edition, 2009.

2. George.F.Luger, "Artificial Intelligence", Pearson Education, Asia, 3rd Edition,2009.

CSCE 835 NATURAL LANGUAGE PROCESSING

L	S	P	C
3	0	0	3

***Pre-requisite**:*

- *Knowledge of Programming Logic and Proof and Machine Learning*

Objectives:

- *To be able to tag a given word with basic language processing features*
- *To be able to discuss the current and likely future performance of several NLP applications;*
- *To be able to describe briefly a fundamental technique for processing language for several subtasks, such as morphological processing, parsing, word sense disambiguation etc.*
- *To understand how these techniques draw on and relate to other areas of Computer Science.*

Course Outcome:

- *Describe the current and likely future performance of several NLP applications.*
- *Explain how these techniques draw on and relate to other areas of Computer Science.*
- *Describe the processing language for subtasks*
- *List the language processing features*

Module-I: **9hrs**

Introduction to NLP : Knowledge in Speech and Language Processing -–Information Theory- Ambiguity Models and Algorithms, Language : N-gram Language Models - Evaluating Language Models, Thought and Understanding - The State of the Art and the Near term Future

Module-II: **9hrs**

Speech Tagging and Transducers: Part of Speech Tagging, Probability Basics: Hidden Markov - Maximum Entropy Models, Word Transducers: Finite State Transducers - Orthographic Rules - Finite-State Transducers Combining FST Lexicon Rules, Lexicon Free FSTs: The Porter Stemmer Human Morphological Processing.

Module-III: **9 hrs**

Syntax Parsing: Syntax Parsing: Grammar Formalisms - Tree Banks - Parsing with Context Free Grammars - Features and Unification, Statistical parsing: probabilistic CFGs (PCFGs) - Lexicalized PCFG

Module-IV: **9 hrs**

Semantic Analysis: Representing Meaning – Semantic Analysis - Lexical Semantics – Computational Lexical Semantics - Supervised – Dictionary based and Unsupervised Approaches - Compositional Semantics - Semantic Role Labelling - Semantic Parsing – Discourse Analysis.

Module-V: **9 hrs**

Case Studies and Applications: Machine Translation Language Similarities and Differences - Named Entity Recognition and Relation Extraction- IE using sequence labelling-Machine Translation (MT) - Basic issues in MT-Statistical translation - Word Alignment - Phrase-based Translation – Question Answering

Laboratory Components:
Skills to be acquired:

- *Sentence Extraction*
- *Medical Language Extraction*
- *Semantic Tutorial for Languages*

Lab Software Requirements:

- *Any Programming Language*

List of Exercises:

1. *Build language models and generate text from them*
2. *Recognize sentences and separate the words*
3. *Speech tagging*
4. *Identify and find all mentions in unstructured text of named entities*
5. *making a simple supervised WSD classifier*
6. *determining topics from text (Lexical analysis)*

Text Book(s):

1. *Daniel Jurafsky and James H. Martin, Martin Speech and Language Processing, 2008, 2nd Edition, Prentice Hall.*
2. *Christopher D. Manning and HinrichSchuetze, Foundations of Statistical Natural Language Processing, 1999, MIT Press.*

Reference Book(s):

1. *James Allen, Natural Language Understanding, 1994, 2nd Edition, Addison Wesley.*
2. *Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, O'Reilly Media, 2009, 1st Edition.*

Web Resources:

1. *http://www.nltk.org/*
2. *http://www.ucl.ac.uk/internet-grammar/home.htm*

CSCE 836 INTRODUCTION TO ROBOTICS

L	S	P	C
3	0	0	3

Pre-requisite:

- *Mathematical Foundation of Computer Science and Basics of Machine Learning*

Objectives:

- *To understand agents,*
- *To learn the principles and applications of agents*
- *To design, build and program simple autonomous robots.*
- *To learn the working of robots*

Course Outcome:

- *Perform designing of various robotic arms*
- *Implement robot programs*
- *Apply and design robots*
- *Understand applications of agents*

Module-I: **9 hrs**

Agents, Paradigms, Sensors: Intelligent agents-Search overview-Adversarial search-Constraint satisfaction- Paradigms: Hierarchical, Reactive- Types of Sensors-Vision

Module-II: **9 hrs**

Knowledge representation, reasoning and planning: Predicate logic-Fuzzy logic-Classical planning-Planning and acting in real world-Navigation

Module-III: **9 hrs**

Learning: Decision making-Learning from examples-Knowledge in learning-Learning probabilistic models-Reinforcement learning-Deep learning

Module-IV: **9 hrs**

Robot Programming: Features of various programming methods, Robot Task planning: concept, different methods, robot learning, Mobile Robot: Introduction, obstacle Representatives, Motion Planning in fixed and Changing structure - Simple Programs.

Module-V: **9 hrs**

Industrial Applications and Case Studies: Application of robots: Material handling - Machine loading and unloading – Assembly – Inspection –Recent developments in Robotics- Safety Considerations.

Text Books:

1. *Robin.R.Murphy, Introduction to AI Robotics, MIT press, 2000.*
2. *Stuart J Russell and Peter Norvig, Artificial Intelligence – A Modern Approach, Third Edition, PHI,2010.*

Reference Books:

1. *Kortenkamp, D., Bonasso, R. P., & Murphy, R. (Eds.). Artificial intelligence and mobile robots. Menlo Park, CA: AAAI Press,1998*
2. *Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.*
3. *M. P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, Industrial Robotics Technology, Programming and Applications, McGraw Hill, Int. 2008.*

CSCE 841 INTRODUCTION TO HUMAN COMPUTER INTERACTION

L	S	P	C
3	0	0	3

***Pre-requisites**:*

- *Basic Understanding of Graphical User Interface.*

Course Objectives:

- *To understand the components of Human Computer Interaction*
- *To understand the basics of interaction design*
- *To understand the fundamentals of Universal design*
- *To understand the software process*

Course Outcome:

- *List the components of Human Computer Interaction*
- *Design interactive models*
- *Implement a HCI based system and evaluate it.*
- *Explain the software process involved*

Module I: **9 hrs**

The Components: The Human : Human Memory – Thinking – Emotion – Individual Preferences – Psychology and Design of Interactive Systems. The Computer : Text Entry Devices – Pointing Devices – Display Devices – Devices for Virtual Reality and 3D interaction – Physical Controls, Sensors and Special Devices – Memory – Processing and Networks.

Module II: **9 hrs**

The Interaction: Models of Interaction – Frameworks and HCI- Ergonomics – Interaction Styles – Elements of WIMP interface – Interactivity – Context of interaction – User Experience; Interaction Design Basics : Design Definition – The process of Design – User Focus – Scenarios – Navigation Design – Screen design and Layout – Iteration and prototyping.

Module III: **9 hrs**

Software Process: HCI in the software process: The software life cycle – Iterative design and prototyping – Design rationale. Design Rules: Introduction – Principles to support usability – Standards – Guidelines – Golden rules and heuristics – HCI patterns

Module IV: **9 hrs**

Dialog Notations and design – Dialog semantics – Modeling rich interaction – Cognitive models – Evaluation techniques.

Module V: **9 hrs**

Universal Design: Universal design principles – multimodal interaction – design for diversity; User Support: requirements of user support – approaches to user support – adaptive help systems – designing user support systems.

Text Book:

1. *Alax Dix, Janet Finaly, Gregory D. Abowd, Russell Beale. Human Computer Interaction-Third Edition – Pearson Prentice Hall Publishers*.

Reference Book:

1. *Jonathan Lazar. Research Methods in Human–Computer Interaction - John Wiley &Sons(2009)*

MOOC

1. *NPTEL Course on Human Computer Interaction (HCI) : http://nptel.ac.in/courses/106103115/*

CSCE 842 PRINCIPLES OF INTERACTION DESIGN

L	S	P	C
3	0	0	3

Pre-requisites:

- *Basic Understanding of Human-Computer Interaction methodology and GUI styles*

Course Objectives:

- *To focus on creating interfaces, systems,*
- *To analyse the devices revolving around user behaviour.*
- *To explore the interaction design process*
- *To explain how interaction designers work and the tools used for principles of interaction design*

Course Outcome:

- *Describe creating interfaces and systems*
- *Explain the devices revolving around user behaviour.*
- *List the interaction of design process*
- *Recognize the designers work and the tools they use for interaction design*

Module - I **9 hrs**

Introduction: Goals of System Engineering – Goals of User Interface Design – Motivations of Human factors in Design – High Level Theories –Object-Action Interface Design - Three Principles – Guidelines for Data Display and Data Entry

Module - II **9 hrs**

Managing Design Process: Organizational Design to Support Usability – The Three Pillars of Design Development Methodologies- Ethnographic Observation – Participating Design- Scenario Development- Social Impact Statement for Early Design – Legal Issues- Reviews – Usability Testing and laboratories- Surveys- Acceptance tests – Evaluation during Active use- Specification Methods- Interface – Building Tools- Evaluation and Critiquing tools

Module - III **9 hrs**

Manipulation and Virtual Environments: Introduction-Examples of Direct Manipulation Systems –Explanation of Direct Manipulation-Visual Thinking and Icons – Direct manipulation Programming – Home Automation- Remote Direct Manipulation- Virtual Environments- Task-Related Organization – Item Presentation Sequence- Response Time and Display Rate – Fast Movement Through Menus- Menu Layouts- Form Filling – Dialog Box – Functionality to Support User's Tasks – Command Organization Strategies – Benefits of Structure- Naming and Abbreviations – Command Menus- Natural Language in Computing.

Module- IV **9 hrs**

Interaction Devices: Introduction – Keyboards and Functions – Pointing Devices- Speech recognition ,Digitization and Generation – Image and Video Displays – Printers – Theoretical Foundations –Expectations and Attitudes – User Productivity – Variability – Error messages – Non anthropomorphic Design –Display Design – color-Reading from Paper versus from Displays- Preparation of Printed Manuals- Preparation of Online Facilities.

Module-V **9 hrs**

Windows Strategies and Information Search: Introduction- Individual Window Design- Multiple Window Design- Coordination by Tightly –Coupled Window- Image Browsing- Personal Role Management and Elastic Windows – Goals of Cooperation – Asynchronous Interaction – Synchronous Distributed – Face to Face- Applying Computer Supported Cooperative Work to Education – Database query and phrase search in Textual documents – Multimedia Documents Searches – Information Visualization – Advance Filtering Hypertext and Hypermedia – World Wide Web- Genres and Goals and Designers – Users and their tasks – Object Action Interface Model for Web site Design

Text book:

1. *Ben Shneiderman , " Designing the User Interface", 5th Edition, Addison-Wesley, 2010*

Reference books:

1. *Barfied , Lon , "The User Interface : Concepts and Design", Addison – Wesley.*
2. *Wilbert O. Galiz , "The Essential guide to User Interface Design", Wiley Dreamtech.*
3. *Jacob Nielsen, "Usability Engineering ", Academic Press.*
4. *Alan Dix et al, "Human - Computer Interaction ", Prentice Hall, 2012.*

CSCE 843 WEB ACCESSIBILITY

L	S	P	C
3	0	0	3

Pre-requisites:

- *Basic Understanding of Web Technologies*.

***Course Objectives*:**

- *To understand the components of web accessibility*
- *To understand Accessibility standards and Evaluation Processes.*
- *To acquire skills to evaluate and make the web contents accessible*.
- To understand web content readability

Course Outcome:

- *Describe the components of web accessibility*
- *Explain accessibility standards and evaluation processes.*
- *Perform skills to evaluate and make the web contents accessible.*
- *Explain readability of web contents*

Module I: **9 hrs**

Introduction: The need for Web accessibility – Universal Design – Types of Disabilities and Accessibility Requirements – Introduction to Guidelines and Standards – Accessibility Myths – Assistive Technologies - Benefits of Accessible Design.

Module II: **9 hrs**

Web Content Accessibility Guidelines: Web Contents Accessibility Guidelines – WCAG 1.0 vs WCAG 2.x – Principles: Perceivable – Operable – Understandable – Robust – Levels A, AA, AAA – WCAG standards evaluation tools and Comparative analysis.

Module III: **9 hrs**

Universal Design of Components: Component Specific Requirements : Images – Hyperlinks – Color contrast – Audio and Video components – Tables – Forms – Document Accessibility – Dynamic web contents Accessibility – Mobile Content Accessibility.

Module IV: **9 hrs**

WAI –ARIA and Other Standards: Web Accessibility Initiatives – Accessible Rich Internet Applications – Features. ATAG : Authoring tools accessibility guidelines – UAAG : User Agents Accessibility Guidelines – Accessibility Laws.

ModuleV: **9 hrs**

Readability: Text Readability – Evaluation : Flesch-Kincaid - Gunning Fog - SMOG index – Dale Challe Score – Other Readability Scores – Web Content Readability. Security and Accessibility : Web Security Concerns for Persons with Disabilities – Making Security accessible.

Laboratory Components:

Skills to be acquired:

1. *Evaluating the Web Accessibility*
2. *Designing Accessible Pages*

Lab Software Requirements:

1. *Open Source Web Development tools.*

List of Exercises:

1. *Exercises to make the student to acquire web accessibility evaluation skills.*
2. *Exercises to make the student to acquire accessibility evaluation comparison skills.*
3. *Exercises to make the student to acquire skills related with accessible page design.*
4. *Exercises to make the student to acquire skills related with design accessible mobile web apps.*

Reference Book:

1. *Simon Harper, YelizYesilada (Editors) . Web Accessibility: A Foundation for Research – Springer Publications.*

Web Resources:

1. *W3C Resources on Web Accessibility https://www.w3.org/WAI/intro/accessibility.php*
2. *WebAIM(Web Accessibility in Mind) Resources : http://webaim.org*

Online Courses

1. *Introduction to Web Accessibility by Google : https://webaccessibility.withgoogle.com/course*

CSCE 844 CONTEXT AWARE COMPUTING

L	S	P	C
3	0	0	3

Pre-requisites:

- *Basic Knowledge of mobile computing and distributed systems*

Course Objectives:

- *To be familiar with the components of Context aware computing*
- *To Acquire skills to build context aware applications*
- *To learn Context aware sensor networks*
- *To understand context aware security systems*

Course Outcome:

- *Explain the components of Context aware computing*
- *Design skills to build context aware applications*
- *Explain the context aware sensor networks*
- *Explain context aware security systems*

Module I **9 hrs**

Introduction: Context, Context awareness and Situations – Analogies – Elements of a Context aware System – Architecture – Infrastructure, Middleware and Toolkits.

Module II **9 hrs**

Context aware mobile devices – Location bases serviced – ambient services – e-communities – Interaction in context aware systems.- Enhancing context-aware mobile services.

Module III **9 hrs**

Context aware mobile software agents – Context-aware addressing and communication for people, things and Software agents.

Module IV **9 hrs**

Context aware sensor networks – Context awareness and mirror-world models – Constructing context aware pervasive systems : Declarative approaches and design patterns.

Module V **9 hrs**

Context Aware Security: Traditional Security issues – models – context aware security systems – context aware safety.

References:

1.Seng W. Loke, Context aware pervasive systems-Architecture for a new breed of applications, Auerbach publications, 2006.
2. Context-Aware Mobile and Ubiquitous Computing for Enhanced Usability: Adaptive Technologies and Applications: Dragan Stojanović, IGI Global Snippet, 2009.
3. Rocha, Ricardo CoutoAntunes da, Endler, Markus, Context Management for Distributed and Dynamic Context-Aware Computing, Springer,2012.

CSCE 845 DATA VISUALIZATION

L	S	P	C
3	0	0	3

Pre-requisites:

- *Basic Understanding of Interaction design.*
- *Basic Understanding of Programming*

Course Objectives:

- *To understand the Objectives of Data Visualization*
- *To acquire skills in professional data visualization techniques*
- *To understand the fundamentals of Universal design*
- To understand data abstraction

Course Outcome:

- *Explain the Objectives of Data Visualization*
- *List the skills in professional data visualization techniques*
- *Explain the fundamentals of Universal design*
- *Describe the data abstraction techniques*

Module I*:* **9 hrs**

Introduction: Introduction to Data Visualization – History of Visualization – Need for Visualization - Interactive Visualization – Web Specific Components – Common Types of Data Visualization – Data Visualization and Infographics – Dashboards.

Module II: **9 hrs**

Data Abstraction : Data Set types – Attribute Types – Semantics. Task Abstraction : Actions – Targets. Charts – Data Preprocessing - Choosing the optimal charts – Making charts effective – Context in Visualization - Analyzing Visual Patterns – Beautiful vs Useful Design - Cognitive Load Theory - Responsive Design principles.

Module III: **9 hrs**

Perception and Visualization – Perceptual processing – Metrics - The Visualization Process – Visual Variables – Taxonomies. Visualization validation : Threats to Validity – Validation approaches .

Module IV: **9 hrs**

Visualization Techniques: Spatial Data Visualization - Multivariate Data Visualization Techniques : Point-Based – Line based – Region based – Hybrid Techniques – Visualization techniques for trees, graphs and networks – Text and Document Visualization.

Module V: **Universal Design** **9 hrs**

Interaction concepts – Interaction techniques: screen space – object space – data space – attribute space – Interaction Control – Web specific visualization with the case study of D3.

Laboratory Components:

Skills to be acquired:

1. *Building effective visualization*
2. *Design and development of interactive visualization*

Lab Software Requirements:

1. *Open Source Web Development and visualization tools.*

List of Exercises:

1. *Exercises to make the student to acquire chart building skills with code.*
2. *Exercises to make the student to acquire skills to build effective infographics.*
3. *Exercises to make the student to acquire skills related with web based visualization.*
4. *Exercises to make the student to acquire skills to handle various visualization libraries such as D3*
5. *Exercises to make the student to acquire advanced visuzliation mechanisms such as Dendrogram, Node-link tree etc.*

Text Book:

1. *Matthew O.Ward Interactive Data Visualization: Foundations, Techniques, and Applications AK Peters / CRC Press.*
2. *Mico Yuk. Data Visualization For Dummies*
3. *Tamara Munzner. Visualization Analysis and Design AK Peters Publications.*

Web Resources:

1. http://chimera.labs.oreilly.com/books/1230000000345/ch01.html#_why_write_code (Interactive Data Visualization for the web – Open Book)

CSCE 846 SOCIAL COMPUTING SYSTEMS

L	S	P	C
3	0	0	3

Pre-requisites:

- Basic Understanding of HCI Concepts

Course Objectives:

- To understand the components of Social computing systems.
- To acquire skills to analyse the social network data.
- To understand embedding concept
- To understand statistical tools

Course Outcome:

- Understanding the components of Social computing systems.
- Acquiring skills to analyse the social network data.
- Describe embedding needs
- Perform statistical analysis

Module I: **9 hrs**

Introduction: Introduction to Social computing – Human centred computing: Methods – benefits – incentives – computer supported cooperative work – collaboration platforms- Introduction to Crowd sourcing: Components – activities.

Module II: **Social Network methods** **9 hrs**

Social Network methods: Social network data – Graphs to represent social relations – Matrices to represent social relations – working with network data – Connection: Networks and actors – basic demographics – density – reachability – connectivity – distance.

Module III: **9 hrs**

Embedding: Introduction – density – reciprocity – transitivity – clustering – Group external and internal ties – Krackhardt's graph theoretical dimensions of hierarchy - Ego networks.

Module IV: **9 hrs**

Opinion Formation: Opinion Formation Models – Cultural and language dynamics – crowd behavior patterns – Hierarchies formation – Propagation models in social networks; Advertisements and social network systems.

Module V: **9 hrs**

Statistical tools: Statistical tools to analyze social network data – Sentiment analysis – Recommendation systems – Link prediction in social networks.

Ref Books:

1. *Cioffi-Revilla, Claudio. Introduction to Computational Social Science, Springer, 2014.*
2. *Robert Hanneman and Mark Riddle. Introduction to social network methods. Online Open Book.*
3. *Matthew A. Russell. Mining the Social Web: Data Mining Facebook, Twitter, Linkedin, Google+, Github, and More, 2nd Edition, O'Reilly Media, 2013.*
4. *Jennifer Golbeck, Analyzing the social web, Morgan Kaufmann, 2013.*

MOOC:

https://www.coursera.org/learn/social-computing

CSCE 851 AUTOMATA, COMPUTATBILITY AND COMPLEXITY

L	S	P	C
3	0	0	3

Pre-requisite:

- *Knowledge of discrete mathematics, proofs, data structures and algorithms*

Objectives:

- *To introduce concepts in automata theory*
- *To design recognizers for different formal languages*
- *To determine decidability*
- *To determine complexity of computational problems.*

Course Outcome:

- *Use regular language and grammar for designing real world problems*
- *Perform computational complexity analysis*
- *Define Turing machines performing simple tasks*.
- *Understand formal languages*

Module-I: **9 hrs**

Introduction to theory of computation and Finite Automata: Mathematical preliminaries – Basic concepts – Applications – DFA – NFA – Equivalence – Reduction of states.

Module-II: **9 hrs**

Regular Language (RL) , Regular Grammar, Properties of RL: Regular Expressions (RE) – Relation between RE and RL – Regular Grammars – Properties – Context Free Grammars (CFG)

Module-III: **9 hrs**

Simplification of Context Free Grammars & Normal Forms: Methods for transforming Grammars – Chomsky and Greibach Normal Forms Push Down Automata (PDA)Non-deterministic PDA – PDA and Context Free Languages (CFL) – Deterministic PDA and CFL

Module-IV: **9 hrs**

Properties of CFL and Turing Machines: Pumping lemma –closure properties Turing machines (TM) – the standard TM – Turings' thesis – Linear Bounded Automata

Module-V: **9 hrs**

Algorithmic computation: Poblems that cannot be solved by TM – Undecidable problems for recursively enumerable and context-free languages- Post correspondence problem

Text Book:

1. *Peter Linz, An introduction to Formal Languages and Automata, 2012, Fifth Edition, Jones & Bartlett Learning.*

Reference Books

1. *Automata, Computability and Complexity: Theory and Applications, Pearson Education India; 1 edition 2012.*
2. *Moore, Cristopher, and Stephan Mertens.* The Nature of Computation. *Oxford University Press, 2011.*
3. *Arora, Sanjeev, and Boaz Barak. Computational Complexity: A Modern Approach. Cambridge University Press, 2009*

Web resources

1. www.Automatatutor.com

MOOC

1. NPTEL COURSE ON Formal languages and Automata Theory - https://nptel.ac.in/courses/111103016/

CSCE 852 MATHEMATICAL LOGIC FOR COMPUTER SCIENCE

L	S	P	C
3	0	0	3

Pre-requisite:

- *Exposure to Automata Theory*

Objectives:

- *To learn the basics of mathematical logic*
- *To apply those concepts in various Computer Science domain*
- *To learn knowledge based applications*
- *To learn logics based reasoning*

Course Outcome:

- *Describe the mathematical logic for knowledge representation*
- *Analyse problems in various Computer Science fields*
- *Implement knowledge based applications*
- *Explain logics based reasoning*

Module-I: **9 hrs**

Introduction: Objective – History – Terminology – Propositions, Beliefs and declarative sentences – Contradictions - Formalization – Formalizing the language – Extending the language

Module-II: **9 hrs**

Propositional Logic: Formulas, Models, Tableaux – Deductive systems – Resolution – Binary Decision Diagrams -

Module-III: **9 hrs**

First order Logic: Formulas, Models, Tableaux – Deductive systems - Gentzen system – Hilbert system – C- Rule - Formulas to Logic, Horn clauses in SLD resolution – Search Rules

Module-IV: **9 hrs**

Temporal Logic: Introduction – Syntax and semantics – Models of Time – Linear Temporal Logic – Binary temporal operators and its Axioms

Module-V: **9 hrs**

Tools: Working with Prolog programs – Standard ML programs

Text Books:

1. *Steve Reeves and Michael Clarke, "Logic for Computer Science", 2003, Addison – Wesley.*
2. *M Ben Ari," Mathematical Logic for Computer Science", 3rd Edition, 2015, Prentice Hall.*

CSCE 853 COMPLEXITY THEORY

L	S	P	C
3	0	0	3

Course Pre-requisite:

Prior knowledge of following materials is assumed. A brief overview of basics will be given in the first lecture. Other than this, the course should be self-contained.

- *Computation Theory*
- *Automata Theory*
- *Linear Algebra, Algorithms*

Course Objectives:

- *To understand the fundamental concepts of Complexity theory*
- *To provide the concepts of complexity classes and reduction problems*
- *To enumerate NP-complete and NP-equivalent problems*
- *To discuss complexity of approximation problems and black box problems*
- *To describe communication complexity*

Course Outcome:

- *Explain the fundamental concepts of Complexity theory*
- *Explain the concepts of complexity classes*
- *Describe the reduction problems*
- *Explain the NP complete and equivalent problems*

Module-I: **9 hrs**

Introduction: Complexity Theory – Algorithmic Problems and Their Complexity – Algorithmic Problems – Some Important Algorithmic Problems – Measuring Computation Time

Module- II: **9 hrs**

Complexity classes: Randomized Algorithms – The Fundamental Complexity Classes for Algorithmic Problems – The Fundamental Complexity Classes for Decision Problems Reductions: Algorithmic Relationships between Problems

Module-III: **9 hrs**

NP-Completeness: Theory of NP-Completeness – Fundamental Considerations Problems in NP – Alternative Characterizations of NP – NP-complete and NP-equivalent Problems – Traveling Salesperson Problems – Knapsack Problems – Scheduling Problems

Module- IV: **9 hrs**

Complexity of Approximation Problems: Complexity Classes – Approximation Algorithms – Approximation-Preserving Reductions. Black Box Problems: Black Box Optimization

Module-V: **9 hrs**

Communication Complexity: The Communication Game – Nondeterministic Communication Protocols– Communication Complexity and Computation Time

Text Book(s):

1. *Ingo Wegener, "Complexity Theory: Exploring the limits of efficient algorithms", Springer-Verlag Berlin Heidelberg, 2005.*
2. *Sanjeev Arora, "Computational Complexity - A Modern Approach", Cambridge University Press, 2009.*

Reference Book(s):

1. *Neil F.Johnson, "Simply Complexity: A Clear Guide to Complexity Theory", Oneworld Publications, 2007.*
2. *OdedGoldreich, "Computational Complexity: A Conceptual Perspective", Cambridge University Press, 2008.*

CSCE 854 COMPUTABILITY THEORY

L	S	P	C
3	0	0	3

Pre-requisite:

- *Exposure to Automata Theory and basic logic*

Objectives:

- *To learn the basics of mathematical logic*
- *To understand the computability theory*
- *To apply those concepts in various Computer Science domain*
- *To understand MOLTAP tool*

Course Outcome:

- *Explain the basics of mathematical logic*
- *Evaluate those concepts in various Computer Science domain*
- *Explain the computability theory*
- *Demonstrate MOLTAP tool*

Module-I: 9 hrs

Computability Theory: Enumerability – Diagonalization – Uncomputability – Abacus Computability – Recursive functions – Recursive sets and relations – Equivalent definitions of computability

Module-II: 9 hrs

Logic: First order Logic – Syntax and Semantics – Undecidability of First Order Logic – Monadic and Dyadic Logic – Second order Logic- Modal Logic and Provability

Module-III: 9hrs

Logic Proofs: Models - The Existence of models – Proofs and completeness – Indefinitability, undecidability, Imcompleteness – Unprovability of consistencey

Module-IV: 9hrs

Logic Theorems: Normal Forms – Disjunctive and Prenex Normal forms – Skolem Normal Form - Herbrand's Theorem - Craig Interpolation Theorem – Ramsey's Theorem

Module-V**: 9hrs**

Tools: Working with Prolog –FLORID - MOLTAP

Text Book:

1. George S Boolos, John P Burgess and Richard C Jeffrey, "Computability and Logic", Fifth Edition, 2007, Cambridge University Press, New York.

Reference Book:

1. *Martin Davis, "Engines of Logic: Mathematicians and the origin of computers", 2001, Norton*

CSCE 855-ADVANCED COMPILER DESIGN

L	S	P	C
3	0	0	3

Pre-requisite:

- *Knowledge of data structures, algorithms, compilers, architecture, assembly language programming*

Objectives:

- *To learn the advanced issues in the design of complier*
- *To learn implementation of compilers*
- *To understand the intermediate representation and optimization*
- *To understand the data flow analysis and scalar optimization*

Course Outcome:

- *Explain the advanced issues in the design of compliers*
- *Describe the implementation of compilers*
- *Implement the intermediate representation and optimization*
- *Explain the data flow analysis and scalar optimization*

Module-I: 9 hrs

Compilers and Scanner: Overview of compilation –compiler structure – Translation - Introduction to Scanners – Regular expressions – Scanner – Implementing scanners

Module-II: 9 hrs

Parser and Context sensitive analysis: Expressing syntax – top down parsing – Bottom Up Parsing – Practical issues. Type systems – attribute grammar framework – Adhoc SDT

Module-III: 9 hrs

Intermediate Representation and Optimization: Graphical IR – Linear IR – Mapping values to names – Symbol Table Scope of optimization – Local – Regional – global – Interprocedural optimization

Module-IV: 9 hrs

Data flow analysis and Scalar optimization: Iterative data flow analysis – Single static assignment - Interprocedural analysis Useless code elimination - code motion – specialization – redundancy elimination – other transformations

Module-V: 9 hrs

Instruction selection, scheduling and register allocation: Code generation – tree pattern matching – peephole optimization -Instruction scheduling – local list – Regional scheduling- Register allocation – issues – local allocation – global allocation

Text Book:

1. *Keith D Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann, 2 edition, 2011*

Reference Book:

1. *Advanced Compiler Design and implementation, Steven Muchnick, .Morgan Kaufmann Publishers , 1997*

MOOC: *https://in.udacity.com/course/compilers-theory-and-practice--ud168*

CSCE 861 DESIGN OF MODERN HEURISTICS

L	S	P	C
3	0	0	3

Pre-requisite:

- *Knowledge of fundamental concepts of Designing Strategies*

Objectives:

- *To enable the students to understand the optimisation methods*
- *To design application of optimization techniques*
- *To practise the optimization techniques using search strategies*
- *To learn heuristics algorithms*

Course Outcome:

- *Identify the importance of optimisation methods*
- *Design optimisation techniques for real world problems*
- *List the results obtained through optimisation*
- *Describe heuristics algorithms*

Module-I: **9 hrs**

Optimization Problems: Introduction - Solution Process – RecognizingProblems, Defining Problems, Constructing Models, Solving Models Validating Solutions, Implementing Solutions - Problem Instances- Search Spaces - Metrics, Neighborhoods, Fitness Landscapes, Optimal Solutions - Properties of Optimization Problems - Problem Difficulty, Locality, Decomposability

Module-II: **9 hrs**

Optimization Methods: Analytical and Numerical Optimization Methods- Optimization Methods for Linear, Continuous Problems - Linear Optimization Problems, Simplex Method Optimization Methods for Linear, Discrete Problems

Module-III: **9 hrs**

Heuristics: Introduction-Heuristics – Applications- Heuristic Optimization Methods - Heuristics, Approximation Algorithms, Modern Heuristics

Module-IV: **9 hrs**

Search Strategies: Local Search Methods - Recombination-Based Search - Genetic Algorithms, Estimation of Distribution Algorithms, Genetic Programming

Module-V: **9 hrs**

Case Study: The Optimal Communication Spanning Tree Problem - Biasing Modern Heuristics for OCST Problems - Search Operator - Representation - Initialization - Using an MST as Initial Solution

Text Book(s):

1. *Rothlauf, Franz, Design of Modern Heuristics - Principles and Application, Nature Computing Series, Springer 2011.*

Reference Books:

1. *Xiaopeng Fang, Engineering Design Using Genetic Algorithms, Iowa State University 2007.*
2. *David E. Goldberg, Genetic Algorithms in Search, Optimization, and Machine Learning, Addison -Wesley publishing company, Inc., 1st Edition, 1989.*

CSCE 862 EVOLUTIONARY ALGORITHMS

L	*S*	*P*	*C*
3	*0*	*0*	*3*

Pre-requisite:

- *Basic knowledge in programming competence.*

Objectives:

- *To master the basics of EA*
- *To learn the techniques for solving optimization problems through EA*
- *To learn genetic programming*
- *To learn multi objective optimization*

Course Outcome:

- *Design an evolutionary technique to a real problem by choosing the parameters for optimal performance*
- *Evaluate the job shop scheduling and routing problems using genetic algorithms*
- *Implement genetic programming and solve classic GP problems*
- *Explain multi objective optimization*

Module-I: **9 hrs**

Introduction to EA: EA Basics: Introduction to Evolutionary Computation: Biological evolution and genetics- artificial evolution, Basics of optimization and search space , evolutionary computation and AI, lasses of EA- Structure of EA - Advantages of Evolutionary Computation -.Hybridization with Other Methods - Parallelism - Applications of Evolutionary Computation - computational time complexity of the algorithms.

Module-II: **9 hrs**

Genetic Algorithm: A simple genetic algorithm- Biological background - Encoding- Fitness Evaluation techniques - Search Operators: Crossover, mutation- Selection Schemes: Fitness proportional selection and fitness scaling, ranking, tournament selection, Selection pressure and its impact on evolutionary search. The Schema Theorem in GA- Building Block Hypothesis - Applications of GA in Engineering problems, job shop scheduling and routing problems

Module-III: **9 hrs**

Advanced operators and techniques in Genetic Algorithm: Inversion and reordering operators – Micro operators- Population sizing - Advanced selection schemes- Types of GA- Parallel & Distributed GA- Hybrid GA- Adaptive GA – Genetic algorithm implementation using MATLAB.

Module-IV: **9 hrs**

Genetic Programming: Genetic programming and how it differs from GA., The creation and regeneration of populations: crossover, mating, and reproduction Classic GP problems and their solutions:

Module-V: **9 hrs**

Multi-objective Optimization: Linear and nonlinear multi-objective problems, convex and non – convex problems, dominance – concepts and properties, Pareto – optimality, Use of Evolutionary Computations to solve multi objective optimization. NSGA, SPEA ,etc. for multi-objective optimization.

Text Book(s):

1. *Sivanandam, S.N., Deepa, S. N ,Introduction to Genetic Algorithms, Springer, 2011*
2. *Deb, K.: Multi-Objective Optimization using Evolutionary Algorithms, John Wiley and Son, 2002.*
3. *John Koza, Genetic Programming, MIT Press, 2005*

Reference Book(s):

1. *D. E. Goldberg, Genetic Algorithm In Search, Optimization And Machine Learning, New York: Addison _ Wesley (1989)*

CSCE 863 LINEAR OPTIMIZATION

L	*S*	*P*	*C*
3	*0*	*0*	*3*

Pre-requisite:

- *Fundamental knowledge of calculus and linear programming problem*

Course Objectives:

- *To understand the fundamental concepts of Operation Research and Optimization*
- *To Provide the concepts of various LPP methods and duality*
- *To Enumerate transportation and assignment problem*
- *To Discuss sequencing theory*
- *To Describe network routing and scheduling*

Course Outcome:

- *Explain the fundamental concepts of Operation Research and Optimization*
- *Evaluate transportation and assignment problem*
- *Explain network routing*
- *Implement sequencing theory*

Module-I: 9 hrs

Operations Research: Introduction – Applications of OR – Linear Programming Problem: Introduction – Formulation of Linear Programming Model- Illustration on Mathematical Formulation of LPP – Graphical Solution – General LPP – Canonical and Standard forms of LPP Optimization**:** Introduction – Classification of Optimization Problems– Mathematical models in Optimization – Types of Optimization Models

Module-II 9 hrs

LPP Methods: Introduction –Simplex method- Fundamental Properties of Solution – The Computational Procedure – Use of Artificial Variables – Degeneracy in LPP – Big M Method – Applications of Simplex Method Duality**:** Duality LPP – General Prime-Dual Pair – Formulating a Dual Problem – Primal-Dual Pair in Matrix Form – Two-Phase Method

Module-III: 9 hrs

Transportation Problem: Introduction – Mathematical Model for Transportation Problem – Types: Balanced Transportation Problem – Unbalanced Transportation Problem – Transportation algorithm: MODI Method – Applications of TP Assignment Problem**:** Introduction – Mathematical Formulation of the Problem – Types of Assignment Problem – Hungerian Method – Applications of AP

Module-IV: 9 hrs

Sequencing Problem: Introduction – Problem of Sequencing – Basic Terms used in Sequencing – Processing *n* Jobs through Two Machines – Processing *n* Jobs through *k* Machines

Module-V: **9 hrs**

Network Routing: Network Flow Problems – Minimal Spanning Tree Problem – Shortest Route Problems – Applications of Shortest Route Problem Network Scheduling**:** Introduction– Logical Sequencing – Concurrent Activities – Critical Path Analysis – PERT – CPM

Text Book(s):

1. *R.Panneerselvam, "Operations Research", PHI, 2006.*
2. *Kanti Swaroop, Man Mohan and P.K. Gupta, "Operations Research", Sultan Chand and Sons, 2005.*
3. *Hamdy A Taha, "Operations Research –An Introduction", 10th Edition, Prentice Hall India, 2017.*

Reference Book(s):

1. *Philips, Ravindran and Solberg, "Operations Research", John Wiley, 2002.*

CSCE 864 NATURE INSPIRED ALGORITHMS

L	*S*	*P*	*C*
3	*0*	*0*	*3*

Pre-requisite:

- *Basic Knowledge of optimization theory*

Objectives:

- *To enable the students to understand the design of nature inspired algorithms*
- *To explore the* Meta-heuristic *techniques.*
- *To understand swarm intelligence algorithms*
- *To understand physics chemistry based algorithms*

Course Outcome:

- *Explain the design of nature inspired algorithms*
- *Implement the Meta-heuristic techniques.*
- *Explain swarm intelligence algorithms*
- *Describe physics chemistry based algorithms*

Module-I: **9 hrs**

Single solution based Meta-heuristics: Introduction-Newton's Method – Optimization: Gradient-Based Algorithms, Hill Climbing with Random Restart - Search for Optimality - Nature Inspired Meta heuristics - A Brief History of Metaheuristics

Module-II: **9 hrs**

Evolutionary Algorithm: Analysis of Optimization Algorithms - Nature-Inspired Algorithms – Cultural Algorithm- Co Evolutionary Algorithm - Simulated Annealing

Module-III: **9 hrs**

Swarm Intelligence: Swarm Intelligence – ACO Algorithm - PCO Algorithm– Ant and Bee Colony Optimization based Algorithm – Accelerated PSO - Convergence Analysis

Module-IV: **9 hrs**

Physics and Chemistry based Algorithms: Quantum computational complexity and chemistry - Digital quantum simulation - Hybrid Algorithm – Krill Herd (KH) algorithm

Module-V: **9 hrs**

Case studies: Simulated annealing – Particle swarm Optimization – Differential Evolution - Firefly algorithm - Cuckoo search – Bat algorithm – Flower pollination algorithm

Reference Books:

1. Xin-She Yang, Nature-Inspired Optimization Algorithms, 2nd Edition, Elsevier, 2016.
2. Nazmul H. Siddique, HojjatAdeli, Nature-Inspired Computing: Physics and Chemistry-Based Algorithms, Taylor & Francis, 2016.
3. Omid Bozorg-Haddad, Advanced Optimization by Nature-Inspired Algorithms, Studies in Computational Intelligence, Springer, 2017.

Web Resources:

1. http://www.academia.edu/7395054/Nature-Inspired_Optimization_Algorithms
2. http://www.cleveralgorithms.com/nature-inspired/index.html
3. http://onlinelibrary.wiley.com/doi/10.1002/adma.201002689/full

CSCE 871 ADVANCES IN COMPUTER GRAPHICS

L	*S*	*P*	*C*
3	*0*	*0*	*3*

Pre-requisite:

- *Fundamental Knowledge in Mathematics, Computer Science and Computer Graphics*

Objectives:

- *Learn image synthesis techniques;*
- *Examine applications of modelling, design and visualization.*
- *Learn different color modelling and computer animation*
- *Learn hierarchical modelling and graphing file formats.*

Course Outcome:

- *Describe image synthesis techniques*
- *Implement color modelling*
- *Design computer animation techniques*
- *Implement hierarchical modelling techniques*

Module-I: **9 hrs**

Three-Dimensional Concepts - Three-Dimensional Display Methods - Parallel Projection - Perspective Projection-Depth Cueing - Visible Line and Surface – Identification - Surface Rendering - Exploded and Cutaway Views - Three-Dimensional and Stereoscopic Views- Three-Dimensional Graphics - Three-Dimensional - Polygon Surfaces - Curved Lines and Surfaces - Quadric Sutiaces – Superquadrics - Blobby Objects - Spline Representations - Interpolation and Approximation Splines - Cubic Spline Interpolation Methods - Bezier Curves and Surfaces - B-Spline Curves and Surfaces - Beta-Spline Continuity - Rational Splines - Conversion Between Spline Representations - Displaying Spline Curves and Surfaces - Sweep Representations - Constructive Solid-Geometry Methods – Octrees - BSP Trees - Fractal-Geometry Methods

Module-II: **9 hrs**

Three-Dimensional Geometric and Modeling Transformations: Translation - Rotation - Scaling - Other Transformations - Composite Transformations -Three-Dimensional Transformation Functions - Modeling and Coordinate Transformations - Three-Dimensional Viewing - Viewing Pipeline - Viewing Coordinates – Projections - View Volumes and General Projection Transformations – Clipping - Hardware Implementations - Three-Dimensional Viewing Functions

Module-III: **9 hrs**

Visible-Surface Detection Methods: Visible-Surface Detection Methods: Classification Of Visible –Surface Detection Algorithms, Back-Face Method, Depth-Buffer Method, A-Buffer Method, Scan-Line Method, BSP-Tree Method, Area-Subdivision Method, Octree Methods, Ray-Casting Method, Comparison of Visibility –Detection Methods, Curved Surfaces, Wire-Frame Visibility –Detection Functions

Module-IV **9 hrs**

Illumination Models and Surface : Illumination Models and Surface- Rendering Methods: Light Sources, Surface Lighting Effects, Basic Illumination Models, Transparent Surfaces, Atmospheric Effects, Shadows, Camera parameters, Displaying light intensities, Halftone patterns and dithering techniques, polygon rendering methods, ray-tracing methods, Radiosity lighting model, Environment mapping, Photon mapping, Adding surface details, Modeling surface details with polygons, Texture mapping, Bump mapping.

Module-V: **9 hrs**

Color models :Color models, color applications and Computer animation: Properties of light, Color models, Standard primaries and the chromaticity diagram, The RGB color model, The YIQ and related color models, The CMY and CMYK color models, The HSV color model, The HLS color model, Color Selection and applications.

Text Book(s):

1. *Hearn Baker, Computer Graphics with openGL, 4rd edition, Pearson publication.2010*
2. *James D Foley,Andries van dam,Steven K Feiner,John F Hughes, Computer graphics, Pearson Education 3rd edition, 2013*

Reference Book(s):

1. *Edward Angel: Interactive Computer graphics a top-down approach with openGL, Addison Wesley, 6th edition 2012*
2. *Advanced graphics programming using openGL: TomMcReynolds-David Blythe. Elesvier.MK, 2005*

CSCE 872 DIGITAL IMAGE PROCESSING

L	*S*	*P*	*C*
3	*0*	*0*	*3*

Pre-requisite:

- *Knowledge in Mathematics and computer graphics*

Objectives:

- *To understand the image fundamentals*
- *To understand the mathematical transforms necessary for image processing*
- *To study the image enhancement techniques.*
- *To understand the image segmentation and representation techniques.*
- *To understand how image are analyzed to extract features of interest.*

Course Outcome:

- *Implement image enhancement techniques*
- *Analyse images and extract features of interest*
- *Perform image processing using various techniques*
- *Perform image segmentation and tranforms*

Module-I: **9 hrs**

Introduction: What is Digital Image Processing, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. Introduction to Digital Image Fundamentals : Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

Module-II: **9 hrs**

Image Enhancement in the Spatial Domain : Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering.

Module-III: **9 hrs**

Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Square Filtering, Geometric Mean Filter.

Module-IV: **9 hrs**

Color Fundamentals: Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression. Wavelets and Multiresolution Processing**:** Image Pyramids, Subband coding, The Haar Transform, Multiresolution Expansions, Wavelet Transforms in one Dimension, Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets. Image Compression**:** Fundamentals, Image Compression Models, Error-free (Lossless) compression, Lossy Compression.

Module-V: **9 hrs**

Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, the Hit-or-Miss Transformation, Some Basic Morphological Algorithms. Image Segmentation**:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

Text Book(s):

1. *Rafael C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 3rd Edition 2007.*

Reference Book(s):

1. *A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.*
2. *Scott.E.Umbaugh: Digital Image Processing and Analysis, CRC Press, 2014.*
3. *S.Jayaraman, S.Esakkirajan, T.Veerakumar: Digital Image Procesing, McGraw Hill Ed. (India) Pvt. Ltd., 2013*

CSCE 873 PATTERN RECOGNITION

L	*S*	*P*	*C*
3	*0*	*0*	*3*

Pre-requisite:

- *Fundamental Knowledge in Mathematics and Digital Image Processing*

Objectives:

- *To study the mathematical morphology necessary for Pattern recognition.*
- *To introduce the student to various Pattern recognition techniques.*
- *To study the Representation and description of feature extraction.*
- *To study the principles of decision trees and clustering in pattern recognition.*

Course Outcome:

- *Explain the mathematical morphology necessary for Pattern recognition.*
- *Explain the Representation and description of feature extraction.*
- *List the principles of decision trees*
- *Describe clustering in pattern recognition*

Module-I: **9 hrs**

Introduction:Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems.

Module-II: **9 hrs**

Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.

Module-III: **9 hrs**

Nearest Neighbor based classifiers & Bayes classifier :Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Basyessian belief network.

Module-IV: **9 hrs**

Decision Trees : Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over-fitting & Pruning, Examples.

Module-V: **9 hrs**

Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means, Isodata), clustering large data sets, examples.

Text Book(s):

1. V Susheela Devi, M Narsimha Murthy, Pattern Recognition (An Introduction), Universities Press, ISBN 978-81-7371-725-3,2014.

2. Earl Gose, Richard Johnsonbaugh, Steve Jost Pattern Recognition & Image Analysis,. PHI ISBN-81-203-1484-0, 1996.

Reference Book(s):

1. Duda R. O., P.E. Hart, D.G. Stork., Pattern Classification, John Wiley and sons, 2000.

CSCE 874 STEGANOGRAPHY AND DIGITAL WATERMARKING

L	*S*	*P*	*C*
3	*0*	*0*	*3*

Pre-requisite:

- *Basic knowledge of security*

Objectives:

To make the student

- *To understand the importance of information hiding*
- *To analyse various steganography techniques*
- *To learn the various watermarking techniques*
- *To analyse study on finger prints*

Course Outcome:

- *Understand the importance of information hiding*
- *Analyse various stenographic techniques*
- *Learn the various watermarking techniques*
- *Learn various fingerprint techniques*

Module-I: **9 hrs**

Introduction to Information hiding : Introduction to Information hiding – Brief history and applications of information hiding – Principles of Steganography – Frameworks for secret communication – Security of Steganography systems –Information hiding in noisy data – Adaptive versus non adaptive algorithms – Laplace filtering – Using cover models – Active and malicious attackers – Information hiding in written text – Examples of invisible communications.

Module-II: **9 hrs**

Survey of steganographic techniques : Survey of steganographic techniques – Substitution system and bitplane tools – Transform domain techniques – Spread spectrum and information hiding – Statistical Steganography - Distortion and code generation techniques – Automated generation of English text.

Module-III: **9 hrs**

Steganalysis: – Detecting hidden information – Extracting hidden information - Disabling hidden information – Watermarking techniques – History – Basic Principles – applications – Requirements of algorithmic design issues – Evaluation and benchmarking of watermarking system.

Module-IV: **9 hrs**

Survey of current watermarking techniques : Survey of current watermarking techniques – Cryptographic and psycho visual aspects – Choice of a workspace – Formatting the watermark bets - Merging the watermark and the cover – Optimization of the watermark receiver – Extension from still images to video – Robustness of copyright making systems.

Module-V **9 hrs**

Fingerprints : Fingerprints – Examples – Classification – Research history – Schemes – Digital copyright and watermarking – Conflict of copyright laws on the internet.

Text Book(s):

1. *Stefan Katzenbelsser and Fabien A. P. Petitcolas, "Information hiding techniques for Steganography and Digital Watermarking", ARTECH House Publishers, January 2004.*

Reference Book(s):

1. *Jessica Fridrich, "Steganography in Digital Media: Principles, Algorithms, and Applications", Cambridge university press, 2010.*
2. *Ingemar Cox, Matthew Miller,JeffreyBloom,JessicaFridrich and TonKalker, "Digital Watermarking And Steganography", Morgan Kaufmann Publishers, Nov 2007.*

CSCE 875 BIOMETRIC SECURITY

L	*S*	*P*	*C*
3	*0*	*0*	*3*

Pre-requisite:

- *Basic knowledge of security*

Objectives:

- *To review image processing techniques for biometric security*
- *To understand Face, Fingerprint, Palmprint, Iris biometric technologies*
- *To understand three-dimensional image analysis techniques*
- *To study some applications of biometric security algorithms*

Course Outcome:

- *List image processing techniques for biometric security*
- *Describe Use Face, Fingerprint, Palmprint, Iris biometric technologies*
- *Perform biometric security algorithms*
- *Implement three-dimensional image analysis techniques*

Module-I: **9 hrs**

Introduction - What Is a Biometric? - Enrollment, Template, Algorithm, and Verification - FAR, FRR, and FTE - Authentication Technologies - The Need for Strong Authentication - Network Convergence Role in Password Proliferation - Mitigating Public Risk through Government Regulation - Mitigating the Risks from an Inside Threat - The Role of Strong Authentication with Single Sign-On (SSO) - Biometric Technologies: An Intelligent Solution - Protecting Privacy with Biometrics and Policy - Employer's Right to Privacy - Employee's Right to Privacy - Protection of Personal Data Collected by the Employer - Creating a Positive Biometric Policy

Module-II: **9 hrs**

Finger Biometric Technologies - General Description of Fingerprints - Macro Fingerprint Features - Micro Fingerprint Features - How Is the Finger Imaged? - Types of Algorithms Used for Interpretation - How Can this Biometric be Spoofed?

Module-III: **9 hrs**

Face Biometric Technologies - General Description of Face Biometrics - How Is the Face Imaged? - What Types of Algorithms Are Used for Facial Interpretation? - Eigenface - Local Feature Analysis - Neural Network - Automatic Face Processing - Which Algorithm Is Best? - How Can This Biometric Be Spoofed?

Module-IV: **9 hrs**

Voice Biometric Technologies - General Description of Voice Biometrics - How Is the Voice Captured? - Types of Algorithms Used for Voice Interpretation - How Can This Biometric Be Spoofed? - Attacking the Physical Voice - Iris Biometric Technology - General Description of Iris Biometrics - How Is the Iris Captured? - Description of the Iris Algorithm - How Can This Biometric Be Spoofed?

Module-V: **9 hrs**

Implementing Biometrics for Network Security - Finger Biometrics - Face Biometrics - Voice Biometrics - Iris Biometrics - The Choice of a Biometric for Network Access - EER - What Measure Is Most Important? - The Biometric Transaction - Securing and Trusting a Biometric Transaction - Matching Location.

Text Book(s):

1. *Paul Reid, "Biometrics for Network Security", Pearson Education, 2004.*
2. *NaliniK.Ratha,RundBolle,"Automatic fingerprint recognition system, Springer", 2003.*

Reference Book(s):

1. *L C Jain, I Hayashi, S B Lee, U Haleci, "Intelligent Biometric Techniques in Fingerprint and Face Recognition".*
2. *S.Y.Kung,S.H.Lin,M.W.,"Mak Biometric Authentication: A Machine Learning Approach".*
3. *John Chirillo, Scott Blaul, "Implementing Biometric Security", John Wile, 2003.*
4. *IEEE – T- PAMI (IEEE transaction on Pattern Analysis and Machine Intelligence) International journal of computer vision, Springer.*

CSCE 876 CONTENT BASED INFORMATION RETRIEVAL

L	*S*	*P*	*C*
3	*0*	*0*	*3*

Pre-requisite:

- *Basic knowledge about information retrieval*

Objectives:

To make the student understand

- *To learn the various techniques used in image enhancement*
- *To learn the image retrieval techniques*
- *To understand colour feature extraction*
- *To understand multimedia databases*

Course Outcome:

- *Explain the various techniques used in image enhancement*
- *Describe various image retrieval techniques*
- *List colour feature extraction*
- *Explain multimedia databases*

Module-I: **9 hrs**

Introduction - Content-Based Retrieval - Challenges and solutions - Formalism of Content-based Multimedia Systems - The System Must be User-centered - Content-based Multimedia Information System - Object Recall - A New Formalism for Content-Based Retrieval - Need for formalism of content-based retrieval - A Content-Based Similarity Retrieval Formalism - Learning of Similarity Function - Experimental Results

Module-II: **9 hrs**

Color Feature Extraction - Color Spaces Selection - Color Measures - Reference Color Table Method -Texture Feature Extraction - Discrete Cosine Transformed Texture - Discrete cosine transform - Feature vector formation - Wavelet Transformed Texture Feature - Wavelet Transform - Feature measures and similarity functions - Learning of multi-level similarity functions - Texture feature based on discrete cosine transform - Texture Features Based on Second Moment Matrix

Module-III: **9 hrs**

Multimedia Databases: Video Processing - Review of Video Processing Techniques - Video features - Video applications - Research areas - State of the art review - Content-Based Representative Frame Extraction and Video Summary - Definition -Related work - Extraction of representative frames - Application of representative frame extraction technique - Object Segmentation - Edge-preserved smoothing of features - Principle of edge-preserved smoothing - EPSM for 2D signal - Application in color feature - Application in texture feature - Clustering in the feature space - Region analysis and region merging.

Module-IV: **9 hrs**

Image Retrieval: Human Face Detection - Color Segmentation of Faces - Chromaticity diagrams -Effects of the projection of 3-D color spaces on chromaticity diagrams - Method for face detection using chromaticity diagrams - Shape Information As a Cue - Geometric characteristic of face - Shape descriptors - Face Feature Detection Using DOG Operators - The DOG (Difference of Gaussians) operator - Face feature detection by DOG operator -

Template-based Human Face Detection - Normalized “face space” - Dimensionality reduction - Clustering and face template generation Template matching - Visual Keywords - Related Works - Methodology - Typification - Description scheme - Selection - Coding scheme - Image Retrieval - Unsupervised learning - Learning by instruction - Image Categorization

Module-V: **9 hrs**

Content Based Image Retrieval: Face Retrieval - CAFIIR system - Content Based Indexing of Multimedia Object - ContIndex Creation by Self-organization Neural Networks - LEP neural network architecture - Fusion of multi-modal feature measures - Spatial self-organization - Bi-directional learning on experiences - Visual Retrieval of Facial Images - Descriptive Queries - Further Improvement of Queries - System for Trademark Archival and Retrieval - Representation of Trademarks - Segmentation of Trademarks - Color segmentation - Capturing Visual Features of Trademark Images - Composite Similarity Measures - Evaluation and Learning of Similarity Measures - Selection of training and test data sets

Text Book(s):

1. *J.K.Wu, M.S.Kankanhalli, J.H.Lim, D.Z.Hong “Perspectives on Content Based Multimedia Systems”, Kluwer Academic publishers,Boston,2000.*
2. *Rafael C.Gonzalez and Richard E.Woods, “Digital Image Processing” Fourth Edition, Pearson Education, 2017.*

Reference Book(s):

1. *Anil K.Jain, “Fundamentals of Digital Image Processing”, Person Education, 2003.*
2. *Michael S.Lew “Image and Video Retrieval”, Springer – Verlag, 2002.*

पांडिच्चेरी विश्वविद्यालय

PONDICHERRY UNIVERSITY

(मानविकी विद्यापीठ/SCHOOL OF HUMANITIES)

हिंदी विभाग

DEPARTMENT OF HINDI

M.A. HINDI

SYLLABUS AND REGULATIONS

(To be implemented from the year 2023-24)

- **M.A HINDI [HARD CORE COURSES, HARD CORE ELECTIVE COURSES AND SOFT CORE COURSES]**

REGUALTIONS
PG PROGRAMME IN M.A (HINDI) DEGREE COURSE
(The revised syllabus shall be effective from the Academic Year 2023-24 onwards.)

DURATION OF THE PROGRAMME
Prescribed Postgraduate studies in M.A. Hindi shall be of four consecutive semesters (Two years). The maximum duration allowed for each student to acquire prescribed number of credits in order to complete the programme of study shall be six consecutive semesters (Three years).

ELIGIBILITY FOR ADMISSION
Students who have passed their Bachelor's degree in Hindi with a minimum of 50% of marks or any degree with Hindi as a subject of study under part I/II or pass in any recognized degree awarded by the voluntrary Hindi Organizations recognized by the Govt. of India.

MEDIUM OF INSTRUCTION
The medium of instruction for all the courses shall be Hindi, however few Soft Core courses are offered in English medium too.

PATTERN OF EXAMINATION
- The end Semester examination for the course shall be conducted by the Department of Hindi, Pondicherry University for a maximum of 60 marks and Internal Assessment for 40 marks.
- The internal assessment marks shall be given as per the following breakup:
  - Internal Assessment Tests /Term papers/Quizzes (Minimum two) = 2 x 15 = 30
  - Seminars/Assignments/Case Demos/Presentations/Write Ups/Viva, etc. = 1 x 10 =10
  - Total Internal Assessment = 40 marks
- No student who has less than 70% attendance in any course shall be permitted to attend the end Semester examination and he/she shall be given grade of FA(failure due to lack of attendance.) He/She shall be required to repeat that course.
- To pass a course the student must secure
  a) A minimum of 40% marks in End Semester exam, and
  b) A minimum of 50% marks in aggregate when Internal Assessment and End-Semester marks are added
  c)

SUPPLEMENTARY EXAMINATION
- A failed student who meets the attendance requirement and has a minimum of 40% in internal assessment mark may be permitted to register for the next end-semester examination in the following semester itself or in any semester of his/her choice.
- Students who have failed due to insufficient attendance and /or less than 40% Internal Assessment marks should repeat the course as and when offered.
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SCHEME OF EXTERNAL EXAMINATION
(Theory Paper)
Duration of Exam : 3 hours
Total marks : 60 Marks

(For other applicable Rules and Regulations kindly refer the Choice Based Credit System Regulations, of Pondicherry University

COURSE STRUCTURE FOR THE P.G. COURSE
M.A Hindi course consists of 14 Hard Core Papers 4 Credits each and 1 Project (4 Credits). 4 Elective Hard Core Papers Students shall take courses offered by the Department out of the list of approved 16 Hard Core Elective courses for 4 credits each respectively. Project will be compulsory and pursued during the first three Semesters. The Board of Studies members considered, approved and ratified the enclosed 16 Hard Core Elective Courses.

SOFT CORE PROGRAMME

The Soft core courses are designed by the Faculty of the Department. 31 Soft Core courses were duly approved which will be offered from time to time depending upon the students and specialization of the Faculty. The Soft core courses can be offered either in English or in Hindi or in Bilingual Medium.

DISTRIBUTION OF CREDITS

Hard Core (Including Project -4 Credits) -Total Credits = 60
Hard Core Optional / Soft Core Courses -Total Credits = 12

-Total Credits = 72

A student has to acquire minimum of 72 Credits with prescribed Hard Core (mandatory) and Optional Hard Core and Soft Core Courses.

COURSE STRUCTURE OF M.A HINDI PROGRAMME To be implemented from 2023-24 onwards		
Course Code	***Course Title***	***Credits***
I Semester		
HIND 411	HINDI BHASHA	4 Credits
HIND 412	AADHUNIK KATHA SAHITYA	4 Credits
HIND 413	KATHETAR GADYA SAHITYA	4 Credits
HIND 414	HINDI SAHITYA KA ITHIHAS -I (AADHIKAL SE RITIKAL TAK)	4 Credits
	HARD CORE OPTIONAL (FROM THE LIST)	4 Credits
II Semester		
HIND 421	BHASHA VIGYAN	4 Credits
HIND 422	PRACHEEN EVAM MADHYAYUGEEN KAVYA	4 Credits
HIND 423	HINDI SAHITYA KA ITIHAS –II (AADHUNIK KAL)	4 Credits
HIND 424	BHARATIYA KAVYA SASRTA	4 Credits
	SOFT CORE COURSE (FROM THE LIST)	4 Credits
III Semester		
HIND 531	AADHUNIK HINDI KAVITHA	4 Credits
HIND 532	BHARATHIYA SAHITYA	4 Credits
HIND 533	PASCHATYA KAVYA SASTRA	4 Credits
HIND 534	PROJECT – I	2 Credits
	*HARD CORE OPTIONAL/**SOFT CORE COURSE	3/4 Credits
IV Semester		
HIND 541	PRAYOJANMOOLAK HINDI	4 Credits
HIND 542	BHASHA PROUDYOGIKI	4 Credits
HIND 543	ADHUNIK HINDI ALOCHANA AUR ALOCHAK	4 Credits
HIND 544	PROJECT – II	2 Credits

** student may choose from the Elective (Hard core optional) courses offered by the Department*

*** student may choose fromt the Soft core courses offered by the Department or other Department.*

❖ **LIST OF HARD CORE ELECTIVE COURSES**

S.No.	***Course Code***	***Course Title***	***Credits***
1.	HIND 551	RACHANAKARON KA VISHESH ADHYAYAN (BHARATHENDU/DWIVEDI/ BALASHORI REDDY/ THULASIDAS /JAYA SANKAR PRASAD)	4 Credits
2.	HIND 552	SAMAKALEEN VIMARSH KA ADHYAYAN (DALIT/STREE/LOK/PAARISTHITIKI/CYBER)	4 Credits
3.	HIND 553	WEB JOURNALISM	4 Credits
4.	HIND 554	BHASHA SHIKSHAN	4 Credits
5.	HIND 555	SAHITYA ADHYAYAN KE DRISHTIYAN	4 Credits
6.	HIND 556	BHARATIYA TULANATMAK SAHITYA	4 Credits
7.	HIND 557	MULTILINGUAL COMPUTING	4 Credits
8.	HIND 558	USE OF ICT IN HINDI TEACHING AND LEARNING	4 Credits
9.	HIND 559	VISHISTA YUG PRAVRITTI(CHAYAVAD)	4 Credits
10.	HIND 560	SHAILI VIGYAN	4 Credits
11.	HIND 561	NAYEE MEDIA ADHYAYAN	4 Credits
12.	HIND 562	HINDITAR PRADESH : HINDI BHASHA EVAM SAHITYA	4 Credits
13.	HIND 563	RAJBHASHA PRASIKSHAN	4 Credits
14.	HIND 564	APABHRAMSA TO CLASSICAL HINDI	4 Credits
15.	HIND 565	ANUSANDHAN PRAVIDHI	4 Credits
16.	HIND 566	ANUVAD SIDHANT EVAM PRAYOG	4 Credits

❖ **LIST OF SOFT CORE COURSES**

- **Dr. S. Padmapriya, Profssor**

S.No.	***Course Code***	***Course Title***	***Credits***
1.	HIND 567	HINDI FILM ALOCHANA	3 Credits
2.	HIND 568	HINDI KAVYA KA STREE PAATH	3 Credits
3.	HIND 569	CONVERSATIONAL HINDI	3 Credits
4.	HIND 570	DRUSHYA –SRAVYA MADHYAM AUR HINDI	3 Credits
5.	HIND 571	HINDI UPANYASO MEIN AANCHALEEKATA	3 Credits
6.	HIND 572	AADHUNIK HINDI KAVYA MEIN RASHTRIYATA	3 Credits
7.	HIND 573	DAKSHIN BHARATHIYA SAHITYA	3 Credits
8.	HIND 574	TAMIL DALIT SAHITYA	3 Credits
9.	HIND 575	TAMIL KAVYA KA PARICHAY	3 Credits
10.	HIND 576	STREE VIMARSH KI SAIDHAANTIKI	3 Credits
11.	HIND 577	21 VEE SADI KI TELUGU KAVITA(Telugu Poetry of 21st Century)	3 Credits
12.	HIND 578	HINDI FILMON KA STREE PAATH	3 Credits

❖ **LIST OF SOFT CORE COURSES…… Cont……**

- **Dr. C. Jaya Sankar Babu, Associate Professor**

S.No.	***Course Code***	***Course Title***	***Credits***
1.	HIND 579	CREATIVE WRITING IN HINDI	4 Credits
2.	HIND 580	COMPARATIVE GRAMMAR (COMPARISON OF HINDI GRAMMAR WITH THE GRAMMAR OF SOUTH INDIAN LANGUAGES)	4 Credits

3.	HIND 581	COMPUTATIONAL LINGUISTICS	4 Credits
4.	HIND 582	MEDIA LAWS IN INDIA	4 Credits
5.	HIND 583	LEXICOLOGY	4 Credits
6.	HIND 584	LITERATURE AND HUMAN RIGHTS	4 Credits
7.	HIND 585	INTRODUCTION TO MODERN TELUGU LITERATURE	4 Credits
8.	HIND 586	PRACTICAL TRANSLATION	4 Credits
9.	HIND 587	TAMIL PRACHEEN SAHITYA KA PARICHAY	4 Credits
10.	HIND 588	RESEARCH WRITING IN DIGITAL SOCIETY	4 Credits
11.	HIND 589	DIGITAL HUMANITIES	4 Credits
12.	HIND 590	ARTIFICIAL INTELLIGENCE AND HUMANITARIAN APPROACH	4 Credits
13.	HIND 591	RESEARCH AND PUBLICATION ETHICS	4 Credits
14.	HIND 592	INSTRUCTIONAL DESIGN AND E-CONTENT DEVELOPMENT	4 Credits
15.	HIND 593	DIGITAL INCLUSION AND KNOWLEDGE SOCIETY	4 Credits
16.	HIND 594	DIGITIZATION OF FOLK LITERATURE AND INDIGENOUS KNOWLEDGE SOURCES	4 Credits
17.	HIND 595	DOCUMENTATION OF ENDANGERED LANGUAGES	4 Credits
18.	HIND 596	INNOVATIONS AND INTELLECTUAL PROPERTY RIGHTS	4 Credits
19.	HIND 597	INTRODUCTION TO VIRTUAL TEACHING TECHNOLOGIES	4 Credits

HIND 551 - RACHANAKARON KA VISHESH ADHYAYAN (BHARATHENDU/DWIVEDI/ BALASHORI REDDY/ THULASIDAS)

Bharatendu Harishchandra

- Recall about what they had studied about Bharatendu Harishchandra.
- Understand the contrinbutions and ideas of Bharatendu Harishchandra expressed in his literature.
- Apply his ideology in solving the social issues.
- Analyse the impact of Bharatendu harishchandra's thoughts on the society and compare with other writers.
- Evaluate his literature and able to critique.
- Create new work like Bharatendu Harishchandra (a possibility).

Hajari Prasad Dwivedi

- Recall about what they had studied about Hajari Prasad Dwivedi.
- Understand the contrinbutions and ideas of Hajari Prasad Dwivedi expressed in his literature.
- Apply his ideology in solving the social issues.
- Analyse the impact of Hajari Prasad Dwivedi's thoughts on the society and compare with other writers.
- Evaluate his literature and able to critique.
- Create new work like Hajari Prasad Dwivedi (a possibility).

Baalashouri Reddy

- Recall about what they had studied about Baalashouri Reddy.
- Understand the contrinbutions and ideas of Baalashouri Reddy expressed in his literature.
- Apply his ideology in solving the social issues.
- Analyse the impact of Baalashouri Reddy's thoughts on the society and compare with other writers.
- Evaluate his literature and able to critique.
- Create new work like Baalashouri Reddy (a possibility).

Tulasidaas

- Recall about what they had studied about Tulasidaas.
- Understand the contrinbutions and ideas of Tulasidaas expressed in his literature.
- Apply his ideology in solving the social issues.

- Analyse the impact of Tulasidaas' thoughts on the society and compare with other writers. To evaluate his literature and able to critique.
- Create new work like Tulasidaas (a possibility).

HIND 552 - SAMAKALEEN VIMARSH KA ADHYAYAN

Study of Contemporary Discourses :

Dalit Discourse :

At the end of the course the learner will be able to-

- Define Dalit discourse and identify the dalit concerns on the literature
- Understand concepts and concerns of Dalit Literature
- Interpret the ideology on the literature
- Analyse and differentiate the ideology present from the ages and now
- Defend the dalit concept raised in the literature
- Produce new original work with the values similar to that of studied (a possibility).

Discourse on Ecocriticism:

At the end of the course the learner will be able to-

- Define Ecocriticism and identify the ecological concerns in the literature
- Interpret and classify the ecological ideologies depicted in various genres of literature
- Analyse the pro - ecological ideology of the literature
- Evaluate the ecological ideas of the writers
- Create literature with pro - ecological ideology.

Cyber Discourse:

At the end of the course the learner will be able to-

- Define cyber criticism and identify the concerns of cyber literature
- Understand cyber literature
- Interpret and classify the cyber age effects depicted in the literature
- Analyse the cyber discourse
- Evaluate the literary values of cyber literature
- Create cyber literature.

HIND 553 - WEB JOURNALISM

At the end of the course the learner will be able to-

- Define concepts of web journalism and recall its characteristics
- Describe various aspects of web journalism.
- Demonstrate the skills of web journalism
- Differentiate traditional journalism and web journalism
- Evaluate various issues of web journalism
- Develop and design website/blog and communicate through it.

HIND 554 - BHASHA SHIKSHAN

At the end of the course the learner will be able to-

- Recall the basic concepts of language teaching
- Describe the linguistic skills
- Apply the knowledge and methods of linguistics, especially contrastive linguistics in language teaching.
- Examine and asses the language abilities.
- Evaluate methods of language teaching.
- Design a module of teaching Hindi language.

HIND 555 - SAHITYA ADHYAYAN KE DRISHTIYAN

At the end of the course the learner will be able to-

- Define various schools of thoughts in the study of literature
- Classify various schools of thoughts
- Interpret various ideologies
- Compare the ideologies of literary studies
- Evaluate the values in the ideologies
- Develop an ideology ideal for study of any literary contribution.

HIND 556 - BHARATEEYA TULANATMAK SAHITYA

At the end of the course the learner will be able to-

- Define the concept of Indian literature
- Discuss about the socio - cultural values of the Indian literature
- Interpret the values system of Indian society
- Examine the literature created in various languages in India
- Integrate and defend the values
- Formulate comparative study plan for Indian literature.

HIND 557 - MULTILINGUAL COMPUTING

At the end of the course the learner will be able to-

- Define multilingual computing
- Explain about the resources available for computing in Indian languages
- Demonstrate the skill of using Indian languages in the computer
- Find solution to the issues of Indian language computing
- Examine and evaluate various software packages resources and standards
- Develop e-content in Indian languages.

HIND 558 - USE OF ICT IN HINDI TEACHING AND LEARNING

At the end of the course the learner will be able to-

- Define ICT
- Interpret characteristics of ICT
- Demonstrate the skills of ICT
- Differentiate effects of traditional teaching and using ICT in teaching Hind language and literature
- Judge the achievements of the student's learning through ICT and e-learning
- Design a module for teaching Hindi language and literature.

HIND 559 - VISHISTA YUG PRAVRITTI (CHAYAVAD)

At the end of the course the learner will be able to-

- Define chayavad
- Appreciate the chayavadi literature
- Interpret the characteristics of chayavad in the literature
- Differentiate chayavadi values with others
- Criticize the chayavadi literary work
- Compare chayavad with other literary moments.

HIND 560 - SHAILI VIGYAN

At the end of the course the learner will be able to-

- Define stylistics
- Explain relation of subjects stylistics with other subjects
- Examine the literature with the knowledge of stylistics
- Appraise the developments of literary criticism with stylistics.

HIND 561 - NAYEE MEDIA ADHYAYAN

At the end of the course the learner will be able to-

- Define various concepts of communications , online communication and New Media.
- Describe the various theories of New Media
- Demonstrate Web designing skills
- Appraise the development of various fields with the emergence and presence of New Media
- Formulate values and codes for information society.

HIND 562 - HINDITAR PRADESH : HINDI BHASHA EVAM SAHITYA

At the end of the course the learner will be able to-

- Enlist the literature written in Hindi in non-Hindi areas of India
- Explain the contribution of non-Hindi areas for development of Hindi language and literature
- Compare the literary culture depicted
- Present critique of the Hindi literature of Non-Hindi areas
- Produce literature.

HIND 563 - RAJBHASHA PRASIKSHAN

At the end of the course the learner will be able to-

- Define the concept of official language
- Discuss the constitutional provisions regarding official language

- Use official language and demonstrate skill of writing and drafting
- Appraise development of Hindi as official language
- Develop various resources for Hindi as official language.

HIND 564 – APABHRAMSHA TO CLASSICIAL HINDI

- Appreciate Apabhramsha Language and Literture
- Demonstrative few syllabus of Apabhramsha Language and Manuscriptology
- Interpret the literacy trends of Apabhramsha
- Develop various resources for Apabhramsha

HIND 565 – ANUSANDHAN PRAVIDHI

- Interpret various concepts of Research
- Demonstrate skills of research
- Find solutions to various issues thorugh research
- Develop and implement a research project

HIND 566 - ANUVAD SIDHANT EVAM PRAYOG

At the end of the course the learner will be able to-

- Remember the concepts & theories of translations
- Understand the difficulties, advantages & disadvantages of translation
- Apply to translate
- Create by translation.

PG Programme Outcome

- The Candidate after passing it can go for various educational, teaching cultural and related jobs.
- They can go for research work in higher degree programs in respective subjects such as M.Phil. and Ph.D.
- They can find employment in both public and private sector such as Government Departments agencies, health sectors travel and tourism sector, Journalism and mass communication related organizations, software and computational companies, interpreting and transition services, libraries, business and information management services, media and advertising, publishing houses, international organizations, market research and public relation companies.
- Those who keep interest in M.A (Hindi) and want to know that how Hindi language and literature and literature come into current form since its beginning are the most suitable for this course.
- Those who willing to go for teaching fields objecting of becoming teacher and at school/colleges are also good match for it
- Those who can to contribute in its reach and cooperative I its development and extension throughout the country are also a go for this course.

Programme Specific Outcome for M.A. Hindi

- Demonstrate knowledge and broad understating of Hindi Literature and analyse the linmon concernes and analyse the human cancerns.
- Explain the development of Hindi Language and its linguistic aspects.
- Exhibit the understating of Indian Literacy Criticism.
- Analyze critically writings of prominent Hindi Writers.
- Compare the philosophy of writers and their concerns in expressed in their writings.
- Demonstrate the skills of using functional Hindi, language computing and writing for various media teaching, research etc.
- Translate from Hindi to English and vise-versa and analyze the translated works
- Analyze the human concerns depicted in the literary texts.
- Compete for the competitive exams like UGC-NET, UPSC etc.
- Teach various aspects language and literature to UG Students.
- Create literature in various genres and conduct quality research in literature

SYLLABUS

M.A HINDI PROGRAMME [2023-24]

COURSE STRUCTURE OF M.A HINDI PROGRAMME To be implemented from 2023-24 onwards		
Course Code	***Course Title***	***Credits***
I Semester		
HIND 411	HINDI BHASHA	4 Credits
HIND 412	AADHUNIK KATHA SAHITYA	4 Credits
HIND 413	KATHETAR GADYA SAHITYA	4 Credits
HIND 414	HINDI SAHITYA KA ITHIHAS -I (AADHIKAL SE RITIKAL TAK)	4 Credits
	HARD CORE OPTIONAL (FROM THE LIST)	4 Credits
II Semester		
HIND 421	BHASHA VIGYAN	4 Credits
HIND 422	PRACHEEN EVAM MADHYAYUGEEN KAVYA	4 Credits
HIND 423	HINDI SAHITYA KA ITIHAS –II (AADHUNIK KAL)	4 Credits
HIND 424	BHARATIYA KAVYA SASRTA	4 Credits
	SOFT CORE COURSE (FROM THE LIST)	4 Credits
III Semester		
HIND 531	AADHUNIK HINDI KAVITHA	4 Credits
HIND 532	BHARATHIYA SAHITYA	4 Credits
HIND 533	PASCHATYA KAVYA SASTRA	4 Credits
HIND 534	PROJECT – I	2 Credits
	*HARD CORE OPTIONAL/**SOFT CORE COURSE	3/4 Credits
IV Semester		
HIND 541	PRAYOJANMOOLAK HINDI	4 Credits
HIND 542	BHASHA PROUDYOGIKI	4 Credits
HIND 543	ADHUNIK HINDI ALOCHANA AUR ALOCHAK	4 Credits
HIND 544	PROJECT – II	2 Credits

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme: M.A. Hindi
2. Title of the subject: HINDI BHASHA
3. Course code: 411

4. Learning outcomes:	**7. Specifications:**
1. Identify the Historical, geographical and linguistics background of Hindi language	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Theory • 100% of Theory
2. Remember, recall facts.	
3. Understand, classify, identify, locate and recognize the dialects and various forms of Hindi language	
5. Skill Training:	**Bridge courses to be done:**
1. To develop a critical vocabulary for teaching and applying their knowledge in different fields such as literature, Information and Communication Technology.	1._____ 2._____ 3._____ 4._____ 5._____
2. Improve oral proficiency through debates, discussions, and presentations, emphasizing clarity and effective communication.	
3. Develop advanced writing skills in Hindi, exploring various writing formats, styles, and genres.	
6. Pre-requisites: 1. Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience and Proficiency / professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/ Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling	

9.

Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
I	**इकाईः -1**	हिंदी की ऐतिहासिक पृष्ठभूमि प्राचीन भारतीय आर्यभाषाएँ वैदिक तथा लौकिक संस्कृत और उनकी विशेषताएँ मध्यकालीन भारतीय आर्यभाषाएँ अर्धमागधी, मागधी, अपभ्रंश औऱ उनकी विशेषताएँ आधुनिक भारतीय आर्यभाषाएँ और उनका वर्गीकरण	12
II	**इकाईः-2**	हिंदी का भौगोलिक विस्तार हिंदी की उपभाषाएँ पश्चिमी हिंदी, पूर्वी हिंदी, राजस्थानी हिंदी बिहारी तथा पहाड़ी हिंदी और उनकी बोलियाँ खड़ी बोली, ब्रज एवं अवधी की विशेषताएँ	14
III	**इकाईः-3**	हिंदी का भाषिक स्वरूप हिंदी की स्वनिम व्यवस्था - खंड्य एवं खड्येतर हिंदी शब्द रचना - उपसर्ग, प्रत्यय, समास	10

		रूप रचना - लिंग, वचन और कारक व्यवस्था के संदर्भ में हिंदी के संज्ञा, सर्वनाम, विशेषण और क्रिया रूप हिंदी वाक्य रचना - पदक्रम और अन्विति	
IV*	**इकाई:-4**	हिंदी के विविध रूप संपर्कभाषा राष्ट्रभाषा राजभाषा के रूप में हिंदी माध्यम भाषा संचार भाषा हिंदी की संवैधानिक स्थिति।	12
V*	**इकाई:-5**	देवनागरी लिपि देवनागरी लिपि का ऐतिहासिक विकासक्रम देवनागरी लिपि की विशेषताएँ देवनागरी लिपि का मानकीकरण।	12

10. Unit wise Student activities:

1. Assignment -I
2. Assignment -II
3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)

1. हिंदी भाषा का इतिहास -धीरेन्द्र वर्मा, हिंदुस्तानी एकेडमी प्रकाशन, इलाहाबाद-211 001
2. हिंदी भाषा की संरचना -भोलानाथ तिवारी, वाणी प्रकाशन, 21-ए, दयानन्द मार्ग, दरियागंज, नई दिल्ली-110002
3. हिन्दी भाषा हरदेव बाहरी . डॉ :
4. भाषा और समाज, रामविलास शर्मा , राजकमल प्रकाशन, नई दिल्ली, c2011.

12. Reference Books (Atleast 5) (Full Details)

1. हिंदी शब्दानुशासन -किशोरीदास वाजपेयी, ए .आई .टी .बी .एस .पब्लिशर्स, दिल्ली-110 051.
2. हिंदी, उर्दू और हिन्दुस्तानी -पद्मसिंह शर्मा, लोकभारती प्रकाशन, पहली मंजिल, महात्मा गाँधी मार्ग, सिविल लाइंस, इलाहाबाद,- 211 001.
3. अच्छी हिंदी -रामचन्द्र वर्मा, लोकभारती प्रकाशन, पहली मंजिल, महात्मा गाँधी मार्ग, सिविल लाइंस, इलाहाबाद,- 211 001.

13. Web Resource (Websites/Databases/E-Resources)

1. **Hindi Vyakaran**:
   - Website: Hindi Vyakaran
   - Description: An online platform offering resources on Hindi grammar, including lessons, exercises, and explanations of various grammatical concepts.
2. **Hindi Language Learning Apps**:
   - Explore popular language learning apps like Duolingo, Memrise, or Drops that offer Hindi language courses and interactive lessons.
3. **Rajbhasha Vibhag - Government of India**:
   - Website: Rajbhasha Vibhag
   - Description: The official website of Rajbhasha Vibhag focuses on promoting the use of Hindi in government communication and provides language-related resources.
4. **Hindi Linguistics Resources**:
   - Include links to online resources that cover Hindi linguistics, phonetics, morphology, and syntax for a deeper understanding of the structure of the Hindi language.
5. **Language Technology Tools**:
   - Introduce tools like Google Input Tools, Lipikaar, or Microsoft Indic Language Input Tools that aid in typing in Hindi and exploring language variations.

14. Journals/Magazines (National /International) (Minimum 5 per subject)

1. हंस
2. अकार
3. वसुधा
4. बनास जन
5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)

1. Assignment – 10
2. Assignment – 10
3. Seminar – I 10
4. Practical 10
5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:
    1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
    2. Completed 1-year PG after 4-year

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme: M.A. Hindi
2. Title of the subject: AADHUNIK KATHA SAHITYA
3. Course code: 412

4. Learning outcomes:	**7. Specifications:**
1. Analyze the novels and stories	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Theory • 100% of Theory **8. Bridge courses to be done:** 1._____ 2._____ 3._____ 4._____ 5._____
Evaluate and justify	
Critique	
5. Skill Training:	
1. Compare, contrast, examine & interpret the fiction.	
2. Develop the skill to critically review and analyze modern Hindi short stories, considering aspects such as plot, character development, and thematic richness.	
3. Develop cultural sensitivity and an understanding of diverse perspectives for a nuanced interpretation of modern Hindi short stories.	
6. Pre-requisites: Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience and Proficiency / professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/ Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling	

9.

Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
I	**इकाईः -1**	**प्रेमचंद युगीन कथा साहित्य** गोदान – प्रेमचंद	10
II	**इकाईः-2**	**प्रेमचंदोत्तर कथा साहित्य** मैला आंचल – फणीश्वर नाथ रेणु	10
III	**इकाईः-3**	**समकालीन कथा साहित्य** 1. जय शंकर प्रसाद- गुण्डा 2. यशपाल – ज्ञानदान 3. कमलेश्वर – राजा निरबंसिया 4. संजीव – प्रेतमुक्ति 5. निर्मल वर्मा – परिंदे 6. मोहन राकेश – आद्रा 7. असगर वजाहर – तमाशे में डूबा हुआ देश 8. मंजूर एहतेशाम – रमजान में एक मौत 9. जैनेंद्र – दो चिड़ियाँ 10. उदयप्रकाश – तिरिछ	16
IV*	**इकाईः-4**	**महिला कथाकारों की कहानियाँ** 1. सिक्का बदल गया - कृष्णा सोबती 2. मछलियाँ – उषा प्रियंवदा 3. मैं हार गयी – मन्नु भंडारी 4. हरी बिंदी – मृदुला गर्ग 5. सिलिया – सुशीला टाकभौरे	14

V*	**इकाई- 5**	1. कथा साहित्य का उदय और विकास 2. यथार्थ तथा मध्य वर्ग का उदय 3. कथा साहित्य में नायक और नायिका की अवधारणा एवं बदलते स्वरूप 4. कथा साहित्य में शिल्पगत प्रयोग 5. स्त्री विमर्श, दलित विमर्श, आदिवासी विमर्श	10

- IV & V units concentrate on contemporary developments in the given subjects)

10. Unit wise Student activities:

1. Assignment -I
2. Assignment -II
3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)

1. गोदान, प्रेमचंद, राजकमल प्रकाशन, नई दिल्ली
2. मैला आंचल, फणीश्वर नाथ रेणु, राजकमल प्रकाशन, नई दिल्ली
3. प्रतिनिधि कहानियाँ, राजेन्द्र पोवार, राजकमल प्रकाशन, नई दिल्ली

12. Reference Books (Atleast 5) (Full Details)

1. कहानी :नई कहानी –नामवर सिंह, राजकमल प्रकाशन प्राइवेट लिमिटेड, 1 बी .नेताजी सुभाष मार्ग, दरियागंज, नई दिल्ली –110002
2. नई कहानी : संदर्भ और प्रकृति – देवीशंकर अवस्थी,राजकमल प्रकाशन प्राइवेट लिमिटेड, 1 बी .नेताजी सुभाष मार्ग, दरियागंज, नई दिल्ली – 110002
3. कथा समय में तीन हम सफर – निर्मला जैन, राजकमल प्रकाशन प्राइवेट लिमिटेड, 1 बी .नेताजी सुभाष मार्ग, दरियागंज, नई दिल्ली – 110002
4. कहानी :समकालीन चुनौतियाँ – शंभु गुप्त, वाणी प्रकाशन, 21-ए , दयानंद मार्ग, दरियागंज, नई दिल्ली – 110002
5. हिंदी कहानी का इतिहास – डॉ .लाल चन्द गुप्त'मंगल', राधाकृष्ण प्रकाशन प्राइवेट लिमिटेड, 2/38, अंसारी रोड, दरियागंज, नई दिल्ली – 110002

13. Web Resource (Websites/Databases/E-Resources)

1. **Gadya Kosh**:
   - Website: Gadya Kosh
   - Description: An online repository of Hindi short stories, providing a collection of modern and classic works along with critical analyses.
2. **Hindi Sahitya - Aadhunik Katha**:
   - Website: Hindi Sahitya - Aadhunik Katha
   - Description: A section dedicated to modern short stories on the Hindi Sahitya Darpan website, offering a variety of stories along with literary discussions.
3. **Rekhta - Short Stories**:
   - Website: Rekhta Short Stories
   - Description: Explore a collection of Hindi and Urdu short stories on Rekhta, featuring works by contemporary and classic authors.
4. **Hindi Short Story Collections on Amazon Kindle**:
   - Explore Kindle collections of Hindi short stories, where students can find modern works by various authors, often available for digital download.

14. Journals/Magazines (National /International) (Minimum 5 per subject)

1. हंस
2. अकार
3. वसुधा
4. बनास जन
5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)

1. Assignment I –10
2. Assignment II–10
3. Seminar 10
4. Practical 10
5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:

1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
2. Completed 1-year PG after 4-year

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme : M.A. Hindi
2. Title of the subject: KATHETAR GADYA SAHITYA
3. Course code: 413

4. Learning outcomes:	**7. Specifications:**
1. Understand the text	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Theory • 100% of Theory _____
2. Describe and discuss the content.	
3.Critical Analysis of Prose Styles	
5. Skill Training:	**8. Bridge courses to be done:** 1._____ 2._____ 3._____ 4._____ 5._____
1. Analyze, relate and compare the various genres.	
2. Develop the skill to construct well-founded literary critiques and reviews, evaluating the artistic and thematic aspects of Hindi nonfiction.	
3. Hone the ability to communicate literary ideas coherently, both in written and verbal forms, within the context of Hindi narrative prose literature.	
6. Pre-requisites: 1. Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience and Proficiency / professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/ Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling	

9.

Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
I	**इकाईः -1**	**- नाटक** जयशंकर प्रसाद – ध्रुवस्वामिनी *	8
II	**इकाईः-2**	**-निबंध** रामचंद्र शुक्ल – कविता क्या है ? * हजारीप्रसाद द्विवेदी – कुटज * कुबेरनाथ राय – रस आखेटक * विद्यानिवास मिश्र – कटहल *	10
III	**इकाईः-3**	**- व्यंग्य** हरिशंकर परसाई – सदाचार का ताबीज	7
IV*	**इकाईः-4**	**- संस्मरण** महादेवी वर्मा – पथ के साथी) मैथिलीशरण गुप्त, सुभद्राकुमारी चौहान, निराला, प्रसाद एवं पंत	9
V*	**इकाईः-5**	**- जीवनी** विष्णु प्रभाकर – आवारा मसीहा	9
VI*	**इकाईः-6**	**- यात्रा वृत्तांत** अज्ञेय एक बूँद सहसा उछली	9
VII*	**इकाईः-7**	**- रिपोर्ताज** रांगेय राघव – तूफानों के बीच	

		*** व्याख्या के लिए केवल द्रुत पाठ के लिए नाटक** मोहन राकेश – आषाढ़ का एक दिन **आत्मकथा** ओमप्रकाश वाल्मीकि – जूठन **जीवनी** विष्णु प्रभाकर – आवारा मसीहा	8

- IV & V units concentrate on contemporary developments in the given subjects)

10. Unit wise Student activities:
    1. Assignment -I
    2. Assignment -II
    3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)
    1. ध्रुवस्वामिनी, जयशंकर प्रसाद ,राजकमल प्रकाशन, नई दिल्ली
    2. आषाढ़ का एक दिन, मोहन राकेश , राजपाल एंड संस
    3. आवारा मसीहा, विष्णु प्रभाकर, राजपाल एंड संस
    4. जूठन, ओमप्रकाश वाल्मीकि, राधाकृष्ण प्रकाशन
    5. तूफानों के बीच, रांगेय राघव, राधाकृष्ण प्रकाशन
    6. एक बूँद सहसा उछली, अज्ञेय, वाणी प्रकाशन
    7. पथ के साथी, महादेवी वर्मा, लोकभारती प्रकाशन
    8. सदाचार का ताबीज, हरिशंकर परसाई, वाणी प्रकाशन
    9. चिंतामणि, भाग 1, रामचंद्र शुक्ल, लोकभारती प्रकाशन
    10. कुटज, हजारीप्रसाद द्विवेदी, लोकभारती प्रकाशन
    11. रस आखेटक, कुबेरनाथ राय, राजकमल प्रकाशन
    12. कटहल, विद्यानिवास मिश्र, राजकमल प्रकाशन

12. Reference Books (Atleast 5) (Full Details)
    1. हिंदी गद्य साहित्य विन्यास एवं विकास – रामस्वरूप चतुर्वेदी, लोकभारती प्रकाशन, दरबारी बिल्डिंग, महात्मा गांधी मार्ग, सिविल लाइन्स, इलाहाबाद – 211001
    2. महादेवी वर्मा – गंगा प्रसाद पाण्डेय, लोकभारती प्रकाशन, दरबारी बिल्डिंग, महात्मा गांधी मार्ग, सिविल लाइन्स, इलाहाबाद – 211001
    3. महादेवी – (सं (इंद्रनाथ मदान, राजकमल प्रकाशन प्राइवेट लिमिटेड, 1 बी .नेताजी सुभाष मार्ग, दरियागंज, नई दिल्ली – 110002
    4. नटरंग) पत्रिका (– मोहन राकेश पर केन्द्रित अंक
    5. हिंदी नाटक एवं रंगमंच – (सं (नेमिचंद्र जैन, मैकमिलन प्रकाशन 21, पट्टूलोस, माउंड रोड, चेन्नई

13. Web Resource (Websites/Databases/E-Resources)

1. **Hindi Sahitya Darpan - Kathetar Gadya:**
   Website: Hindi Sahitya Darpan - Kathetar Gadya
   Description: A section on Hindi Sahitya Darpan dedicated to narrative prose literature, providing a collection of articles, analyses, and discussions
2. **Rekhta - Prose Literature**:
   Website: Rekhta - Prose Literature
   Description: Explore a collection of Hindi and Urdu prose works on Rekhta, featuring works by various authors, including essays, memoirs, and other narrative forms.
3. **Hindi Prose Collections on Amazon Kindle:**
   Explore Kindle collections of Hindi prose works, where students can find both classic and modern works, often available for digital download.

14. Journals/Magazines (National /International) (Minimum 5 per subject)
    1. हंस
    2. अकार
    3. वसुधा
    4. बनास जन
    5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)
    1. Assignment I –10
    2. Assignment II–10
    3. Seminar 10
    4. Practical 10
    5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:
    1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
    2. Completed 1-year PG after 4-year

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme: M.A. Hindi

2. Title of the subject: HINDI SAHITYA KA ITHIHAS -I (AADHIKAL SE RITIKAL TAK)

3. Course code: 414

4. Learning outcomes:	**7. Specifications:**
Remember & recall facts regarding history of literature of Ancients & Medieval period	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Theory • 100% of Theory _____ **8. Bridge courses to be done:** 1._____ 2._____ 3._____ 4._____ 5._____
Understand	
Apply the facts & ideas to interpret Ancient Medieval poetry	
Analyze	
Evaluate and critique the literature	
5. Skill Training:	
1. Hone the skill to critically critique and analyze literary works from different periods, emphasizing the nuances and stylistic variations present in Hindi literature.	
2. Cultivate cultural sensitivity to interpret literary works within their historical and societal contexts, fostering a nuanced understanding of the Adikal to Ritikal eras.	
3. Develop a comprehensive understanding of the historical evolution of Hindi literature from the Adikal (Early Period) to the Ritikal (Riti Period).	
6. Pre-requisites: 1. Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience and Proficiency / professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/ Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling ◣Total 18-19 years of	

9.

Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
I	**इकाईः -1**	इतिहास-लेखन की परंपरा हिंदी साहित्य के इतिहास का काल-विभाजन, सीमा-निर्धारण और नामकरण साहित्यिक प्रवृत्तियाँ काव्यधाराएँ रचनाकार एवं उनकी रचनाएँ) परिचय द्रुतपाठ(	10
II	**इकाईः-2**	आदिकाल की पृष्टभूमि रासो साहित्य	12

		जैन साहत्य सिद्ध एवं नाथ साहित्य अमीर खुसरो की हिंदी कविता विद्यापति एवं उनकी पदावली आरंभिक गद्य तथा लौकिक साहित्य	
III	**इकाई:-3**	पूर्व मध्यकाल) भक्तिकाल(ऐतिहासिक पृष्ठभूमि सांस्कृतिक चेतना भक्ति आन्दोलन	12
IV*	**इकाई:-4**	विभिन्न कव्यधाराएँ एवं उनका वैशिष्ट्य निर्गुण ज्ञानाश्रयी निगुण प्रेमाश्रयी सगुण रामभक्ति सगुण कृष्णभक्ति भक्तितर काव्य और भक्तिकालीन गद्य साहित्य	10
V*	**इकाई:-5**	उत्तर मध्यकाल) रीतिकाल(ऐतिहासिक पृष्टभूमि तथा नामकरण की समस्या विभिन्न धाराएँ) रीतिबद्ध,रीतिसिद्ध एवं रीतिमुक्त (एवं प्रवृत्तियां प्रतिनिधि रचनाकार एवं रचनाएँ रीतिकालीन गद्य साहित्य	16

- IV & V units concentrate on contemporary developments in the given subjects)

10. Unit wise Student activities:

    1. Assignment -I
    2. Assignment -II
    3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)

1. हिंदी साहित्य का इतिहास -रामचंद्र शुक्ल, प्रकाशन संस्थान, 1715/21, दयानंद मार्ग, दरियागंज .नई दिल्ली-110 002
2. हिंदी साहित्य का इतिहास, डॉ. नगेंद्र, राजकमल प्रकाशन, नई दिल्ली
3. हिंदी साहित्य का सरल इतिहास, विश्वनाथ त्रिपाठी, ओरिएंट ब्लैक स्वान प्रकाशन
4. हिन्दी साहित्य का आदिकाल, हजारी प्रसाद द्विवेदी, वाणी प्राकाशन
5. रीतिकालीन साहित्य का पुनर्मूल्यांकन, रामकुमार वर्मा, साहित्य भवन, इलाहबाद

12. Reference Books (Atleast 5) (Full Details)

1. हिंदी साहित्य एवं संवेदना का विकास – रामस्वरूप चतुर्वेदी,लोक भारती प्रकाशन, दरवारी बिल्डिंग, महात्मा गाँधी मार्ग, इलाहबाद-1
2. हिंदी साहित्य का दूसरा इतिहास -डॉ बच्चन सिंह, राधाकृष्ण प्रकाशन प्राइवेट लिमिटेड, 7/31, अंसारी रोड, दरियागंज, नई दिल्ली=110 002
3. इतिहास क्या है – ई.एच.कार, मैकमिलन पब्लिशर्स इंडिया लिमिटेड, चेन्नई
4. साहित्य का इतिहास दर्शन -नलिनविलोचन शर्मा, बिहार-राष्ट्रभाषा-परिषद्, आचार्य शिवपूजन सहाय मार्ग, सैदपुर विस्तार पथ, पटना-800 004

13. Web Resource (Websites/Databases/E-Resources)

1. **JSTOR**:
    - Website: JSTOR
    - Description: JSTOR is a digital library that offers access to academic journals, books, and primary source materials. It can be useful for in-depth research on specific topics.
2. **Sahitya Akademi**:
    - Website: Sahitya Akademi
    - Description: The official website of Sahitya Akademi, India's national academy of letters, may provide information and publications related to the history of Hindi literature.
3. **Rajasthan Hindi Granth Academy**:
    - Website: Rajasthan Hindi Granth Academy
    - Description: This academy focuses on the promotion of Hindi literature. The website may have resources related to the historical development of Hindi literature.
4. **Hindi Sahitya Darpan - Itihas Section**:

- Website: Hindi Sahitya Darpan - Itihas
- Description: This section on Hindi Sahitya Darpan provides articles, analyses, and discussions on the history of Hindi literature, spanning from the Aadhikal to Ritikal.

5. **Rekhta - Hindi Literature**:
   - Website: Rekhta - Hindi Literature
   - Description: Rekhta is a comprehensive platform offering a vast collection of Hindi literary works, including historical information, biographies, and literary analyses.
6. **Hindi Sahitya Kosh**:
   - Website: Hindi Sahitya Kosh
   - Description: An extensive online dictionary and encyclopedia of Hindi literature, providing information about authors, literary terms, and historical context.

14. Journals/Magazines (National /International) (Minimum 5 per subject)

1. हंस
2. अकार
3. वसुधा
4. बनास जन
5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)
    1. Assignment I –10
    2. Assignment II–10
    3. Seminar 10
    4. Practical 10
    5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:
    1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
    2. Completed 1-year PG after 4-year

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme: M.A. Hindi
2. Title of the subject: BHASHA VIGYAN
3. Course code: 421

4. Learning outcomes:	**7. Specifications:**
1. Remember & recall facts and basic concepts of linguistics.	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Theory • 100% of Theory _____
2. Define list, memorize, repeat & state the content & theories	**8. Bridge courses to be done:**
3. Understand, classify, describe, discuss and identify linguistics characteristics	1._____ 2._____ 3._____ 4._____ 5._____
4. Apply to demonstrate & interpret knowledge of linguistics	
5. Skill Training:	
1. Construct, develop & formulate the basic requirements of language	
2. Develop skills in phonetic and morphological analysis of the Hindi language, facilitating a deeper understanding of its linguistic components.	
3. Enhance the ability to communicate linguistic concepts and analyses effectively, both in written and oral forms, to diverse audiences.	
6. Pre-requisites: 1. Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience and Proficiency / professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling	

9.

Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
I	**इकाईः -1**	**भाषा और भाषा विज्ञान** • भाषा की परिभाषा एवं अभिलक्षण • भाषा का विकास, परिवर्तन और कारण • भाषा के विभिन्न स्वरूप • भाषा विज्ञान की परिभाषाएँ • भाषा विज्ञान का भारतीय एवं पाश्चात्य इतिहास • भाषा विज्ञान की शाखाएँ) व्यतिरेकी भाषा विज्ञान, सामाजिक भाषा विज्ञान(• भाषा का आकृतिमूलक एवं पारिवारिक वर्गीकरण	12
II	**इकाईः-2**	**ध्वनि विज्ञान** • ध्वनि अध्ययन के आयाम) क (उच्चारणात्मक) ख (संवहन) ग (श्रवणात्मक • ध्वनियों का वर्गीकरण) स्वर एवं व्यंजन(	12
III	**इकाईः-3**	**इकाई- 3 - स्वनिम विज्ञान** • स्वनिम की अवधारणा	12

		• स्वनिम व संरचना • स्वनिम के भेद	
IV*	**इकाई:-4**	**रूप विज्ञान एवं वाक्य विज्ञान** • रूपिम की अवधारणा: रूपिम और स्वरूप • रूप परिवर्तन और उनके कारण • शब्द एवं पद • शब्द एवं पद में अंतर • वाक्य की परिभाषाएँ • वाक्य के प्रकार	12
V*	**इकाई:-5**	**अर्थ विज्ञान** • अर्थ की व्युत्पत्ति • शब्द एवं अर्थ का संबंध • अर्थ परिवर्तन की दशाएँ • अर्थ परिवर्तन के कारण	12
	इकाई:-6	**लिपि विज्ञान का परिचय** • लिपि का अर्थ • लिपि के प्रकार	12

- IV & V units concentrate on contemporary developments in the given subjects)

10. Unit wise Student activities:
    1. Assignment -I
    2. Assignment -II
    3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)

1. भाषा विज्ञान - डॉ .भोलानाथ तिवारी, किताब महल, फ्लोर- 20, 8,अंसारी रोड, दरियागंज, नई दिल्ली –110 002.
2. हिंदी भाषा की संरचना -भोलानाथ तिवारी, वाणी प्रकाशन, 21-ए, दयानन्द मार्ग, दरियागंज, नई दिल्ली-110002
3. हिन्दी भाषा हरदेव बाहरी . डॉ :
4. भाषा और समाज, रामविलास शर्मा , राजकमल प्रकाशन, नई दिल्ली, c2011.

12. Reference Books (Atleast 5) (Full Details)

5. भाषा विज्ञान की भूमिका - आचार्य देवेन्द्रनाथ शर्मा, राजकमल प्रकाशन प्राइवेट लिमिटेड, 1-B, नेताजी सुभाष मार्ग,दरिमागंज, नई दिल्ली – 110 002.
6. भाषा विज्ञानः सैद्धांतिक चिंतन -रवीन्द्रनाथ श्रीवास्तव, राधाकृष्ण प्रकाशन प्राइवेट लिमिटेड, जी – 17, जगतपूरी, दिल्ली – 110 051.
7. भाषा) अनुवाद - लेयोनार्ड ब्लूमफील्ड) अनुवादक – विश्वनाथ प्रसाद(, मोतीलाल बनारसी दास, 41, सं.ए .बंग्लो रोड, जवाहर नगर, नई दिल्ली – 110 007.
8. भाषा और भाषिकी - डॉ .देवीशंकर द्विवेदी, लक्ष्मीनारायण अग्रवाल पबिलकेशन, ब्लांक नं-.50, अनुपम प्लाजा, संमज पैलेस, सिविल लाईन्स, आगरा- 282 002.

13. Web Resource (Websites/Databases/E-Resources)

1. International Phonetic Association
Description: Explore the IPA website for resources related to phonetics, including the International Phonetic Alphabet and guidelines for transcription.

2 Ethnologue:
Website: Ethnologue
Description: Ethnologue provides comprehensive information about languages spoken worldwide, including language families, dialects, and language maps.

3 Google Scholar:
Website: Google Scholar
Description: Google Scholar can be used to search for scholarly articles, papers, and books related to various branches of linguistics.

4. MIT OpenCourseWare - Linguistics:
Website: MIT OCW - Linguistics
Description: MIT OpenCourseWare offers free access to course materials for linguistics, including lecture notes, assignments, and readings.

5. Stanford Online - Natural Language Processing with Deep Learning:
Website: Stanford Online - NLP with Deep Learning
Description: This course on natural language processing provides insights into language analysis using deep learning techniques.

14. Journals/Magazines (National /International) (Minimum 5 per subject)

1. हंस
2. अकार
3. वसुधा
4. बनास जन
5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)
    1. Assignment I –10
    2. Assignment II–10
    3. Seminar 10
    4. Practical 10
    5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:
    1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
    2. Completed 1-year PG after 4-year

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme: M.A. Hindi
2. Title of the subject: PRACHEEN EVAM MADHYAYUGEEN KAVYA
3. Course code: 422

4. Learning outcomes:	**7. Specifications:**
1. Develop the ability to critically analyze and interpret classical and medieval Hindi poems, including their themes, language, and poetic devices.	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Theory • 100% of Theory _____
2. Gain a comprehensive understanding of the socio-cultural and historical context of classical and medieval Hindi poetry.	**8. Bridge courses to be done:** 1._____ 2._____
3. Apply the learnt theories of linguistics & poetics to interpret, relate, examine the ancient and medieval poetry.	3._____ 4._____
5. Skill Training:	5._____
Critical Thinking and Argumentation: Hone critical thinking skills and the ability to construct well-reasoned arguments when discussing the significance and impact of classical and medieval Hindi poetry.	
Literary Appreciation: Cultivate an appreciation for the aesthetic and literary values inherent in the works of renowned poets from the ancient and medieval periods.	
Interdisciplinary Understanding: Develop an interdisciplinary understanding by exploring the intersections between classical and medieval Hindi poetry, history, philosophy, and other relevant disciplines.	
6. Pre-requisites: 1. Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience and Proficiency / professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/ Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling	

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Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
	इकाईः -1	**विद्यापति** - (सं (.शिवप्रसाद सिंह – लोकभारती प्रकाशन, प्रारंभिक 10 पद	8
I	**इकाईः -2**	**कबीर**- (10 दोहे) गुरुदेव कौ अंग (11,20) सुमिरन कौ अंग (5) विरह कौ अंग) 3,18) परचा कौ अंग) 8) माया कौ अंग) 11) कस्तूरियाँ मृग कौ अंग) 1) निंद्या कौ अंग) 4) बेलि कौ अंग) 2) कबीर ग्रंथावली, (सं (.श्याम सुंदर दास, राजकमल प्रकाशन	14

		जायसी -पद्मावत (नागमती वियोग खण्ड(जायसी ग्रंथावली – (सं (.आचार्य रामचन्द्र शुक्ल, वाणी प्रकाशन	
	इकाई:-3	**सूरदास** -भ्रमरगीत सार, पद सं - .)9,23,34,38,39,42,52,57,62,64) कुल 10 पद भ्रमरगीत सार – (सं (.– रामचन्द्र शुक्ल, वाणी प्रकाशन **तुलसीदास** -रामचरितमानस) उत्तर काण्ड((शुरूआत से 10 पद(	12
II	**इकाई:-4**	**बिहारी** -बिहारी रत्नाकर) दोहा सं – 1,20,32,35,38,52,70,73,94,121) विहारी रत्नाकर – (सं) – जगन्नाथ दास रत्नाकर, लोकभारती प्रकाशन **घनानंद** -घनानंद) पद सं .– 1,2,3,13,20,32,38,45,69,94) घनानंद - (सं) – विश्वनाथ प्रसाद मिश्र ,संजय बुक सेंटर, वाराणसी	12
III	**इकाई:-5**	**मीरा** -मीराबाई की पदावली) पद सं – 1,3,18,28,32,36,38,41,53,70) मीराबाई की पदावली – (सं) परशुराम चतुर्वेदी, हिन्दी साहित्य सम्मेलन प्रयाग **द्रुत पाठ के लिए** **जायसी** -मानसरोदक खंड	12

- IV & V units concentrate on contemporary developments in the given subjects)

10. Unit wise Student activities:

1. Assignment -I
2. Assignment -II
3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)

1. विद्यापति के पद, शिवप्रसाद सिंह – लोकभारती प्रकाशन, प्रारंभिक 10 पद
2. जायसी ग्रंथावली –(संपादक - आचार्य रामचन्द्र शुक्ल) वाणी प्रकाशन
3. रामचरितमानस , तुलसीदास, गीता प्रैस
4. कबीर, हजारी प्रसाद द्विवेदी, राजकमल प्रकाशन
5. भ्रमरगीत सार, सूरदास, संपादक रामचन्द्र शुक्ल, वाणी प्रकाशन
6. विहारी रत्नाकर – (सं) – जगन्नाथ दास रत्नाकर, लोकभारती प्रकाशन
7. घनानंद - (सं) – विश्वनाथ प्रसाद मिश्र ,संजय बुक सेंटर, वाराणसी
8. मीराबाई की पदावली – (सं) परशुराम चतुर्वेदी, हिन्दी साहित्य सम्मेलन प्रयाग

12. Reference Books (Atleast 5) (Full Details)

1. भक्ति काव्य का समाज दर्शन - प्रेमशंकर, वाणी प्रकाशन, 21-ए, दयानंद मार्ग, दरियागंज, नई दिल्ली-110 002
2. जायसी - एक नयी दृष्टि - डॉ रघुवंश, लोकभारती प्रकाशन, पहली मंजिल, दरबारी बिल्डिंग, महात्मा गाँधी रोड, सिविल लाइन्स, इलाहाबाद-211 001.
3. कबीर - एक नयी दृष्टि - डॉ रघुवंश, लोकभारती प्रकाशन, पहली मंजिल, दरबारी बिल्डिंग, महात्मा गाँधी रोड, सिविल लाइन्स, इलाहाबाद-211 001.
4. कबीर -हज़ारी प्रसाद द्विवेदी, राजकमल प्रकाशन प्राइवेट लिमिटेड, 1-बी, नेताजी 1 मार्ग, दरियागंज, नई दिल्ली-110 002.
5. लोकवादी तुलसीदास - विश्वनाथ त्रिपाठी, राधाकृष्ण प्रकाशन प्राइवेट लिमिटेड, जी-17, जगतपुरी, दिल्ली-110051.

13. Web Resource (Websites/Databases/E-Resources)

1. **Sahitya Akademi - Medieval Hindi Literature**:
   - Website: Sahitya Akademi
   - Description: The official website of Sahitya Akademi may include publications and resources related to medieval Hindi poetry.
2. **JSTOR - Hindi Literature**:
   - Website: JSTOR
   - Description: JSTOR provides access to scholarly journals and books, offering articles on various aspects of Hindi literature, including classical and medieval poetry.
3. **Bhandarkar Oriental Research Institute (BORI)**:
   - Website: BORI
   - Description: BORI is known for its extensive collection of manuscripts and historical documents. It may contain resources related to ancient and medieval Hindi poetry.

4. **IGNCA - Indian Literature Collection**:
    - Website: IGNCA - Indian Literature
    - Description: The Indira Gandhi National Centre for the Arts (IGNCA) has a collection of Indian literature, including poetry. It can be a valuable resource for researchers.

14. Journals/Magazines (National /International) (Minimum 5 per subject)

    1. हंस
    2. अकार
    3. वसुधा
    4. बनास जन
    5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)
    1. Assignment I –10
    2. Assignment II–10
    3. Seminar 10
    4. Practical 10
    5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:
    1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
    2. Completed 1-year PG after 4-year

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme: M.A. HINDI
2. Title of the subject: HINDI SAHITYA KA ITIHAS –II (AADHUNIK KAL)
3. Course code: 423

4. Learning outcomes:	**7. Specifications:**
Learn comprehension & evaluation of history of Hindi literature	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Theory • 100% of Theory & Problems
Define social, political & economical effects on the modern society & Hindi literature	
Describe the major events and individuals associated with the history of Hindi literature.	
5. Skill Training:	**8. Bridge courses to be done:**
Hone skills in analyzing and interpreting literary works, with a focus on recognizing themes, styles, and narrative techniques employed by authors in the modern Hindi period.	1._____ 2._____ 3._____ 4._____ 5._____
Explore and assess the cultural and social impact of modern Hindi literature, examining how it reflects and influences the changing dynamics of society.	
Foster skills in comparative literature by analyzing the similarities and differences between modern Hindi literature and other literary traditions.	
6. Pre-requisites: 1. Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience and Proficiency / professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/ Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling	

9.

Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
	इकाईः -1	**आधुनिक काल की पृष्ठभूमि:** -राजनैतिक, आर्थिक, सांस्कृतिक-भाषाई परिस्थितियाँ -आधुनिकता एवं समकालीनता की अवधारणा -नवजागरण एवं लोकजागरण -आधुनिकता एवं मध्यकालीनता -आधुनिक काल की समय सीमा, नामकरण एवं उपविभाजन -आधुनिक साहित्य के विकास में संस्थानों एवं पत्र-पत्रिकाओं का योगदान	12
I	**इकाईः -2**	**आधुनिक काव्य के विविध सोपान-प्रमुख प्रवृत्तियाँ, मुख्य रचनाकार एवं रचनाएँ** -भारतेंदु युग -द्विवेदी युग -छायावाद -छायावादोत्तर युग -प्रगतिवाद -प्रयोगवाद -नई कविता -जनवादी कविता -समकालीन हिंदी कविता) दलित, आदिवासी एवं स्त्रीवादी कविताएँ(-नवगीत	14

	इकाई:-3	हिंदी गद्य का विकास – इसाई मिशनरियाँ, फोर्ट विलियम कॉलेज तथा आर्य समाज की भूमिका गद्य साहित्य की विधाओं का उद्भव एवं विकास :प्रवृत्तियाँ और विशेषताएँ 1. हिंदी कहानी 2. हिंदी उपन्यास 3. हिंदी नाटक एवं एकांकी 4. हिंदी निबंध और आलोचना	13
II	**इकाई:-4**	**हिंदी गद्य साहित्य की अन्य विधाएँ :उद्भव एवं विकास** रेखाचित्र -संस्मरण -जीवनी -आत्मकथा -साक्षात्कार -यात्रावृतांत -पत्रलेखन -भेंटवार्ता -रिपोतार्ज़	13
III	**इकाई:-5**	**दक्खिनी हिंदी साहित्य का संक्षिप्त परिचय** उर्दू साहित्य का संक्षिप्त परिचय -हिंदीतर क्षेत्रों एवं प्रवासी हिंदी भाषा और साहित्य	8

- IV & V units concentrate on contemporary developments in the given subjects)

10. Unit wise Student activities:

1. Assignment -I
2. Assignment -II
3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)

1. हिंदी साहित्य एवं संवेदना का विकास – रामस्वरूप चतुर्वेदी,लोक भारती प्रकाशन, दरवारी बिल्डिंग, महात्मा गाँधी मार्ग, इलाहबाद-1
2. हिंदी साहित्य का दूसरा इतिहास -डॉ बच्चन सिंह, राधाकृष्ण प्रकाशन प्राइवेट लिमिटेड, 7/31, अंसारी रोड, दरियागंज, नई दिल्ली=110 002
3. हिन्दी साहित्य का इतिहास, रामचन्द्र शुक्ल, राजकमल प्रकाशन
4. हिंदी साहित्य का सरल इतिहास, विश्वनाथ त्रिपाठी, ओरिएंट ब्लैक स्वान प्रकाशन
5. हिंदी साहित्य का इतिहास, संपादक - डॉ. नगेंद्र, राजकमल प्रकाशन, नई दिल्ली

12. Reference Books (Atleast 5) (Full Details)

1. कहानी नयी कहानी – नामवर सिंह, राजकमल प्रकाशन प्राइवेट लिमिटेड, 1-बी, नेताजी सुबाष मार्ग, नई दिल्ली-110002
2. हिंदी का गद्य साहित्य – रामचंद्र तिवारी, विश्वविद्यालय प्रकाशन, बुयूबोक 24. कॉम, 726 ओल्ड कातरा, अलाहाबाद, उत्तर प्रदेश- 211002
3. आधुनिक साहित्य की प्रवृतियाँ – नामवर सिंह, राजकम प्रकाशन प्राइवेट लिमिटेड, 1-बी, नेताजी सुभाष मार्ग, नई दिल्ली-110002
4. महावीर प्रसाद द्विवेदी और हिंदी नवजागरण – रामविलाश शर्मा, राजकम प्रकाशन प्राइवेट लिमिटेड, 1-बी, नेताजी सुबाष मार्ग, नई दिल्ली-110002
5. आधुनिक हिंदी साहित्य का इतिहास – बच्चन सिंह, लोक भारती प्रकाशन, पहली मंजिल,दरवारी बिल्डिंग, महात्मा गाँधी मार्ग, इलाहबाद-1

13. Web Resource (Websites/Databases/E-Resources)

1. **Hindi Sahitya Darpan - Aadhunik Kavya**:
   - Website: Hindi Sahitya Darpan - Aadhunik Kavya
   - Description: This section on Hindi Sahitya Darpan focuses on modern poetry, providing articles, analyses, and discussions on poets and literary trends from the modern period.
2. **Hindvi - Aadhunik Sahitya**:
   - Website: Hindvi - Aadhunik Sahitya
   - Description: Hindvi's vast collection includes modern Hindi literary works, biographies of contemporary authors, and critical analyses of Aadhunik Sahitya.
3. **Sahitya Akademi - Modern Hindi Literature**:
   - Website: Sahitya Akademi
   - Description: The official website of Sahitya Akademi may include publications and resources related to modern Hindi literature, including Aadhunik Kavya.
4. **JSTOR - Hindi Literature**:
   - Website: JSTOR

- Description: JSTOR provides access to scholarly journals and books, offering articles on various aspects of Hindi literature, including modern Hindi poetry and prose.
- websites run by Hindi literature enthusiasts and critics who analyze and discuss Aadhunik Kavya. Include links to notable bloggers or critics.

5. **IGNCA - Indian Literature Collection**:
   - Website: IGNCA - Indian Literature
   - Description: IGNCA may have resources related to modern Hindi literature, including literary events, publications, and discussions.

14. Journals/Magazines (National /International) (Minimum 5 per subject)

    1. हंस
    2. अकार
    3. वसुधा
    4. बनास जन
    5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)
    1. Assignment I –10
    2. Assignment II–10
    3. Seminar 10
    4. Practical 10
    5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:
    1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
    2. Completed 1-year PG after 4-year

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme: M.A. HINDI
2. Title of the subject: BHARATIYA KAVYA SASRTA
3. Course code: 424

4. Learning outcomes:	**7. Specifications:**
Learn comprehension & evaluation of history of Hindi literature	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Theory • 100% of Theory & Problems
Define social, political & economical effects on the modern society & Hindi literature	
Describe the major events and individuals associated with the history of Hindi literature.	
5. Skill Training:	**8. Bridge courses to be done:**
Hone skills in analyzing and interpreting literary works, with a focus on recognizing themes, styles, and narrative techniques employed by authors in the modern Hindi period.	1._____ 2._____ 3._____ 4._____ 5._____
Explore and assess the cultural and social impact of modern Hindi literature, examining how it reflects and influences the changing dynamics of society.	
Foster skills in comparative literature by analyzing the similarities and differences between modern Hindi literature and other literary traditions.	
6. Pre-requisites: 1. Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience and Proficiency / professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/ Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling	

9.

Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
	इकाईः -1	**आधुनिक काल की पृष्ठभूमि:** -राजनैतिक, आर्थिक, सांस्कृतिक-भाषाई परिस्थितियाँ -आधुनिकता एवं समकालीनता की अवधारणा -नवजागरण एवं लोकजागरण -आधुनिकता एवं मध्यकालीनता -आधुनिक काल की समय सीमा, नामकरण एवं उपविभाजन -आधुनिक साहित्य के विकास में संस्थानों एवं पत्र-पत्रिकाओं का योगदान	12
I	**इकाईः -2**	**आधुनिक काव्य के विविध सोपान-प्रमुख प्रवृतियाँ, मुख्य रचनाकार एवं रचनाएँ** -भारतेंदु युग -द्विवेदी युग -छायावाद -छायावादोत्तर युग -प्रगतिवाद -प्रयोगवाद -नई कविता -जनवादी कविता -समकालीन हिंदी कविता) दलित, आदिवासी एवं स्त्रीवादी कविताएँ(-नवगीत	14

	इकाई:-3	हिंदी गद्य का विकास – इसाई मिशनरियाँ, फोर्ट विलियम कॉलेज तथा आर्य समाज की भूमिका गद्य साहित्य की विधाओं का उद्भव एवं विकास :प्रवृत्तियाँ और विशेषताएँ 2. हिंदी कहानी 2. हिंदी उपन्यास 3. हिंदी नाटक एवं एकांकी 4. हिंदी निबंध और आलोचना	13
II	**इकाई:-4**	**हिंदी गद्य साहित्य की अन्य विधाएँ :उद्भव एवं विकास** रेखाचित्र -संस्मरण -जीवनी -आत्मकथा -साक्षात्कार -यात्रावृतांत -पत्रलेखन -भेंटवार्ता -रिपोतार्ज़	13
III	**इकाई:-5**	**दक्खिनी हिंदी साहित्य का संक्षिप्त परिचय** उर्दू साहित्य का संक्षिप्त परिचय -हिंदीतर क्षेत्रों एवं प्रवासी हिंदी भाषा और साहित्य	8

- IV & V units concentrate on contemporary developments in the given subjects)

10. Unit wise Student activities:

1. Assignment -I
2. Assignment -II
3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)

6. हिंदी साहित्य एवं संवेदना का विकास – रामस्वरूप चतुर्वेदी,लोक भारती प्रकाशन, दरवारी बिल्डिंग, महात्मा गाँधी मार्ग, इलाहबाद-1
7. हिंदी साहित्य का दूसरा इतिहास -डॉ बच्चन सिंह, राधाकृष्ण प्रकाशन प्राइवेट लिमिटेड, 7/31, अंसारी रोड, दरियागंज, नई दिल्ली=110 002
8. हिन्दी साहित्य का इतिहास, रामचन्द्र शुक्ल, राजकमल प्रकाशन
9. हिंदी साहित्य का सरल इतिहास, विश्वनाथ त्रिपाठी, ओरिएंट ब्लैक स्वान प्रकाशन
10. हिंदी साहित्य का इतिहास, संपादक - डॉ. नगेंद्र, राजकमल प्रकाशन, नई दिल्ली

12. Reference Books (Atleast 5) (Full Details)

6. कहानी नयी कहानी – नामवर सिंह, राजकमल प्रकाशन प्राइवेट लिमिटेड, 1-बी, नेताजी सुबाष मार्ग, नई दिल्ली-110002
7. हिंदी का गद्य साहित्य – रामचंद्र तिवारी, विश्वविद्यालय प्रकाशन, बुयूबोक 24. कॉम, 726 ओल्ड कातरा, अलाहाबाद, उत्तर प्रदेश- 211002
8. आधुनिक साहित्य की प्रवृतियाँ – नामवर सिंह, राजकम प्रकाशन प्राइवेट लिमिटेड, 1-बी, नेताजी सुभाष मार्ग, नई दिल्ली-110002
9. महावीर प्रसाद द्विवेदी और हिंदी नवजागरण – रामविलाश शर्मा, राजकम प्रकाशन प्राइवेट लिमिटेड, 1-बी, नेताजी सुबाष मार्ग, नई दिल्ली-110002
10. आधुनिक हिंदी साहित्य का इतिहास – बच्चन सिंह, लोक भारती प्रकाशन, पहली मंजिल,दरवारी बिल्डिंग, महात्मा गाँधी मार्ग, इलाहबाद-1

13. Web Resource (Websites/Databases/E-Resources)

6. **Hindi Sahitya Darpan - Aadhunik Kavya**:
   - Website: Hindi Sahitya Darpan - Aadhunik Kavya
   - Description: This section on Hindi Sahitya Darpan focuses on modern poetry, providing articles, analyses, and discussions on poets and literary trends from the modern period.
7. **Hindvi - Aadhunik Sahitya**:
   - Website: Hindvi - Aadhunik Sahitya
   - Description: Hindvi's vast collection includes modern Hindi literary works, biographies of contemporary authors, and critical analyses of Aadhunik Sahitya.
8. **Sahitya Akademi - Modern Hindi Literature**:
   - Website: Sahitya Akademi
   - Description: The official website of Sahitya Akademi may include publications and resources related to modern Hindi literature, including Aadhunik Kavya.
9. **JSTOR - Hindi Literature**:
   - Website: JSTOR

- Description: JSTOR provides access to scholarly journals and books, offering articles on various aspects of Hindi literature, including modern Hindi poetry and prose.
- websites run by Hindi literature enthusiasts and critics who analyze and discuss Aadhunik Kavya. Include links to notable bloggers or critics.

10. **IGNCA - Indian Literature Collection**:
    - Website: IGNCA - Indian Literature
    - Description: IGNCA may have resources related to modern Hindi literature, including literary events, publications, and discussions.

14. Journals/Magazines (National /International) (Minimum 5 per subject)

    1. हंस
    2. अकार
    3. वसुधा
    4. बनास जन
    5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)
    1. Assignment I –10
    2. Assignment II–10
    3. Seminar 10
    4. Practical 10
    5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:
    1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
    2. Completed 1-year PG after 4-year

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme: M.A. Hindi
2. Title of the subject: AADHUNIK HINDI KAVITA
3. Course code: 531

4. Learning outcomes:	**7. Specifications:**
Explore and comprehend the thematic diversity in modern Hindi poetry, including but not limited to social issues, identity, gender, and the intersection of tradition and modernity.	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Theory • 100% of Theory _____ **8. Bridge courses to be done:** 1._____ 2._____ 3._____ 4._____ 5._____
Develop a deep understanding of the various trends and movements in modern Hindi poetry, including post-independence developments and the influence of globalization.	
5. Skill Training:	
Acquire skills to analyze and appreciate diverse poetic forms employed in modern Hindi poetry, ranging from traditional forms to experimental and avant-garde expressions.	
6. Pre-requisites: 1. Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience and Proficiency / professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/ Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling	

9.

Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
	इकाईः -1	मैथिलीशरण गुप्त – साकेत (नवम सर्ग) भारतेंदु हरिश्चंद्र – दशरथ विलाप, बसंत	10
	इकाईः -2	जयशंकर प्रसाद – कामायनी (श्रद्धा सर्ग) हरिवंशराय बच्चन -जो बीत गई सो बात गई निराला – राम की शक्ति पूजा सुमित्रानन्दन पंत – नौका विहार महादेवी वर्मा – मैं नीर भरी दुख की बदरी, मधुर-मधुर मेरे दीपक जल	13
	इकाईः-3	मुक्तिबोध – अंधेरे में रघुवीर सहाय – आत्महत्या के विरुद्ध (2-3 कवितायें) धूमिल -पटकथा	13
	इकाईः- 4	रामधारी सिंह दिनकर – हिमालय नागार्जुन – अकाल और उसके बाद केदारनाथ अग्रवाल – छोटे हाथ सवेरा होता अज्ञेय – असाध्य वीणा	11
	इकाईः- 5	श्रीकांत वर्मा -हस्तक्षेप आलोक धन्वा – ब्रूनो की बेटियाँ राजकमल चौधरी -मुक्तिप्रसंग	13

10. Unit wise Student activities:

1. Assignment -I
2. Assignment -II
3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)

1. आधुनिक साहित्य – मूल्य और मूल्यांकन – निर्मला जैन, राजकमल प्रकाशन प्राइवेट लिमिटेड, 1-बी, नेताजी सुभाष मार्ग, नई दिल्ली-110 002
2. छायावाद की प्रासंगिकता-रमेशचंद्र शाह, वाग्देवी प्रकाशन, ITI रोड, सरदार पटेल कॉलोनी, बीकानेर-334 001

12. Reference Books (Atleast 5) (Full Details)

1. आधुनिक साहित्य – मूल्य और मूल्यांकन – निर्मला जैन, राजकमल प्रकाशन प्राइवेट लिमिटेड, 1-बी, नेताजी सुभाष मार्ग, नई दिल्ली-110 002
2. छायावाद की प्रासंगिकता-रमेशचंद्र शाह, वाग्देवी प्रकाशन, ITI रोड, सरदार पटेल कॉलोनी, बीकानेर-334 001
3. महादेवी-दूधनाथ सिंह,राजकमल प्रकाशन प्राइवेट लिमिटेड, 1-बी, नेताजी सुभाष मार्ग, नई दिल्ली-110 002
4. पंत, प्रसाद और मैथिलीशरण गुप्त-रामधारी सिंह दिनकर,लोक भारती प्रकाशन, पहली मंजिल दरबारी बिल्डिंग, महात्मा गांधी मार्ग, इलाहाबाद -211 001
5. निराला की कविताएँ)-सं (.परामानंद श्रीवास्तव, नीलाभ प्रकाशन, इलाहाबाद

13. Web Resource (Websites/Databases/E-Resources)

1. **Hindi Sahitya Darpan - Aadhunik Kavita**:
   - Website: Hindi Sahitya Darpan - Aadhunik Kavita
   - Description: This section on Hindi Sahitya Darpan focuses on modern poetry, providing articles, analyses, and discussions on contemporary poets and their works.
2. **Rekhta - Aadhunik Kavita**:
   - Website: Rekhta - Aadhunik Kavita
   - Description: Rekhta's extensive collection includes contemporary Hindi poetry, biographies of modern poets, and critical analyses of Aadhunik Kavita.
3. **Kavishala**:
   - Website: Kavishala
   - Description: Kavishala is a platform that showcases and promotes modern Hindi poetry. It includes poems, articles, and discussions on contemporary poets.
4. **Sahitya Akademi - Modern Hindi Poetry**:
   - Website: Sahitya Akademi
   - Description: The official website of Sahitya Akademi may include publications and resources related to modern Hindi poetry, featuring works of contemporary poets.

14. Journals/Magazines (National /International) (Minimum 5 per subject)

1. हंस
2. अकार
3. वसुधा
4. बनास जन
5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)

1. Assignment I –10
2. Assignment II–10
3. Seminar 10
4. Practical 10
5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:

1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
2. Completed 1-year PG after 4-year

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme: M.A. Hindi
2. Title of the subject: BHARATHIYA SAHITYA
3. Course code: 532

4. Learning outcomes:	**7. Specifications:**
Understanding Indian literature	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Theory • 100% of Theory _____
Classify, describe, discuss, explain, identify and translate	
Analyze and evaluate	
5. Skill Training:	**8. Bridge courses to be done:**
Develop skills in cross-linguistic literary analysis, enabling students to appreciate and analyze literary works from various Indian languages and traditions.	1._____ 2._____ 3._____ 4._____ 5._____
Cultivate cultural sensitivity to interpret literary works within their cultural and historical contexts, fostering a nuanced understanding of Indian literature.	
Acquire the ability to critically analyze and evaluate major literary movements, themes, and trends that have shaped Indian literature throughout its rich history.	
6. Pre-requisites: 1. Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience andProficiency/professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling	

9.

Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
	इकाईः -1	**भारतीय साहित्य का स्वरूप** • भारतीय साहित्य का मूलभूत एकता • भारतीय साहित्य के अध्ययन की समस्याएँ • भारतीय साहित्य में भारतीयता • भारतीय साहित्य में आज के भारत का बिंब • भारतीय का समाजशास्त्र • भारतीय साहित्य का समाजशास्त्र • हिन्दी साहित्य में भारतीय मूल्यों की अभिव्यक्ति	13
I	**इकाईः -2**	**भारतीय साहित्य का संक्षिप्त परिचय** • बंग्ला - असमी • उड़िया - पंजाबी • मराठी - कन्नड़ • गुजराती - तमिल • तेलुगु - मलयालम	13
	इकाईः-3	**भारतीय भाषाओं से अनूदित साहित्य) कविता(** • दो पंछी – रविन्द्रनाथ टैगोर) बंग्ला(• काला हांड़ी – जगन्नाथ प्रसाद दास) उड़िया(• सब शत्रुभाव मिट जाएँगे – सुब्रहमण्यम भारती)तमिल(	14

		• विश्वशांति – उमाशंकर जोशी) गुजराती(• डोना पौला – ओ .एन .वी .कुरूप) मलयालम(• खतरनाक – पाश) पंजाबी(• बुढ़ापा -नामदेव ताराचंदाणी) सिंधी(• कदम आगे बढ़ाकर आओ नव भारत नारी मणिओ - श्रीश्री) तेलुगु(• धरती का धर्म (कविता)कुसमाग्रज) मराठी(	
	इकाई- 4	**भारतीय भाषाओं से अनूदित उपन्यास की व्याख्या एवं आलोचना** छह बीघा जमीन -फकीर मोहन सेनापति) उड़िया (उपन्यास	12
	इकाई- 5	**भारतीय भाषाओं से अनूदितनाटक** हयवदन– गिरीश कर्नाड) कन्नड(	8

10. Unit wise Student activities:

1. Assignment -I
2. Assignment -II
3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)

1. छह बीघा जमीन -फकीर मोहन सेनापति, साहित्य अकादमी, 35, रवीन्द्र भवन, फिरोजशाह रोड, रवीन्द्र नगर,नई दिल्ली-110001
2. हयवदन– गिरीश कर्नाड, राधाकृष्ण प्रकाशन प्राइवेट लिमिटेड, नई दिल्ली-110002
3. बीच का रास्ता नहीं होता, पाश, आकार प्रकाशन
4. गीतांजलि, रविंद्रनाथ टैगोर, रूपा प्रकाशन
5. जगन्नाथ प्रसाद दास, सुब्रमण्यम भारती, उमाशंकर जोशी, ओ. एन॰ वी. कुरूप, नामदेव तारचन्दाणी, श्री श्री की कवितायें, https://www.hindwi.org

12. Reference Books (Atleast 5) (Full Details)

1. आज का भारतीय साहित्य – एस .राधाकृष्ण, साहित्य अकादमी, 35, रवीन्द्र भवन, फिरोजशाह रोड, रवीन्द्रनगर, नई दिल्ली – 110001
2. भारीत्य साहित्य की भूमिका, रामविलास शर्मा, राजकमल प्रकाशन
3. भारतीय भाषाओं के साहित्य का संक्षिप्त इतिहास, केंद्रीय हिन्दी निदेशालय, भारत सरकार
4. A History Of Indian Literature 5001399 from The Courtly To The Popular, SISIR KUMAR DAS, Sahitya Akademi Publications
5. बंग्ला साहित्य का इतिहास -सुकुमार सेन, साहित्य अकादमी, 35, रवीन्द्र भवन, फिरोजशाह रोड, रवीन्द्रनगर, नई दिल्ली – 110001

13. Web Resource (Websites/Databases/E-Resources)

1. **Sahitya Akademi - Indian Literature**:
   - Website: Sahitya Akademi
   - Description: The official website of Sahitya Akademi provides information on Indian literature, including publications, awards, and resources related to various languages and literary traditions.
2. **National Book Trust (NBT) - Indian Literature**:
   - Website: National Book Trust
   - Description: NBT promotes Indian literature and offers a diverse collection of books in various languages. The website may include information on literary events, authors, and publications.
3. **Columbia University - South Asian Literary Recordings Project**:
   - Website: South Asian Literary Recordings Project
   - Description: This project at Columbia University features audio recordings of readings and discussions by prominent South Asian authors, providing insights into Indian literature.
4. **Project MUSE - South Asian Studies Journals**:
   - Website: Project MUSE
   - Description: Project MUSE offers access to a variety of journals covering South Asian studies, including articles on Indian literature, culture, and history.
5. **Digital Library of India - Indian Literature Section**:
   - Website: Digital Library of India
   - Description: The digital library may have a collection of Indian literary works in various languages, allowing students to explore texts from different regions.
6. **JSTOR - Indian Literature Journals**:
   - Website: JSTOR

- Description: JSTOR provides access to scholarly journals and books, offering articles on various aspects of Indian literature, including critical analyses and research papers.

14. Journals/Magazines (National /International) (Minimum 5 per subject)

    1. हंस
    2. अकार
    3. वसुधा
    4. बनास जन
    5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)
    1. Assignment I –10
    2. Assignment II–10
    3. Seminar 10
    4. Practical 10
    5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:
    1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
    2. Completed 1-year PG after 4-year

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme: M.A. Hindi
2. Title of the subject: PASCHATYA KAVYA SASTRA
3. Course code: 533

4. Learning outcomes:	**7. Specifications:**
Develop comprehension	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Theory • 100% of Theory & Problems _____
Application of the western poetics in literary criticism	
Analysis on the basis of the knowledge gained during the course	
Identify the various schools of thought and 'isms'	
5. Skill Training:	**8. Bridge courses to be done:** 1._____ 2._____ 3._____ 4._____ 5._____
Develop a comprehensive understanding of the major principles, theories, and movements in Western poetics, exploring their historical evolution and philosophical underpinnings.	
Acquire the ability to critically analyze and evaluate various poetic forms, techniques, and innovations within Western poetics, considering their aesthetic and structural aspects.	
. Develop familiarity with and an understanding of the contributions of key poets, theorists, and movements in Western poetics, highlighting their impact on the broader literary landscape.	
6. Pre-requisites: 1. Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience andProficiency/professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling	

9.

Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
	इकाईः -1	प्लेटो -काव्य सिद्धांत अरस्तू -त्रासदी विवेचन, विरेचन सिद्धांत	13
I	**इकाईः -2**	लोन्चाइनस -उदात्त की अवधारणा ड्राइडन -काव्य सिद्धांत	13
	इकाईः-3	लोन्चाइनस -उदात्त की अवधारणा ड्राइडन -काव्य सिद्धांत वर्ड्सवर्थ -काव्यभाषा का सिद्धांत कालरिज - कल्पना सिद्धांत और ललित कल्पना) कल्पना और फैंटसी(	13
	इकाई- 4	मैथ्यू आर्नल्ड -आलोचना का स्वरूप एवं प्रकार्य टी.एस .इलियट-निर्वैयक्तिकता का सिद्धांत, वस्तुनिष्ठ सह – संबंधी, परंपरा की अवधारणा	11
	इकाई- 5	प्रमुख वाद -अभिजात्यवाद, स्वच्छंदतावाद, यथार्थवाद, आति यथार्थवाद, प्रतीकवाद, बिंबवाद, कलावाद, स्तित्ववाद, मार्क्सवाद, आधुनिकतावाद, उत्तर आधुनिकतावाद, नव इतिहासवाद, निम्नवर्गीयविमर्श, संरचनावाद एवं उत्तर संरचनावाद, रूसीरूपवाद	10

		एवं नयी समीक्षा ।	

10. Unit wise Student activities:

1. Assignment -I
2. Assignment -II
3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)

1. Poetics, Aristotle, Penguin Publications
2. The Republic, Plato, Penguin Publications
3. On The Sublime – Longinus, Rama Brothers India Pvt Ltd.-new Delhi
4. Literary Criticism from Plato to the Present: An Introduction, Rafey HabibRafey Habib, Wiley-Blackwell
5. पाश्चात्य काव्यशास्त्र : इतिहास, सिद्धांत और वाद -डॉ भगिरथ मिश्र, विश्वविद्यालय प्रकाशन, विशलाक्ष्मी भवन, चौक, कबीर रोड, सी.के.56-35, वाराणसी-221001
6. पाश्चत्य काव्यशास्त्र - देवेन्द्रनाथ शर्मा, नेशनल पब्लिशिंग हाउस, 2/35, अंसारी रोड, दरियागंज, दिल्ली-110002.

12. Reference Books (Atleast 5) (Full Details)

1. पाश्यात्य काव्यशास्त्र का इतिहास -डॉ तारकनाथ बाली, किताबघर प्रकाशन, 24/4855, अंसारी रोड, दरियागंज, नई दिल्ली-110 002
2. साहित्य सिद्धांत - रेने वेलेक, आस्टिन वारेन, लोकभारती प्रकाशन, प्रथम तल, दरबारी बिल्डिंग, महात्मा गाँधी रोड, सिविल लाइंन्स, इलाहाबाद-211001.
3. पाश्चात्य काव्यशास्त्र की परंपरा-डॉ सावित्री सिन्हा) सं (हिंदी विभाग प्रकाशन, हिंदी विभाग, दिल्ली विश्वविद्यालय, दिल्ली-110007.
4. पाश्चात्य काव्यशास्त्र - अधुनातन संदर्भ, सत्यदेव मिश्र, लोकभारती प्रकाशन
5. पाश्चात्य काव्यशास्त्र, रामपूजन तिवारी, राधाकृष्ण प्रकाशन

13. Web Resource (Websites/Databases/E-Resources)

1. **Stanford Encyclopedia of Philosophy - Literary Theory**:
   - Website: Stanford Encyclopedia of Philosophy - Literary Theory
   - Description: Stanford Encyclopedia of Philosophy provides an extensive overview of literary theory, including Western poetics and critical approaches.
2. **Internet Encyclopedia of Philosophy - Aesthetics**:
   - Website: Internet Encyclopedia of Philosophy - Aesthetics
   - Description: This resource covers aesthetics, including Western theories of beauty, art, and poetics.
3. **The Poetry Foundation - Poetics and Literary Criticism**:
   - Website: The Poetry Foundation
   - Description: The Poetry Foundation includes articles and essays on poetics, literary criticism, and contemporary discussions about poetry.
4. **JSTOR - Literary Criticism Journals**:
   - Website: JSTOR
   - Description: JSTOR provides access to a variety of literary criticism journals, offering articles on Western poetics and literary theories.
5. **The British Library - Literary Theory and Criticism**:
   - Website: The British Library
   - Description: The British Library's section on literary theory provides resources on Western poetics and critical approaches to literature.

14. Journals/Magazines (National /International) (Minimum 5 per subject)

1. हंस
2. अकार
3. वसुधा
4. बनास जन
5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)

1. Assignment I –10
2. Assignment II–10
3. Seminar 10
4. Practical 10
5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:

1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
2. Completed 1-year PG after 4-year

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme: M.A. Hindi
2. Title of the subject: PRAYOJANMOOLAK HINDI
3. Course code: 541

4. Learning outcomes:	**7. Specifications:**
Cognitive learning - describe, identify, relate, examine, define the functional Hindi	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Practical • 60% of Theory & Problems _____
Differentiate, discuss, extend, translate, review	**8. Bridge courses to be done:** 1._____ 2._____ 3._____ 4._____ 5._____
Apply, employ, interpret & synthesize the various aspects of functional Hindi	
Measurable outcome. Ability to translate from Hindi to English and vice - versa is demonstrable knowledge and skill is learnt in this course.	
5. Skill Training:	
Hone communication skills specific to professional settings, including the ability to draft emails, reports, and documents effectively in Hindi.	
Develop skills for using Hindi effectively in media and public relations contexts, including press releases, promotional materials, and public communication.	
Develop and enhance functional writing skills in Hindi, focusing on business correspondence, official communication, and other practical writing applications.	
6. Pre-requisites: 1. Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience andProficiency/professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling	

9.

Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
	इकाईः -1	राजभाषा के प्रयोग की व्यावहारिक कुशलता : टिप्पणी, आलेख	12
	इकाईः -2	पारिभाषिक शब्दावली – स्वरूप एवं महत्व	12
	इकाईः-3	पारिभाषिक शब्दावली – निर्माण के सिद्धान्त	10
	इकाई- 4	ज्ञान विज्ञान के विभिन्न क्षेत्रों की पारिभाषिक शब्दावली	13
	इकाई- 5	प्रयोजनमूलक हिन्दी के क्षेत्र में कंप्यूटर के अनुप्रयोग	13

10. Unit wise Student activities:

1. Assignment -I
2. Assignment -II
3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)

1. प्रयोजनमूलक एवं अनुप्रायोगिक हिंदी, सी. जयशंकर बाबू, अमन प्रकाशन, कानपुर
2. प्रयोजनमूलक हिंदी – डॉ .रामप्रकाश और दिनेश गुप्त
3. प्रशासनिक हिन्दी -डॉ .रामप्रकाश और दिनेश गुप्त
4. प्रयोजनमूलक हिंदी – डॉ.विनोद गोदरे

5. हिंदी में सरकारी कामकाज – डॉ .रामविनायक सिंह, हिन्दी प्रचारक संस्थान सी २१/३०, पिशाचमोचन, वारणासी
6. सरकारी कार्यलयों में हिंदी का प्रयोग – गोपीनाथ श्रीवास्तव, लोक भारती, इलाहाबाद

12. Reference Books (Atleast 5) (Full Details)

1. कार्यालयीन हिन्दी – कार्मिक एवं प्रशासनिक विभाग, गृह मंत्रालय, भारत सरकार
2. हिन्दी आलेख और टिप्पणी, प्रो. विराज
3. प्रयोजनमूलक हिंदी : सिद्धान्त और प्रयोग, दंगल झाल्टे, वाणी प्रकाशन
4. प्रयोजनमूलक हिंदी, डॉ. एस. ए. मंजूनाथ, नोशन प्रैस
5. प्रयोजनमूलक हिंदी, विनोद गोदरे, वाणी प्रकाशन

13. Web Resource (Websites/Databases/E-Resources)

1. **Hindi Vishwa - Language Learning and Applications**:
   - Website: Hindi Vishwa
   - Description: Hindi Vishwa offers language learning resources and practical applications of Hindi in everyday life, business, and communication.
2. **BBC Hindi - Technology Section**:
   - Website: BBC Hindi - Technology
   - Description: The technology section of BBC Hindi provides articles and news related to technological advancements where Hindi language is applied.
3. **Hindustan Times - Education Section**:
   - Website: Hindustan Times - Education
   - Description: The education section of Hindustan Times may include articles on the application of Hindi in the field of education and language learning.
4. **National Portal of India - Official Language Section**:
   - Website: National Portal of India - Official Language
   - Description: The official language section on the National Portal of India provides information on the use and application of Hindi as an official language.

14. Journals/Magazines (National /International) (Minimum 5 per subject)

1. हंस
2. अकार
3. वसुधा
4. बनास जन
5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)

1. Assignment I –10
2. Assignment II–10
3. Seminar 10
4. Practical 10
5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:

1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
2. Completed 1-year PG after 4-year

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme : M.A. Hindi
2. Title of the subject: BHASHA PROUDYOGIKI
3. Course code: 542

4. Learning outcomes:	**7. Specifications:**
Define concepts of Language Technology and recall its characteristics	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Practical • 50% of Theory & Problems _____ **8. Bridge courses to be done:** 1._____ 2._____ 3._____ 4._____ 5._____
Describe various aspects of Language Technology and NLP.	
Demonstrate the skills of Natural Language Processing	
Evaluate various issues of Language Technology and products developed for Hindi	
5. Skill Training:	
Hone practical skills in applying language technology tools for various applications, such as information retrieval, sentiment analysis, and language generation.	
Explore ways to integrate language technology in education, fostering skills in designing language technology-based educational resources and tools.	
Acquire skills in developing and managing language resources, including corpora, lexicons, and databases, for linguistic research and technological advancements.	
6. Pre-requisites: 1. Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience andProficiency/professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling	

9.

Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
	इकाईः -1	**कंप्यूटर – भाषा – सूचना एवं संचार प्रौद्योगिकी** 1. कंप्यूटर का सामान्य परिचय 2. भाषा चिंतन 3. सूचना एवं संचार प्रौद्योगिकी 4. भाषा प्रौद्योगिकी 5. हिंदी भाषा एवं देवनागरी लिपि का कंप्यूटरीय अनुकूलता के प्रयास	12
I	**इकाईः -2**	**कंप्यूटरीय भाषाविज्ञान का परिचय** 1. कंप्यूटरीय भाषाविज्ञान 2. भाषावैज्ञानिक चिंतन परंपरा 3. रूपवैज्ञानिक विश्लेषण 4. वाक्यगत विश्लेषण: व्याकरणिक कोटियाँ अर्थ विज्ञान के कंप्यूटरीय पहलू	12
	इकाईः-3	**प्राकृतिक भाषा संसाधन की भूमिका** 1. प्राकृतिक भाषा संसाधन की अवधारणा 2. कृत्रिम बुद्धि का परिचय	12

		3. प्राकृतिक भाषा संसाधन के सामान्य कार्य	
	इकाई- 4	**कंप्यूटरीय भाषाविज्ञान के उत्पादों का सामान्य परिचय** 1. प्राकृतिक भाषा संसाधन के अनुप्रयोगों का वर्गीकरण 2. शब्द-संसाधन प्रणालियाँ 3. पाठ विश्लेषण व अन्य प्रौद्योगिकीय प्रणालियाँ 4. वाक् विश्लेषण व अन्य प्रौद्योगिकीय प्रणालियाँ 5. सूचना प्रत्ययन, सूचना निष्कर्षण एवं विशेषज्ञता प्रणालियाँ मशीनी अनुवाद प्र	12
	इकाई- 5	**हिंदी के लिए कंप्यूटरीय भाषाविज्ञान के उत्पाद** 1. हिंदी में भाषाप्रौद्योगिकी के विकास में सरकारी प्रयास 2. हिंदी में भाषाप्रौद्योगिकी के विकास में निजी प्रयास 3. हिंदी शब्द-संसाधन प्रणालियाँ 4. हिंदी लिप्यंतरण एवं अनुवाद प्रणालियाँ हिंदी प्राकृतिक भाषा संसाधन के औज़ार	12

10. Unit wise Student activities:

1. Assignment -I
2. Assignment -II
3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)

1. प्रयोजनमूलक एवं अनुप्रायोगिक हिंदी, सी. जयशंकर बाबू, अमन प्रकाशन, कानपुर
2. भाषा प्रौद्योगिकी एवं भाषा प्रबंधन, सूर्यप्रसाद दीक्षित
3. भाषा और प्रौद्योगिकी, विनोद कुमार प्रसाद, वाणी प्रकाशन

12. Reference Books (Atleast 5) (Full Details)

1. D. Jurafsky, J. H. Martin, and A. Kehler, Speech and language processing: An introduction to natural language processing, computational linguistics, and speech recognition, MIT Press, 2008.
2. Christopher Manning and Hinrich Schutze. Foundations of Statistical Natural Language Processing. MIT Press, Cambridge, MA, 1999.
3. Igor Bolshakov, Alexander Gelbukh, Computational Linguistics: Models, Resources, Applications, Instituto Politecnico Nacional, Tresguerras, DF, 2004
4. Ralph Grishman, Computational Linguistics: An Introduction, Cambridge University Press, 1986
   Alexander Clark, Chris Fox, and Shalom Lappin (Editors), The Handbook of Computational Linguistics and Natural Language Processing, A John Wiley & Sons, Ltd., Publication, 2010.

13. Web Resource (Websites/Databases/E-Resources)

1. http://cdac.in
2. http://ildc.in
3. http://tdil.mit.gov.in

14. Journals/Magazines (National /International) (Minimum 5 per subject)

1. हंस
2. अकार
3. वसुधा
4. बनास जन
5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)

1. Assignment I –10
2. Assignment II–10
3. Seminar 10
4. Practical 10
5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:

1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
2. Completed 1-year PG after 4-year

Annexure IV

PONDICHERRY UNIVERSITY

TEMPLATE FOR DESIGNING SUBJECT WISE SYLLABUS
(THEORY SUBJECTS)

1. Title of the PG programme: M.A. Hindi
2. Title of the subject: ADHUNIK HINDI ALOCHANA AUR ALOCHAK
3. Course code: 543

4. Learning outcomes:	**7. Specifications:**
Develop the ability to critically analyze and evaluate modern Hindi literature, including novels, short stories, poetry, and essays, considering cultural, social, and literary contexts.	• Nature of the Course: Major • No. of credits: 4 • Pedagogy: Theory • 100% of Theory & Problems _____
Gain insight into various literary movements and trends in modern Hindi literature, exploring their impact on literary creation and cultural discourse.	**8. Bridge courses to be done:**
Acquire proficiency in literary criticism, emphasizing the application of diverse theoretical frameworks and methodologies to analyze and interpret literary texts.	1._____ 2._____ 3._____ 4._____ 5._____
5. Skill Training:	
Hone the application of diverse literary theories and critical approaches in the analysis and interpretation of modern Hindi literary works.	
Understand the perspectives of different critiques	
Get an understanding of the literary movements of Hindi Literature	
6. Pre-requisites: 1. Total 17-18 years of learning including academic education, vocational education, training and skilling and/or Experiential learning including relevant experience andProficiency/professional levels acquired, subject to assessment OR 3 years relevant experience at NSQF Level 5.5 or 1.5 year of relevant experience at level 6 AND 630- 690 hrs. of Vocational education and training/ skilling & Training/Skilling OR Pursuing 2nd year PG (after 3 years of UG Degree) OR Ph.D. after Degree (honors) AND 570-660 hrs. of Vocational education & Training/ Skilling	

9.

Unit No.	Unit Heading	Detailed Syllabus	No. of Hours of Teaching
	इकाईः -1	1. हिन्दी आलोचना की पूर्वपीठिका 2. शुक्लपूर्व आलोचना 3. शुक्ल युगीव आलोचना 4. शुक्लोत्तर आलोचना 5. समकालीन आलोचना	12
	इकाईः -2	1. रामचन्द्र शुक्ल – लोकमंगल की साधनावस्था 2. हजारिप्रसाद द्विवेदी	10
	इकाईः-3	1. नन्ददुलारे वाजपेयी – स्वच्छंदतावाद और परंपरा 2. रामविलास शर्मा – परंपरा का मूल्यांकन	12
	इकाई- 4	1. नगेन्द्र – सौंदर्यानुभूति का स्वरूप 2. नामवर सिंह – दूसरी परंपरा की खोज/कविता के नए प्रतिमान	13
	इकाई- 5	1. अज्ञेय – रचनात्मक भाषा और संप्रेषक की समस्याएँ 2. मुक्तिबोध – कला के तीन क्षण 3. विजयदेव नारायण साही – लघु मानव के बहाने नई कविता पर एक बहस	13

10. Unit wise Student activities:

1. Assignment -I
2. Assignment -II
3. Seminar - I

11. Basic Text Books (Author, Title, Pub, Place, Year) (one/two)

1. चिंतामणी भाग 1, रामचन्द्र शुक्ल, राजकमल प्रकाशन
2. हिन्दी साहित्य की भूमिका, हजारिप्रसाद द्विवेदी, लोकभारती प्रकाशन
3. आधुनिक साहित्य, नन्ददुलारे वाजपेयी, राजकमल प्रकाशन
4. परंपरा का मूल्यांकन, रामविलास शर्मा, राजकमल प्रकाशन
5. दूसरी परंपरा की खोज, नामवर सिंह, राजकमल प्रकाशन
6. कविता के नए प्रतिमान, नामवर सिंह, राजकमल प्रकाशन
7. एक साहित्यिक की डायरी, मुक्तिबोध, राजकमल प्रकाशन

12. Reference Books (Atleast 5) (Full Details)

1. हिन्दी आलोचन, विश्वनाथ त्रिपाठी, राजकमल प्रकाशन
2. हिन्दी आलोचन : शिखरोन्न का साक्षात्कार, रामचन्द्र तिवारी
3. हिन्दी आलोचना का पुनः पाठ, कैलाशनाथ पांडेय, लोकभारती प्रकाशन
4. हिन्दी आलोचना की बीसवीं सदी, निर्मला जैन, राजकमल प्रकाशन
5. हिन्दी आलोचना का आलोचनात्मक इतिहास, डॉ. अमरनाथ, राजकमल प्रकाशन

13. Web Resource (Websites/Databases/E-Resources)

1. **Sahitya Akademi - Hindi Criticism Section**:
   - Website: Sahitya Akademi
   - Description: Sahitya Akademi's website may have a section dedicated to Hindi criticism, featuring articles, reviews, and discussions on modern Hindi literature.
2. **Jnanpith - Hindi Literary Criticism**:
   - Website: Jnanpith
   - Description: Jnanpith is a prestigious literary award organization. The website may include critical essays, interviews, and resources related to Hindi literary criticism.
3. **Hindi Literary Journals**:
   - Include links to prominent Hindi literary journals that publish critical essays and reviews. Examples include "Katha Kshetre," "Vagarth," and "Alok."
4. **Kavita Kosh - Hindi Literary Criticism Section**:
   - Website: Kavita Kosh
   - Description: Kavita Kosh is an online repository of Hindi poetry, and it may have a section dedicated to critical analyses and discussions on Hindi literary works.

14. Journals/Magazines (National /International) (Minimum 5 per subject)

1. हंस
2. अकार
3. वसुधा
4. बनास जन
5. कथादेश

15. Evaluation methodology: (Theory/Practical/Oral components)

1. Assignment I –10
2. Assignment II–10
3. Seminar 10
4. Practical 10
5. End Semester – 60

16. Qualifications/Specialisations required for faculty to handle the subject:

1. Completed 2nd year of 2-year PG after 3-year UG/ 40 credits PG Degree
2. Completed 1-year PG after 4-year

DEPARTMENT OF PHILOSOPHY

PONDICHERRY UNIVERSITY

MA SYLLABI

Programmes offered

M.A. PHILOSOPHY (Two Year - Revised Syllabus)

[With effect from the academic year (2023 – 2024)]

ABOUT THE DEPARTMENT

Department of Philosophy, School of Humanities, Pondicherry University

The History and Profile of the Department of Philosophy,

The Department of Philosophy on campus was established during 1989-90 as Sri Aurobindo School of Eastern and Western Thought by Pondicherry University. Dr. R. Balasubramaniam was the Founder, and the Head of the department. From its very inception, it offers M. A. & Ph.D. in Philosophy, covering a diversity of areas in Philosophy: Classical Western Philosophy, Classical Indian Philosophy, Logic, Ethics, Theory of Knowledge, Philosophy of Language, Contemporary Analytic Philosophy, Phenomenology, Existentialism, Philosophy of Mind, Philosophy of Science, Philosophy of Religion and Social & Political Philosophy etc.

The members of the Faculty of the Department have accomplished their academic excellence till today by participating in Seminars, Workshops and Conferences in India and abroad. Besides, they actively engage in research, which has results in the publication of a number of books, reports, and articles in Philosophy in Indian and International journals and anthologies. The Department has also undertaken several research projects during the last three decades. It organized in the past, various International and National Seminars in the course of its history.

The Department regularly holds its special lectures, seminars and discussion groups. The faculty of the Philosophy adopt creative and constructive pedagogical methods to enhance critical thinking and learning practices among students who are encouraged to participate in discussions, in seminars and regular classes. The Department organizes seminars on every Tuesday on diverse topics expounded by the students. This facilitates the students to involve in academic debates. The writing of papers for Internal Assessment and research presentations were made compulsory for research scholars as part of their course. The paper presentations of students in the presence of faculty and research scholars develop the writing skills and confidence of students.

I. Learning Outcomes based approach to Curriculum Planning

The Learning Outcomes-based Curriculum Framework for M.A. Philosophy is based on the Postgraduate attributes which a Postgraduate in Philosophy is expected to attain along with the expected learning outcomes of each course. The curriculum for M.A. Philosophy is designed keeping in mind the needs, expectations and aspirations of the students of Philosophy as well as the modern trends and methodological perspectives of Philosophy as a Discipline. The course learning outcomes of the programme specify the knowledge, understanding, skills, attitudes, values that a student completing this degree is expected to inculcate in oneself.

The learner will be able to identify, summarize and critically engage with various philosophical concepts from the Eastern and Western Philosophical traditions. He/she will become familiar with thinkers and his/her writings with the ability to read and understand the importance of primary texts. The wide range of electives offered in the Second Year enables the learner to undertake and in-depth and focused reading in particular philosophical traditions especially Buddhism, Advaita, Recent Western Philosophy, Phenomenology and Existentialism.

He/she will also be acquainted with current research trends and techniques in the field of philosophy through continuous project assignments and dissertation during the four semesters of the MA Programme. He/she will also develop skills of organizing and participating in seminars, workshops and conferences by availing of opportunities for active involvement in departmental academic activities.

The learner is expected to develop an understanding of contemporary trends and developments both in Indian and Western Philosophy. The aim is to grasp meaningfully the ideas and concepts in core branches of philosophy by thinkers across the globe through the centuries.

The learner should be able to appreciate and employ the various terms of art in current in different areas of academic philosophy and other interdisciplinary pursuits. The various textual study electives will enable the learner to engage with philosophical and academic texts with scholarly depth and rigor. Through evaluative writings and other modules, the learner will continually develop the ability to work on research problems, to write and produce quality work of original research. The learner will cultivate the spirit and techniques of critical thinking and apply them to a host of debates around conceptual, social, and political issues.

The learner will also cultivate the spirit of responsible citizenship and sensitivity to social and environmental issues through an exposure to a wide range of thinkers and their works. The learner will undertake substantial and critical engagement with values such as interreligious and intercultural harmony, empathy, freedom, human rights, and compare cross cultural traditions for better holistic understanding of one's world.

II. Nature and extent of the M.A. Philosophy

In pursuing these objectives, M.A. Philosophy Programme aims at augmenting the ability to think critically, logically and analytically and hence use philosophical reasoning in practical situations. Pursuing a degree in philosophy will make students attain interesting careers in Film industry, education, law, politics, government etc.

The M. A. Philosophy programme deals with complete range of philosophy, from classical Indian Philosophy, to Modern Logic, Ethical theories of Mill, Kant and contemporary reflections on current debates in applied ethics, analytic philosophy, continental philosophy, philosophy of science and law, core courses in Indian and western philosophy. Current issues in feminist theory are also dealt with. Students have many choices which they can make. The students are trained to develop their own methodologies in understanding philosophical problems in general and the research problems in particular. The department has introduced the contemporary relevant courses that reflect the immediate social reality such as gender equlaity, caste, culture and environment (Especially courses such as, Eco-philosophy, Philosophy of B. R. Ambedkar, Philosophy and Films, Philosophy of literature, Media ethics**,** philosophy of technology). The students are trained to identify the social problem and motivated to reflect on social experiences from their own philosophical perspective. This plays a crucial role in self-learning and knowledge production.

III. SCHEME OF EXAMINATIONS

(i) The medium of instruction and examination shall be as per the policies and regulations of the Pondicherry University

(ii) Examinations shall be conducted at the end of each Semester as per the Academic Calendar notified by Pondicherry University.

(iii) The system of evaluation shall be as follows:

Each Course will carry 100 marks, of which 40 marks shall be reserved for internal assessment based on classroom participation, seminar, term papers, tests, viva-voce, and attendance. The weightage given to each of these components shall be decided and announced at the beginning of the semester by the individual teacher responsible for the course. Any student who fails to participate in classes, seminars, term papers, tests, viva-voce, will be debarred from appearing in the end semester examination in the specific course and no Internal Assessment marks will be awarded to such a candidate. His/her Internal Assessment marks will be awarded as and when he/she attends regular classes in the course in the next applicable semester. No special classes will be conducted or him/her during other semesters.

The remaining 60 marks in each paper shall be awarded on the basis of a written examination at the end of each semester. The duration of written end of semester examination for each paper shall be three hours.

Examinations for courses shall be conducted only in the respective odd and even Semesters as per the Scheme of Examinations. Regular as well as Ex-students shall be permitted to appear/re-appear/improve in courses of Odd Semesters only at the end of Odd Semesters

and courses of Even Semesters only at the end of Even semesters.

IV.MEDIUM OF INSTRUCTION

The medium of instruction in the classes is English.

V. PASS PERCENTAGE

The pass percentage in each paper shall be 50%.

No student would be allowed to avail of more than THREE chances to pass any paper inclusive of the first attempt.

Promotion Rules for all the Post-Graduate (M.A, M.Sc. and M.Com.) Courses under the Semester Scheme.

1) **Pass Percentage & Promotion Criteria**

a) The minimum marks required to pass any paper in a semester shall be 50% in theory and 50% in Practical, wherever applicable. The student must secure 40% in the external End Semester Examination and 50% in the total of End Semester Examination.

b) No student will be detained in I or III Semester on the basis of his/her performance in I or III Semester examination; i.e. the student will be promoted automatically from I to II and III to IV Semester.

c) A student shall be eligible for promotion from 1st year to 2nd year of the course provided he/she has passed 50% papers of I and II Semester taken together. However, he/she will have to clear the remaining papers while studying in the 2nd year of the programme.

d) Students who do not fulfill the promotion criteria (c) above shall be declared fail in the part concerned. However, they shall have the option to retain the marks in the papers in which they have secured Pass marks as per clause (a) above

e) A student who has to reappear in a paper prescribed for Semester I/III may do so only in the odd Semester Examinations to be held in November/December. A student who has to reappear in a paper prescribed for Semester II/IV may do so only in the even Semester examinations to be held in April/May.

2) **Reappearance in passed papers:**

a) A student may reappear in any theory paper prescribed for a Semester, on forgoing in writing her/his previous performance in the paper/s concerned. This can be done once only in the immediate subsequent semester examination only (for example, a student

reappearing in a paper prescribed for Semester I examination, may do so along with the immediate next Semester III examinations only).

b) A candidate who has cleared the papers of Part II (III &IV Semesters) may reappear in any paper of III or IV Semester only once, at the immediate subsequent examination on foregoing in writing her/his previous performance in the paper/s concerned, within the prescribed span period.

(Note: The candidate of this category will not be eligible to join any higher course of study)

c) In the case of reappearance in a paper, the result will be prepared on the basis of candidate's current performance in the examination.

d) In the case of a candidate, who opts to re-appear in any paper/s under the aforesaid provisions, on surrendering her/his earlier performance but fails to re-appear. In the paper/s concerned, the marks previously secured by the candidate in the paper/s in which she/he has failed to re-appear shall be taken into account while determining her/his result of the examination held currently.

e) Reappearance in Practical examinations, dissertation, Project and field work shall not be allowed.

f) A student who reappears in a paper shall carry forward the internal assessment marks, originally awarded.

VI. SPAN PERIOD

After four years from the date of admission to Part I/Semester I-1 of the M. A. (Philosophy) Program, no student may be enrolled as a candidate for the examination for any of the Parts/Semesters.

VII Course Plan (Hard & Soft Cores Credits Sharing in Two Year M. A. Programme)

1. Every M.A. Philosophy Student has to complete a total 72 Credits for getting the M.A Philosophy Degree.

2. From among the 72 Credits:
   48 Credits are for Hard Core Courses (3 Instructors x 16 Credits), &
   24 Credits are for Soft Core Courses among them:
   12 Credits from within the Department, &
   12 Credits outside the Department.

3. A minimum of ONE Soft Core Course must be compulsorily completed with each Instructor.

4. Therefore, each Semester - every Instructor will offer 2 Hard & 2 Soft Core Courses.

Semester	Hard Core Courses			Soft Core Courses		
	Course	**Name of the Course**	**Credits**	**Course**	**Name of the Course**	**Credits**
		Compulsory				
1		Classical Indian Philosophy	4		Eco-Philosophy	3
1		Problems in Metaphysics	4		Film and Philosophy	3
1	**Optional**	Problems in Epistemology	4		Applied Ethics	3
1		Philosophy of Gandhian Thought	4		Vidura Niti	3
			12			
		Compulsory				
2		Naiskarmyasiddhi	4		Philosophy of Technology	3
2		Philosophy of Sri Aurobindo	4		Philosophy of Time	3
2		Recent Western Philosophy	4		Socially Engaged Buddhism	3
2	**Optional**	Philosophical Perspectives of Wittgenstein	4		Philosophy of History	3
					Vaisnavism	3
			12			
		Compulsory				
3		Foundations of Indian Culture	4		Modern Logic	3
3		Philosophy of Ambedkar	4		Philosophical Psychology	3
3	**Optional**	Two Metaphysicians Heidegger and Strawson	4		Philosophy of Mind	3
3		Contemporary Indian Philosophy	4		Philosophy of Artificial Intelligence	3
					Indian Philosophy of Beauty	3
			12			
		Compulsory				
4		A Study of Arthashastra	4		Indian Psychology	3
4		Indian Philosophy of Values	4		Critical Thinking	3
4		Social Epistemology	4		Exploring Modernity &Postmodernity	3
4	**Optional**	Research Methodology in Philosophy	4		Philosophical Counselling	3
4	**Optional**	**Individual Project**	**4**		Socio-political Thought	3
		Cumulative Credits	48			12

PONDICHERRY UNIVERSITY, SCHOOL OF HUMANITIES

DEPARTMENT OF PHILOSOPHY

(HARD & SOFT CORE COURSES)

1st Year, Semester – I

CLASSICAL INDIAN PHILOSOPHY

Hard-Core: 4 Credits

Course Objective – This Course intends to introduce the students to the concepts, methodology and issues examined in Classical Indian Philosophy, through a study of the epistemology, metaphysics and ethics of classical thinkers with emphasis on Advaita Vedanta. It examines the main arguments and counter-arguments put forward by different schools of classical Indian philosophy for appreciating the holistic nature of classical Indian philosophy and its significance for contemporary philosophy.

Course Outcome – After studying this course, students can gain and in-depth knowledge for better appreciation of the concepts of Classical Indian epistemology, metaphysics and ethics. They can identify the unique concepts that distinguish the major schools of Indian thought for comparing and contrasting Indian philosophical writings with other systems of philosophy.

I. **Epistemology**

(a) Nature and objects of perception (pratyakṣa) – distinction between determinate and indeterminate perception – ordinary and extra-ordinary perception – theories of perceptual error (khyāti-vādas)

(b) Nature of inference (anumāna) – grounds of inference – different methods of ascertaining vyāpti.

(c) Comparision(upamāna) as explained by Nyāya and Advaita schools.

(d) Verbal testimony (śabda) – distiniction between laukika and vaidika-śabda – sentence and its meaning – primary and secondary meanings – the views of the Mimamsakas and Advaitins on the nature and authority of śruti.

(e) Postulation (arthāpatti) – cannot be reduced to inference

(f) Non-cognition (anupalabdhi) – Views of the Prābhākaras and the Bhattas on accepting it as a separate pramana

(j) The Jaina theory of judgment.

(k) Nyāya and Mīmāṁsā Views on the validity of knowledge.

II. Metaphysics

(a) Carvaka view of the world-Jaina conception of substance – Buddhist realism, subjective idealism, and nihilism.

(b) The categories (padārthas) of the Nyāya – Vaiśeṣika – the Vaiśeṣika theory of the world – the nature of and evolution from prakṛti, according to Sānkhya.

(c) The nature and status of the world according to the schools of Vedanta – the Advaita doctrine of māyāand the objections thereto.

(d) Theories of causation.

(e) The Nyāya arguments for the existence of God – the atheism of Sāṁkhya – the distinction between Nirguṇa-Brahman and Saguṇa-Brahman in Advaita and the objections thereto – the theism of Viśiṣṭādvaita and Dvaita.

(f) The no-soul theory of Buddhism – the nature and destiny of the jīva according to different schools – the relation between Brahman and jīva according to the Schools of Vedanta.

III. Axiology

(a) Liberation (mokṣa) at the highest value – the nature of liberation according to the different schools.

(b) The concepts of jīvanmuktiand videhamukti – the ideal of bodhisattva

IV. Ethical discipline

(a) The discipline of right knowledge, faith and conduct of Jainism.

(b) The eightfold path of Buddhism.

(c) The eight limbs of the Yoga discipline.

(d) Karma, bhakti andjñāna as means to liberation as interpreted by the different schools – the concept of prapatti.

Essential Readings:

1.M. Hiriyanna, Outlines of Indian Philosophy (New Delhi: Blackie & Sons (India) Ltd., 1979), Reprint

2.S. Radhakrishnan, Indian Philosophy, Volumes I & II (London: George Allen & Unwin, 1962)

3. D.M. Datta, Six Ways of Knowing (Calcutta: Calcutta University Press), 1960

4. Satischandra Chatterjee & Dhirendramohan Datta, An Introduction to Indian Philosophy, Motilal Banarsidass Publishing House (MLBD), 2016

PROBLEMS IN METAPHYSICS

(Hard-Core) 4 Credits

Course Objectives: Examine foundational metaphysical issues, including appearance and reality, idealism, ontology, and the nature of substance. Analyze the distinctions between particular and general entities, theories of universals, and the complexities of substance like monism and pluralism. Investigate the philosophical dimensions of space, time, and the mind, exploring Cartesian dualism and its defensibility.

Course Outcomes: Develop a nuanced understanding of foundational metaphysical problems, demonstrating proficiency in ontological concepts and the evaluation of substance theories. Articulate distinctions between particular and general entities, theories of universals, and complexities of substance. Critically engage with the philosophical dimensions of space, time, and the mind, utilizing foundational and suggested readings for comprehensive insight into metaphysical concepts.

1. **Appearance and reality**

Appearance, reality and idealism – transcendental idealism – absolute idealism – realism.

2. **Ontology**

What there is – being-qua-being – ontological relativity of philosophical ontologies – formal concepts.

3. **Substance**

The traditional conception of substance – must there be substances? – the individuation of substances – essentialism – primary and secondary qualities.

4. Particular and general

The distinction – everything that exists is particular – theories of universals the primacy of the particular.

5.Simple substances: monism and pluralism

Must substance be simple? - monism and pluralism – absolute idealism and logical atomism.

6. Space and time

What are space and time?--time and human existence – are space & time essentially one?

7. Minds

The concept of the mental – body-mind theories – Cartesian dualism – the criteria of the mental – Can dualism be defended?

Essential Readings:

D.W. Hamlyn, *Metaphysics* (Cambridge, Cambridge University Press, 1984).

Ney, Alyssa. Metaphysics: An Introduction. Routledge, 2014.

Loux, Michael J., and Thomas M. Crisp, editors. Metaphysics: Contemporary Readings. Routledge, 2002.

Further Readings:

A.E. Taylor, *Elements of Metaphysics* (London: Methuen, 1961).

Brian Garrett, *what is this thing called metaphysics?* (London and New York: Routledge, 2006).

PROBLEMS IN EPISTEMOLOGY

(Hard-Core) 4 Credits

Course Objectives:

This course aims to explore the foundational questions of epistemology by delving into the necessity of a theory of knowledge, skepticism, certainty, and various sources of knowledge. Traditional responses to skepticism, including rationalism, empiricism, common sense, and dialectical argumentation, will be critically examined. The course will also scrutinize the intricate relationship between knowledge and belief, analyze concepts of truth, and question the viability of correspondence theory. Furthermore, epistemological issues in perception, memory, self-knowledge, and knowledge of others will be explored to provide students with a comprehensive understanding of key concepts.

Course Outcomes:

By the conclusion of the course, students will demonstrate a nuanced understanding of foundational epistemological questions, including the necessity of a theory of knowledge, responses to skepticism, and the complex interplay between knowledge and belief. They will critically evaluate concepts of truth, ranging from classical theories to recent accounts, and

engage in discussions on the defensibility of correspondence theory. Additionally, students will explore and analyze epistemological challenges in perception, memory, self-knowledge, and knowledge of others, honing their ability to articulate and assess key philosophical concepts in the realm of epistemology. The study of D.W. Hamlyn's "The Theory of Knowledge" and suggested readings will deepen their understanding and contribute to their analytical skills in philosophical discourse.

1. **Why a theory of knowledge?**

   (a)The questions asked (b) Skepticism, knowledge and the search for certainty (c) Is philosophical skepticism possible? (d) Sources of knowledge

2. **Traditional Answers to Skepticism**

   (a) Rationalism (b) Empiricism (c) Commonsense and ordinary language (d) Dialectical argument and proof

3. **Knowledge and Belief**

   (a) Does knowledge involve belief? (b) What is belief? (c) What is knowledge (d) Types of knowledge.

4. **Truth**

   (a) What are the problems about truth? (b) Classical theories of truth

   (c) Recent accounts of truth (d) Can correspondence theory be defended?

   (e) Facts and objectivity

5. **Perception**

   (a) The argument from illusion (b) The "given" (c) Sense data and appearances (d) Traditional theories of perception (e) Perception and the world (f) Perception, knowledge and belief

6. **Memory**

   a) Skepticism about memory (b) The concept of the past (c) Types of memory (d) Ismemory a source of knowledge?

7. **Knowledge of Oneself and Others**

   (a) Privacy and solipsism (b) Knowledge of one's own states of mind (c) Knowledge of other people's states of mind (d) Self-knowledge and knowledge of other persons

8. ***A priori* Knowledge**

   (a) What is a priori knowledge? (b) The analytic and the synthetic (c) Synthetic *a priori* truth (d) Conceptual truths (e) The a priori in mathematics and science

Essential Readings

D.W. Hamlyn, *The Theory of Knowledge* (London: Macmillan, 1971).

A. J. Ayer**,** *Problems of Knowledge* **(**Hormondsworth: Penguin, 1977).

Roderick M. Chisholm, *Theory of Knowledge* (New Delhi: Prentice hall of India Pvt. Ltd, 1977).

Duncan Prichard, *What is this thing called knowledge*? (London & New York: Routledge, 2006)

Further Readings

Keith Lehrer, *Knowledge* (Oxford: Clarendon Press, 1978).

A. D .Woozley, *Theory of Knowledge*: *An Introduction* (London: Hutchinson University Library, 1967).

PHILOSOPHICAL APPROACH TO GANDHIAN THOUGHT

(Hard-Core) 3 Credits

Course Overview:

This course explores a philosophical approach to Gandhian thought, focusing on foundational concepts and ethical principles. Students delve into Mahatma Gandhi's worldview, examining ideas on nonviolence, truth, and building a just society. The course aims to deepen understanding of the philosophical dimensions of Gandhian thought, fostering critical analysis and interpretation of its ethical and political implications.

Learning Outcomes:

Students will gain a comprehensive understanding of the philosophical aspects of Gandhian thought, evaluating ethical principles and foundational concepts. They will critically analyze Gandhi's ideas on nonviolence, truth, and social justice, enhancing analytical and interpretative skills. Through primary texts and contemporary discussions, students will appreciate the philosophical richness of Gandhian thought and its relevance to ethical and political discourse.

1. **Introduction**

(a) Lifework of Gandhi (b) early influence on the life of Gandhi

(c) Western influence on Gandhi (d) Indian influence on Gandhi

2. **Fundamental Beliefs and Ideals**

(a) Truth (b)Non-essentialism **(**c) Pluralism

3. **Ethical Foundations of Gandhian Thought**

Cardinal vows- (a) *satya* (b) *ahimsa (c) brahmacarya*, (d)*asteya,* (e) *parigraha*

4. Swaraj and Satyagraha

(a) Swarajand Self-rule (b) Meaning and characteristics of *satygraha*

(c*)* Santisena (peace brigade)

5. Sarvodaya

(a) Trusteeship (b) Bread labour (c) Sarvodya and utilitarianism

6. Gandhi's views on *sarva dharma samabhava*

(a) Hinduism (b) Jainism (c) Buddhism (d) Christianity (e) Islam

7. Gandhi's Views on women

(a) Women as personification of *ahimsa* (b) Women and social suppression

(c) women and education

8. Gandhi and Social Development

(a) Rural economy (b) Technology (c) Ecology

Essential Readings

Gandhi, Mahatma. Sarvodaya. Navajivan Publishing House, 1958.
Gandhi, Mahatma. Gandhi on Women. Navajivan Publishing House, 1959.
Gandhi, Mahatma. Constructive Programme: Its Meaning and Place. Navajivan Publishing House, 1941.
Gandhi, Mahatma. My Religion. Navajivan Publishing House, 1955.

Suggested Readings:

S. N. Sinha, *Gandhian Philosophy of Survodaya* (New Delhi: Classical Publishers, 1990)
Raghavan Iyer, *The Moral and Political Writings of Gandhi* (Oxford: Oxford University Press, 1973), 3 Vols.
M. K. Gnadhi, *Hind Svaraj*(Ahamdabad: Gujarat Navajivan book Publishing House, 1938)
Margaret Chatterjee, *Gandhi's Religious Thought* (London: Macmillan, 1985)

ECO-PHILOSOPHY

(Soft-Core) 3 Credits

Course Objectives: This course aims to introduce students to eco-philosophy, covering key topics such as eco-cosmology, the need for a new cosmology, and eco-ethics. Students will explore the relationship between eco-philosophy and contemporary thought, focusing on life orientation, commitment, spirituality, and social responsibility within a framework of trans-physical tolerance. The course will delve into the historical background of knowledge and values, analyzing the 19th-century eclipse of values and examining the role of information, knowledge, and ecological values for sustainable development. Additionally, students will explore humanism and ecological consciousness, evaluating ethical and cosmological perspectives, the impact of scientific cosmology, and the contrast between deep and shallow ecologies.

Course Outcomes: By the end of the course, students will demonstrate a comprehensive understanding of eco-philosophy, including eco-cosmology, ethics, and the interplay between knowledge and values. They will critically assess the relationship between eco-philosophy and contemporary thought, focusing on life orientation, commitment, spirituality, and social responsibility. Students will gain insight into the historical background of knowledge and values, analyzing the 19th-century eclipse of values and discerning the role of information, knowledge, and ecological values for sustainable development. Furthermore, they will explore humanism and ecological consciousness, evaluating ethical and cosmological perspectives, the impact of scientific cosmology, and contrasting deep and shallow ecologies.

1. **Eco-cosmology**

   (a) One or many cosmologies (b) Why do we need a new cosmology? (c) Eco-cosmology: Anthropocentric principle, evolution and participatory mind (d) Eco-ethics

2. **Eco-philosophy vis-à-vis Contemporary Philosophy**

   (a) The debacle of contemporary philosophy (b) Life orientation (c) Commitment, spirituality (d) social responsibility and tolerance of trans-physical

3. **Knowledge and Values**

   (a) Historical background (b) Eclipse of values in 19^{th} century (c) Information, knowledge and wisdom (d) Ecological values and sustainable development

4. **Humanism and Ecological Consciousness**

   (a) Ethics and cosmology (b) The scientific cosmology (c) Kant, Marx and Schweitzer

(d) The Promethean heritage (e) Deep and shallow ecologies

5. **The Ecological Person**

   (a) Western philosophies of man and their shortcomings (b) Ecological person and the celebration of life (c) Wisdom, technology and human destiny (d) Summary

6. **Power: Myth and Reality**

   (a) The myth of power (b) The Faustian life (c) Marx and Lenin on mythologizing economic power (d) Power as authority: Gandhi, Khomeini and Walesa (d) Towards a new paradigm of power

7. **Space, Life and Modern Architecture**

   (a) The human as a spiritual animal (b) The quest for quality (c) Beyond the magic of machine (d) From shell to temple

Essential Readings:

Henryk Skolimowski, *Dancing Shiva in the Ecological Age* (New York: Clarion Books,1991).

Naess, Arne. The Ecology of Wisdom: Writings by Arne Naess. Counterpoint, 2010.

Burkett, Paul. Marxism and Ecological Economics: Toward a Red and Green Political Economy. Haymarket Books, 2009.1992).

Peter Singer, *Practical Ethics* (London: Cambridge University Press, 2003, Reprint).

Further Readings:

Abram, David. The Spell of the Sensuous: Perception and Language in a More-Than-Human World. Vintage Books, 1997.

Morton, Timothy. The Ecological Thought. Harvard University Press, 2010.

Film and Philosophy

Soft core 3 Credits

Objectives:

The course proposes to know what the Philosophers have said about cinema, starting with the work of Hugo Munsterberg, Stanley Cavell and moving through to the radical philosophy of Gilles Deleuze. It explores the core philosophical areas such as Ethics, Phenomenology and Existentialism, as well as Postmodern Thinking on the Simulacrum and the Hyperreal, and how these can be approached through cinema. What may be overlooked in certain "philosophical" approaches towards film, by considering politics, race, sex and world cinema. And lastly, we explore the notion that film itself can philosophise through a consideration of Daniel Frampton's provocative claim that film should be understood as 'minded' – that it expresses thoughts,

intentions and emotions about the world it depicts – and can be considered a form of philosophy, or in Frampton's neologism, 'Filmosophy'.

Outcomes:

Knowledge acquisition:

This course aims at providing the students with a clear understanding of core philosophical concepts and issues in the philosophy of film. Students will distinguish and appreciate the specificity of various approaches to film and will appropriate the critical tools necessary to pursue a sophisticated reflection on cinema.

Development of cognitive skills:

This course will enable the students to develop and sharpen their interpretative and analytical skills, using the cinematic medium. They will learn to articulate their insights and thoughts on the film medium in clear and rigorous terms. They will also learn to discuss philosophical issues and concepts in relation to the film medium.

Unit 1: Introduction
Text-On Films and Philosophy
Screenings: *Masaan, Eternal Sunshine of the Spotless Mind* (Gondry, 2004)

Unit 2:
Skepticism, Truth and Relativism
Screenings:
Skepticism (Reality and Appearance) – *The Matrix, Inception*
Truth, Relativism – *Ankhon Dekhi,12 Angry man*

Unit 3:
Problem of Evil, Free Will, Determinism and Moral Responsibility
Free Will, Determinism and Moral Responsibility – *Memento, Minority Report*
The Problem of Evil –, *God on Trial, Anbe Shivam*
Freedom- *Munnayirippu , Shawshank Redemption, Into the Wild*

Unit-4: Hierarchy, Theory of Psychosis
Social Philosophy
Hierarchy: *Jai Bhim, Pariyerum perumaal,*
Theory of Psychosis: *Shutter island*

Unit-5: Purpose of Life, Personal identity,Existentialism
Purpose of Life : *Anbe Shivam, c/o Kancharapalem, Goodwill Hunting*
Personal identity*: Being John Malkovich*
Ethics- *Prisoners, Oppenheimer,*
Existentialism: *PK, Truman Show*

Essential Readings:

Boulé, Jean-Pierre, and Enda McCaffrey, editors. E*xistentialism and Contemporary Cinema: A Sartrean Perspective.* Berghahn Books, 2011.
Herzogenrath, Bernd, editor. Film as Philosophy. University of Minnesota Press, 2017.
Blessing, Kimberly A., and Paul J. Tudico, editors. *Movies and the Meaning of Life: Philosophers Take on Hollywood.* Open Court, 2005.
Corrigan, Timothy. *Film as Ethical Challenge*. Stanford University Press, 2009.
Tzioumakis, Yannis, and Claire Molloy, editors. *The Routledge Companion to Cinema and Politics.* Routledge, 2016.
Jarvie, Ian. *Film, Philosophy, and Reality: Ancient Greece to Godard*. Routledge, 2018.
Schmerheim, Philipp. *Skepticism Films: Knowing and Doubting the World in Contemporary Cinema*. Bloomsbury Academic, 2018.
Shimamura, Arthur P. *Psychocinematics: Exploring Cognition at the Movies*. Oxford University Press, 2013.

APPLIED ETHICS

(Soft-Core) 3 Credits

Course Objectives:

This course explores problems in metaphysics, addressing fundamental questions about existence, reality, and the nature of being. Students delve into topics such as appearance and reality, substance, space and time, and the mind-body problem. The course aims to foster critical thinking skills, enabling students to analyze and engage with philosophical questions related to the nature of reality and existence.

Course Outcomes:

By the end of the course, students will gain a comprehensive understanding of problems in metaphysics, including appearance and reality, substance, space and time, and the mind-body problem. They will develop the ability to critically analyze and evaluate various metaphysical theories. Through engagement with primary texts and contemporary discussions, students will enhance their analytical and interpretative skills, contributing to a nuanced appreciation of the complexities within the realm of metaphysics.

1.Introduction.

a) Meaning-nature-scope of ethics
b) Evaluation of human actions (moral, immoral and amoral)
c) Ethical standards

1. **Applied Ethics and Human Resource Development**
   a) Life values
   b) Goodness
   c) Justice
   d) Truth telling

2. **Professional Ethics: Ethical codes of conduct in various professions**

   a) Fundamentals of medical ethics
   b) Business ethics
   c) Eco-ethics
   d) Situational ethics

4. **Morality and Contemporary Social Issues**

   a) Feminism
   b) Information revolution
   c) Animal liberation
   d) Hate speech

5. Morality, Law and Society

   a) Use of drugs
   b) Death penalty
   c) Suicide and Euthnasia
   d) Individual Freedom

6. Morality, Sex and Reproduction

   a) Homosexuality
   b) Pornography

c) Abortion

d) Surrogate motherhood

Essential Readings

1. Harold R. Titus, *Ethics for Today* (Indiana: Prentice Hall, 2006), 9thedn.
2. Jadunath Sinha, *Manual of Ethics*(Kolkota:New Central Book Agency, 2006), Revised edn.
3. Thiroux P. Jacques, *Ethics: Theory and Practice*(New York: Van Nostrand, 1973).
4. W.K. Frankena, *Ethics* (Indiana: Prentice Hall, 1988).
5. Winkelr E.R. & Coombs J.R., *Applied Ethics: A Reader* New Jersey: Wiley-Blackwell, 1993).

Further Readings

1. Harold R. Titus, *Ethics for Today* (Indiana: Prentice Hall, 2006), 9thedn.
2. Jadunath Sinha, *Manual of Ethics* (Kolkota: New Central Book Agency, 2006), Revised edn.
3. W.K. Frankena, *Ethics* (Indiana: Prentice Hall, 1988)

VIDURA NITI
3 Credits

Course Objective

To introduce the students to Vidura's views on ethics & codes of conduct for individuals through a textual study of *VIDURANITI* – translated by Dr.Sir C.P.Ramaswamy Aiyar – Former Vice-Chancellor of Benares Hindu University.

Course Outcome

On completing the Course, a student will appreciate the relation between one's actions, social responsibility, & the significance of karma & dharma for attaining moksa.

Essential Reading:

VIDURANITI – Translated by Dr.Sir C.P.Ramaswamy Aiyar, Palghat: The Scholar Press, 1955.

Semester - II

STUDY OF AN INDIAN CLASSIC (SURESVARA'S *NAISKARMYASIDDHI*)

(Hard-Core) 4 Credits

Course Objectives:

The course "Study of an Indian Classic (Suresvara's Naiskarmyasiddhi)" aims to introduce students to the philosophical thought of Suresvara, a prominent disciple of Adi Shankaracharya, through his work Naiskarmyasiddhi. Students will gain a deep understanding of the Advaita Vedanta tradition and its core philosophical concepts as expounded by Suresvara. The course will also focus on analyzing the structure, language, and argumentation style employed in Naiskarmyasiddhi, while exploring central themes such as the nature of reality (Brahman), the concept of liberation (Moksha), and the means to attain it. Additionally, students will examine the relevance and implications of Suresvara's philosophy in contemporary philosophical discourse.

Course Outcomes:

By the end of this course, students will develop a comprehensive understanding of Suresvara's philosophical teachings as presented in Naiskarmyasiddhi. They will be equipped to critically analyze and evaluate the arguments and reasoning presented in the text, gaining proficiency in reading classical Sanskrit philosophical texts and interpreting their meanings. Students will deepen their understanding of Advaita Vedanta philosophy, including its metaphysical foundations and epistemological framework. Furthermore, students will engage in comparative philosophical analysis by comparing Suresvara's teachings with other philosophical traditions, enhancing their critical thinking and analytical skills through class discussions, written assignments, and presentations. Ultimately, students will be able to articulate their own interpretations and insights into the philosophical themes addressed in Naiskarmyasiddhi, developing a broader perspective on the Advaita Vedanta tradition and its continued relevance in contemporary philosophical debates.

Unit 1: Introduction to Suresvara and Naiskarmyasiddhi

Introduction to Suresvara: Life and Background

Overview of Naiskarmyasiddhi: Structure and Context

Unit 2: Preliminary Concepts and Terminology

Definitions and Interpretations of Key Terms

Metaphysical Foundations: Brahman and Atman

Unit 3: Analysis of Fundamental Philosophical Concepts

Ontological Inquiry: Nature of Reality (Sat)

Epistemological Foundations: Means of Knowledge (Pramanas)

The Concept of Moksha: Liberation from Samsara

Unit 4: Examination of the Concept of Action (Karma)

Analysis of Karma: Types and Implications

Karma and the Cycle of Birth and Death (Samsara)

Unit 5: Pathways to Liberation

Exploration of Jnana Yoga: Path of Knowledge

Bhakti Yoga: Path of Devotion

Karma Yoga: Path of Selfless Action

Unit 6: Refutation of Opposing Philosophical Schools

Critique of Dualistic Philosophies

Rebuttal of Materialistic and Nihilistic Views

Comparison with Other Schools of Vedanta

Unit 7: Practical Implications and Ethical Considerations

Application of Philosophical Principles in Daily Life

Ethical Guidelines and Moral Conduct

Unit 8: Conclusion and Reflection

Summative Evaluation of Naiskarmyasiddhi

Essential Reading:

Suresvara, *The Naiskarmyasiddh*(Text with English Translation and Annotation, Madras, University of Madras, 1988)

PHILOSOPHY OF SRI AUROBINDO

Hard-Core 4 Credits

Course Objectives:

This course delves into the philosophy of Sri Aurobindo, exploring the foundational concepts, key themes, and transformative insights in his philosophical thought. Students will examine Aurobindo's perspectives on integral yoga, spirituality, consciousness, and the evolutionary journey of the soul. The course aims to foster a deep understanding of Sri Aurobindo's philosophical contributions and their implications for personal and collective transformation.

Course Outcomes:

By the end of the course, students will develop a comprehensive understanding of the philosophy of Sri Aurobindo, including his views on integral yoga, spirituality, and the evolution of consciousness. They will gain the ability to critically analyze Aurobindo's writings, assess the implications of his philosophical ideas, and engage with the transformative aspects of integral yoga. Through critical engagement with primary texts and scholarly discussions, students will enhance their analytical and interpretative skills, contributing to a nuanced appreciation of Sri Aurobindo's profound philosophical insights and their relevance in contemporary contexts.

1. Introduction

(a) Life and works of Sri Aurobindo (b) Philosophical Orientation

(c) The Integral Philosophy (d) Evolution and Involution

2. The Life Divine-I

(a) The Human Aspiration (b) The Materialist Denial (c) The Denial of Ascetic

(d) Reality Omnipresent

3. The Life Divine –II

(a) The Destiny of Individual (b) The Supreme Consciousness

(c) The Ego and the Dualities (d) The Methods of Vedantic Knowledge

4. The Life Divine-III

(a) The Pure Existent (b) The Conscious Force (c) Delight of Existence

(d) The Divine Maya

5. The Synthesis of Yoga-I

(a) The Four Aids (b) Self-consecration (c) The Supreme Will (d) The Supermind

6. The Synthesis of Yoga-II

(a) The Object of Knowledge (b) The Status of Knowledge

(c) The Purified Understanding (d) The Realization of the Cosmic Self

7. The Human Cycle

(a) The Imperfection of the Past Aggregates (b) The Group and the Individual

(c) The Inadequacy of the state Idea (d) Nation and Empire

Essential Readings:

Sri Aurobindo. *The Life Divine*. Pondicherry: Sri Aurobindo Ashram, 2005.

Sri Aurobindo. *The Synthesis of Yoga*. Pondicherry: Sri Aurobindo Ashram, 1995.

Sri Aurobindo. *The Human Cycle*. Pondicherry: Sri Aurobindo Ashram, 2005.

Choudhari, Haridas. *Sri Aurobindo: The Prophet of Life Divine*. Pondicherry: Sri Aurobindo Ashram, 1951.

Lal, Basant Kumar. *Contemporary Indian Philosophy*. New Delhi: Motilal Banarsidass, 1999.

Pandit, M. P. *Commentaries on Sri Aurobindo's Thought.* Pondicherry: Sri Aurobindo Ashram, 1957.

RECENT WESTERN PHILOSOPHY

(Hard-Core) 4 Credits

Course Objectives:

This course delves into recent Western philosophy, exploring key movements and thinkers shaping contemporary thought. Students will examine the evolution of Western philosophy in the modern era, analyzing significant developments and engaging with recent trends and perspectives. The course aims to foster critical thinking skills, enabling students to evaluate and engage with the dynamic landscape of recent Western philosophical discourse.

Course Outcomes:

By the end of the course, students will develop a comprehensive understanding of recent Western philosophy, including major movements and influential thinkers. They will gain the ability to critically analyze contemporary developments, articulate the interconnections between various philosophical trends, and assess the impact of recent ideas on broader intellectual and cultural contexts. Through critical engagement with primary texts and contemporary literature, students will enhance their analytical and interpretative skills, contributing to a nuanced appreciation of the complex and evolving nature of Western philosophical thought in recent times.

1. **Husserl**

Definition of phenomenology – psychologism – phenomenology as a Rigorous science – consciousness and intentionality – phenomenological

Reduction – the structure of the transcendental

2. **Sartre**

Pre-reflective and reflective consciousness – the for – itself and the in - Itself – bad faith – freedom – the other.

3. **Russell**

Theory of descriptions (only) – Theory of types – logical atomism – Physical world

4. **Ayer**

Elimination of metaphysics–principle of verification as a criterion of Meaningfulness – phenomenalism as a theory of perception – other Minds.

5. **James**

Pragmatic theory of truth – radical empiricism – the construction of the physical world – religious experience.

6. **Dewey**

Mind as symbolic function – ideas as instruments of successful action – attitude towards metaphysics – the social basis of true ideas.

7. **Bergson**

Time and change – matter and mind – creative evolution – intellect and intuition – closed and open morality.

8. **Whitehead**

Epistemology – reality – world and God.

Essential Readings:

Herbert Spiegelberg, *The Phenomenological Movement* (The Hague: Martinus Nijhoff Publishers, 1982).

D.M. Datta, The *Chief Currents of Contemporary Philosophy* (Calcutta: University of Calcutta, 1970, Third edition)

A.J. Ayer, *Language, Truth &Logic* (Hormonusworth: penguin Books, 1975, Second edition).

Fuller and McMurrin, *History of Western Philosophy* (New York: Holt, Rinehart and Winston I.C., 1955, Third edition, Rewised)

W.T. Jones, *History of Philosophy*, Vol. V. from Wittgenstein to Sartre (New York: Harcourt Brace Jovanovich Inc., 1975, second edition, Revised).

PHILOSOPHICAL PERSPECTIVES OF WITTGENSTEIN

(Hard-core) 4 Credit

Course Objectives:

This course explores the philosophical perspectives of Ludwig Wittgenstein, focusing on his influential contributions to philosophy. Students will examine Wittgenstein's early and later works, analyzing key themes such as language, meaning, and the nature of philosophy itself. The course aims to provide a nuanced understanding of Wittgenstein's philosophical development and its impact on various areas of philosophy.

Course Outcomes:

By the end of the course, students will develop a comprehensive understanding of Wittgenstein's philosophical perspectives, including his views on language, meaning, and the nature of philosophy. They will gain the ability to critically analyze and interpret Wittgenstein's major works. Through engagement with primary texts and contemporary discussions, students will enhance their analytical and interpretative skills, contributing to a nuanced appreciation of Wittgenstein's enduring influence on philosophy.

1.Introduction to Logical Atomism

(a)Ideal Language (b) Propositions (c) Facts (c) Picture theory of meaning (d) Tautologies (e) Values

2.The Rejection of Logical Atomism

(a) The problem of interpretation (b) The motley of language (c) Critique of ostensive definition (d) Attack on analysis (e) Family resemblance (f) Some remarks on philosophy

3.Understanding

(a) Is understanding all mental process? (b) 'Now I can go on' (c) deriving (d) Experiencing

4.Sensations and Mental Acts

(a) Cartesianism (b) Behaviourism (c) Meaning as "I" that (d) sensations

5.Skeptical Doubts and Skeptical Solutions to these Doubts

(a) The same gain (b) The machine as a symbol for itself (c) A paradox and its solution (d)Know-nothing approach

6.The Private Language Argument

(a) Its occurrence in the text (b) Privacy and certainty (c) Fixing meaning in private language(d) Concluding remarks

7.Philosophical Psychology

(a) Introduction (b) Treatment of psychological concepts (c) Expression (d) Seeing and seeing as Privacy and solipsism

Essential Readings

L. Wittgenstein, *Philosophical Investigations*, G.E. M. Anscombeetal , trans. (Oxford: Basil Blackwell, 1953).

Further Readings

Avrum Stroll, *Wittgenstein* (London: Oneworld Publications, 2007, Reprint).

David Pears, *Wittgenstein* (Glasgow: Fontana-Collins,1977,5th Reprint).

P.M.S. Hacker, *Wittgenstein's Place in the Twentieth Century Analytic Philosophy* (Oxford: Blackwell, 1996).

Robert R. Fogelin, *Wittgenstein* (London: Routledge and Kegan Paul, 1987).

PHILOSOPHY OF TECHNOLOGY

(Soft-core) 3 Credits

Course Objectives:

This course explores the philosophy of technology, focusing on fundamental concepts, ethical considerations, and the societal impact of technology. Students examine technological determinism, the role of values in development, and ethical implications. The course aims to

foster critical thinking, enabling students to analyze and engage with the philosophical aspects of technology.

Course Outcomes:

By course end, students will comprehend key concepts and ethical considerations in the philosophy of technology. They will critically analyze technological determinism, assess the role of values, and understand ethical implications. Through engagement with primary texts and discussions, students enhance analytical skills, contributing to a nuanced understanding of the complex relationship between philosophy and technology.

1. What is Philosophy of Technology?

(a)Introduction (b) Technology and epistemology (c) Technology and axiology (d) Technology and metaphysics (e) Technology and methodology

2. Defining Technology

(a) Issues and debates (b) Towards avoiding confusion (c) Towards avoiding excessive breadth (d) Our definition

3. Technology and Metaphysics

(a) Technology and models of human nature (b) Free-will and technological determinism (c) Techno-scientific thinking and alternative metaphysics (d) Postmodern thinking and future of technology

4. Technology and Modern Existence

(a) The technological phenomenon (b) Bright visions: Karl Marx (c) Sombre visions: Martin Heidegger (d) Herbert Marcuse and Jürgen Habermas (e) Gandhi

5. Ethics, Assessment and Technology

(a) Basic ethical theory (b) Problems and possibilities in technology assessment (c) Ethical Questions for current technologies (d) The "given"

6. Technology and Religion

(a) Mystic images of technology (b) Judeo-Christian embrace of technology (c) Judeo-Christian rejection of technology (d) New western religions and technology

7. Technology and Practical Intelligence

(a) Reflections on intelligence (b) Practical versus theoretical intelligence (c) Tradition based practical intelligence (d) Tradition based theoretical intelligence

Essential Readings

Frederick Ferré, *Philosophy of Technology* (Georgia: University of Georgia Press, 1995).

Further Readings

Val Dusek, *Philosophy of Technology: An Introduction* (Oxford: Willey, 2006).

Scharff and Val Dusek (eds.), *The Philosophy of Technology*: *The Technological Condition* (Oxford: Blackwell, 2003).

Don Ihde, *Philosophy of Technology: An Introduction* (New York: Paragon House, 1993).

Martin Heidegger, *The Question of Technology* (San Francisco: Harper,1993).

Philosophy of Time

Soft core (3 credits)

Course Objectives:

The "Philosophy of Time" course aims to survey the answers that philosophers have given to metaphysical questions about time, as well as questions regarding time and value, and time and rationality. Students will explore key concepts in the philosophy of time and engage with major theories of time through critical analysis and critique.

Course Outcomes:

By the end of this course, students will have a solid understanding of key concepts in the philosophy of time, including various theories and perspectives on temporal existence. They will be able to analyze and critique major theories of time, evaluating their strengths, weaknesses, and implications. Additionally, students will explore the intricate relationship between time and space, gaining insights into how these fundamental dimensions of reality intersect philosophically. Through assignments and discussions, students will demonstrate good writing skills and the ability to think critically and reflectively about complex philosophical issues related to time and its philosophical implications.

Unit 1:

Introduction to Time and space, Nature of Change, temporal becoming

Mc Taggart and the Unreality of Time,Time without Change, bringing about Past

Unit 2:

A-Theory vs B-theory of Time, Paradoxes of Time Travel

Fatalism, Time and Well being

Unit 3:

Eternalism vs Presentism, Reasons and persons

Arrow of Time, Duration of Time and perception of Time

Unit 4:

Memory and Time

Essential Readings:

Schlesinger, George N. *Aspects of Time*. Hackett Pub Co Inc, 1980.e.

Ludlow, Peter, ed. *The Philosophy of Time*: A Collection of Essays. New York: Oxford University Press, 2001.

Le Poidevin, Robin. *The Images of Time: An Essay on Temporal Representation*. New York: Oxford University Press, 2007.

MacBeath, Murray, and Robin Le Poidevin. *Philosophy of Time*. Oxford University Press, 1993.

Socially Engaged Buddhism

Soft core 3 Credits

Course Objectives

This course aims to introduce the essence of philosophy of Buddhism and its engagement with issues such as caste, gender, ecology and peace of contemporary times.

Learning Outcomes

The student will be realizing the moral potential of Buddhism by applying it to various social and political issues of everyday life.

Unit I Introduction to Engaged Buddhism

1) Buddhism as Saddhamma

2) Fourteen Guidelines for Engaged Buddhism

3) Features of Socially Engaged Buddhism

Unit 2 Buddhism as an Emancipatory Identity

1) Ambedkar, Buddha or Karl Marx

2) Iyothee Thassar and Tamil Buddhist movement

3) Buddhism in Indian Philosophy.

Unit 3

Women in Buddhism

Periyar on Buddhism

Buddhism: Human Rights & Social Renewal

Unit 4

Buddhism and Caste by P. Lakshmi Narasu

The Social Philosophy of Buddhism and the Problem of Inequality

Buddhism, Ecology and Peace Movement

Essential Readings:

1. Narasu, P. Lakshmi. *Buddhism and Caste*. Motilal Banarsidass Publishers, 1993.
2. Raghuramaraju, A. *Buddhism in Indian Philosophy*. Centre for Studies in Civilizations, 2005.
3. Periyar. *Periyar on Buddhism*. Kalachuvadu Publications, 2004.
4. Thassar, Iyothee. *Tamil Buddhist Movement*. Institute of Asian Studies, 1991.
5. Various Authors. *Features of Socially Engaged Buddhism*. Buddhist Publication Society, 2004.
6. https://cooperative-individualism.org/raghuramaraju-a_buddhism-in-indian-philosophy-2014-spring.pdf
7.

Further Readings:

1. Ambedkar, B. R. *The Buddha and His Dhamma*. Dr. Ambedkar Foundation, 2013.
2. Loy, David. *The Great Awakening: A Buddhist Social Theory*. Wisdom Publications, 2003.
3. Batchelor, Stephen. *Buddhism Without Beliefs: A Contemporary Guide to Awakening.* Riverhead Books, 1997.
4. Kaza, Stephanie. *The Attentive Heart: Conversations with Trees.* Shambhala Publications, 1993.
5. Kraft, Kenneth. Inner Peace, *World Peace: Essays on Buddhism and Nonviolence.* State University of New York Press, 1992.

PHILOSOPHY OF HISTORY

(Soft -Core) 3 Credits

Course Objectives:

This course explores the philosophy of history, delving into foundational concepts, theories, and methodologies that shape our understanding of historical processes. Students will examine key philosophical questions about the nature of history, causation, and the interpretation of historical events. The course aims to foster critical thinking skills, enabling students to analyze and engage with various perspectives on the philosophy of history.

Course Outcomes:

By the end of the course, students will develop a comprehensive understanding of the philosophy of history, including key concepts, theories, and methodologies. They will gain the ability to critically analyze historical narratives, assess different approaches to understanding causation in history, and evaluate the impact of philosophy on historical interpretation. Through critical engagement with primary texts and contemporary discussions, students will enhance their analytical and interpretative skills, contributing to a nuanced understanding of the complex relationship between philosophy and the study of history

Unit 1

What is History?

Introduction to Philosophies of History

Historical Objectivity-Historicism and Anti-Historicism, Objectivity and Subjectivity, Modernity and Post-Modernity

Unit 2

Metaphysical Approach –Hegel

An Empirical Approach –Toynbee

A Religious Approach –Reinhold Niebuhr

Unit 3

The Materialistic Conception of History –Karl Marx

Critiques of Classical Theories of History –Karl Popper, W.H. Walsh, Isaiah Berlin

Unit 4

Towards Philosophical Understanding Indian History- Nationalist, Marxist and Subaltern Historiographies

Essential Readings:

G.W.F. Hegel- *Philosophical History* Pp.58-72

Arnold Toynbee-*My view of History* Pp.205-211

Karl Popper- *Prediction and Prophecy in the social sciences* Pp. 275-284

R.G. Collingwood- *History as Re-enactment of Past experience* Pp.249-262

Karl G.Hempel- *The functions of general laws in History* Pp.244-255

Further Readings:

Dray, William H., *Philosophy of History*, Prentice Hall, Inc.

Carr, E.H. *What is History?* (Harmondsworth: Penguin Books, 1977)

Walsh, W.H., *Philosophy of History-An introduction* (New York: Harper, 1967)

From Gardiner, Patrick (Ed.) *Theories of History*, New York: The Free Press, Mac Millan Publishing Co, 1959

Guha, Ranjit. *Small Voice of History*, from *Subaltern Studies IX*, Writings on South Asian History and Society New Delhi: OUP, 2005

Chatterjee, Partha. *Nationalism as the Problem in the History of Political Ideas* In *The Partha Chatterjee Omnibus*, New Delhi: OUP, 1997

VAISNAVISM

(Soft-Core) 3 Credits

Course Objective –

This course explores Vaisnavism, delving into the foundational concepts, historical development, and key principles of the Vaisnavite tradition. Students will examine the theological and philosophical aspects of Vaisnavism, views on deity worship, devotion (bhakti), and the pursuit of spiritual liberation (moksa) for providing a comprehensive understanding of Vaisnavism within the broader context of Hindu philosophy and religious traditions.

Course Outcome –

The Course will enable students to gain a thorough understanding of Vaisnavism, its theological principles and historical development by analyzing the philosophical aspects of deity worship, bhakti and prapatti, the pursuit of moksa within the Vaisnavite tradition. Through in-depth study of the primary texts and discussions, students will enhance their interpretative skills, contributing to a nuanced appreciation of Vaisnavism within the broader landscape of Hindu philosophy and religious traditions and practices.

1. **INTRODUCTION**

   Major Schools of Vedānta, Schools of Vaiṣṇavism, Life & Works of Rāmānuja and Madhva

2. **EPISTEMOLOGY OF VIŚIṢṬĀDVAITA**

   Means of Knowledge (Perception, Inference & Scripture); Stages of Knowledge; Criteria for Truth; Theory of Error

3. **METAPHYSICS OF VIŚIṢṬĀDVAITA**

   Nature of & Inter-Relation between Brahman, Souls & World; *Sapta-vidha Anupappati*

4.ETHICS OF VIŚIṢṬĀDVAITA

Cause & Nature of Bondage and Liberation; Means to Liberation – Devotion & Surrender

5.EPISTEMOLOGY OF DVAITA

Means of Knowledge (Anu-pramanas&Kevalapramanas) ; Stages of Knowledge; Criteria for Truth; Theory of Error

6. **METAPHYSICS OF DVAITA**

   Nature of & Inter-relation between Brahman, Souls & World; Classification of Souls; Difference & Dependence

7.ETHICS OF DVAITA

Cause and Nature of Bondage & Liberation; Means to Liberation- Grace

Essential Readings

1. Anima Sen Gupta, *Critical Philosophy of Visistadvata* (Patna: Patna University,
2. Srinivasachari'sYatundramatadipika' Chennai: Ramakrishna Math
3. S.M Srinivasachari, *Vaisnavism: Its Philosophy, Theology and Religious Discipline* (Delhi: MotilalBanarsidass, 1994
4. Sharma, B.N.K., History of the Dvaita Schools of Vedanta and its Literature
5. Ramachandran, T.P.: Dvaita Vedanta, New Delhi.ArnoldHememann Publishers (India) Pvt. Ltd., 1976

2nd year, Semester - III

FOUNDATIONS OF INDIAN CULTURE

Textual Study

(Hard-Core) 4 Credits

Course Objective:

This Course explores the foundations of Indian culture, providing an in-depth examination of its historical, philosophical, and cultural dimensions. Students will delve into topics such as ancient scriptures, classical literature, the philosophical systems of Indian thought, focussing on their epistemology, metaphysics & ethics. The Course facilitates appreciation of the rich diversity and foundational principles that have determined and sustained the perennial holistic Indian culture over millennia.

Course Outcome:

After completing the Course, students will gain a comprehensive understanding of the epistemological, metaphysical, ethical & experiential foundations of Indian culture, its historical development, classical literature, and timeless philosophical antiquity. They will develop the ability to critically analyze and appreciate the diverse aspects of the holistic Indian cultural heritage. Through critical study of primary texts and discussions, students will enhance their interpretative skills, contributing to a healthy appreciation of the foundational principles that continue to influence and vitalize Indian culture.

Book for Study

C.C. Pande, *Foundations of Indian Culture* (Motilal Banarsidass, Delhi, 1990)
Vol. I all chapters
Vol. II chapters 1,8,9,10, & 11

Philosophy of B.R. Ambedkar

Hard core 4 Credits

Course Objectives:

The aim of this course is to introduce the alternative approaches of contemporary Indian philosophical thought with special focus on Philosophy of B R Ambedkar. This course is an exploration of democratic and normative philosophical thought in reconstruction Indian society. This course introduces the essential philosophical writings of contemporary Indian Thinker B RAmbedkar by discussing the Philosophical method in general and Social- Political philosophy and philosophy of religion of Ambedkar in particular.

Learning Outcomes:

Learn Ambedkar's alternative reading of Indian philosophy by interrogating dominant philosophical systems and its texts.

Critical engagement with social reality conditioned by the caste system.

Learn the liberative and democratic potential of philosophy of Ambedkar in reconstructing Indian nation.

To make good citizen by understudying the indigenous democratic philosophical thought.

Unit 1 Life world of B R Ambedkar

1. Life and Essential Writings of Ambedkar
2. Concepts and methodology of B.R.Ambedkar

Unit 2 Philosophy of Religion

Philosophy of Religion and Hindu Social Order

Buddhism and Marxism

Religion and Dhamma

Unit 3 Social and Political Philosophy

Annihilation of Caste

What way Emancipation

Unit 4 Constitutional morality and Democracy

Democracy

If Democracy dies it will be our doom

Mr. Russell & The Reconstruction of Society

Essential Readings:

B.R. Ambedkar,;Introduction;, Rodrigues, Valerian (ed). T*he Essential Writings of B.R. Ambedkar.* New Delhi: Oxford Press, 2002, p.1- 43.

B.R. Ambedkar, *Philosophy of Hinduism*, Vasant (Compiled) Dr. Babasaheb Ambedkar Writings and Speeches Vol.3, Education Department, Government of Maharashtra, 1987.

B.R. Ambedkar, *Krishna and His Gita*, Rodrigues, Valerian.(Ed.) The Essential Writings of B.R. Ambedkar. New Delhi: Oxford Press, 2002, pp.193-204

B.R. Ambedkar . *Democracy*, Rodrigues, Valerian.(ed.) The Essential Writings of B.R. Ambedkar. New Delhi: Oxford Press, 2002 ,pp.60-65

B.R. Ambedkar, *Basic Features of Indian constitution*, Rodrigues, Valerian(Ed.). New Delhi: Oxford Press, 2002, pp.473-495

Further Readings:

Omvedt, Gail. *Dalits And The Democratic Revolution: Dr. Ambedkar And The Dalit Movement In Colonial India* (Sage India, 1994) p. (Ambedkarism)

B.R. Ambedkar, *'Caste, Class, and Democracy*, Rodrigues, Valerian (ed). The Essential Writings of B.R. Ambedkar. New Delhi: Oxford Press, 2002, p.132-148.

B.R. Ambedkar, Christophe Jaffrelot and Narender Kumar (ed). *Dr. Ambedkar and Democracy: An Anthology*. India: Oxford University Press, 2018, Chap. 16.

G. Aloysius, *Nationalism without a nation in India*. Delhi: Oxford University Press, 1997. Xii + 265 pp.

TWO METAPHYSICIANS-HEIDEGGER & STRAWSON

(Textual Study)

Hard Core 4 Credits

Course Objectives:

This course explores the metaphysical perspectives of two influential philosophers, Heidegger and Strawson. Students will delve into Heidegger's existential phenomenology and Strawson's analytic philosophy, examining their views on ontology, existence, and the nature of reality. The course aims to provide a comparative analysis of these two metaphysicians, fostering an understanding of their divergent approaches to fundamental metaphysical questions.

Course Outcomes:

By the end of the course, students will develop a comprehensive understanding of the metaphysical perspectives of Heidegger and Strawson. They will gain the ability to critically analyze and compare the ontological views, existential insights, and conceptual frameworks presented by these two metaphysicians. Through engagement with primary texts and scholarly discussions, students will enhance their analytical and interpretative skills, contributing to a nuanced appreciation of the diverse approaches to metaphysics within the philosophical traditions of existential phenomenology and analytic philosophy.

Essential Readings:

1. Martin Heidegger, An *Introduction to Metaphysics*, Ralph Menhism (tr. (Yale: Yale University Press, 1959)
2. P.F. Strawson, *Individuals: An Essay in Descriptive Metaphysics* (London: Macmillan, 1959), Part-1 only

Further Readings:

Blattner, William. *Being and Time by Martin Heidegger: An Introduction.* Edinburgh University Press, 2005.

Large, William. *Heidegger's Being and Time: A Reader's Guide.* Continuum, 2008.

Kitcher, Patricia. *Strawson and Kant*. Oxford University Press, 2011.

Polger, Thomas W. *Reading Strawson's Individuals:* An Essay in Descriptive Metaphysics. Continuum, 2008.

CONTEMPORARY INDIAN PHILOSOPHY

(Hard-Core) 4 Credits

Course Objectives:

This course explores problems in metaphysics, addressing fundamental questions about existence, reality, and the nature of being. Students delve into topics such as appearance and reality, substance, space and time, and the mind-body problem. The course aims to foster critical thinking skills, enabling students to analyze and engage with philosophical questions related to the nature of reality and existence.

Learning Outcomes:

By the end of the course, students will gain a comprehensive understanding of problems in metaphysics, including appearance and reality, substance, space and time, and the mind-body

problem. They will develop the ability to critically analyze and evaluate various metaphysical theories. Through engagement with primary texts and contemporary discussions, students will enhance their analytical and interpretative skills, contributing to a nuanced appreciation of the complexities within the realm of metaphysics.

1.Introduction.

Characteristics of contemporary Indian Philosophy- distinction between classical and contemporary Indian Philosophy-

2. **Swami Vivekananda**

Life and influences- metaphysical stand Point-Ideal of universal religion – realization of immortality –ways of realizations.

3. **RabindraNath Tagore**

Introduction- nature of man- nature of religion- Realization of beauty- Tagore's humanism

4. **Sri Aurobindo**

Life-Philosophical Background- evolution and involution- nature of man- Gnostic Being- Ays of Realisation

5. **S. Radhakrishnan**

Life- Nature of His Philosophy- Ultimate reality- Doctrine of re-birth-human destiny –Intuition and Intellect

6. Mahatma Gandhi

Life- Influences that shaped his thought- concepts of non-violence- ends and means- concept of religion- trusteeship- sarvodaya.

7. K.C. Bhattacharya

Life- General characteristics of his thought and Philosophy- theory of knowledge-concept of absolute and its alternation.

8. J. Krishnamurthy

Mind, Freedom-choice-less awareness-psychological revolution

9. Periyar EV ramaswamy -Justice Party, Critique of Brahmanic Orthodoxy, judiciary and the Madras University. Self-Respect Movement, Rationalism and atheism, Dravidian Identity and Language Politics, Gender Equality.

Essential Readings:

1. B.K. Lal, *Contemporary Indian Philosophy*, Motilal Banarasidas Publication, New Delhi, 2005.
2. D.K Dutta Social *and Moral Philosophy of Mahatma Gandhi,* Intellectual Book Corner,1980.
3. R.S. Srivastava, *Contemporary Indian Philosophy*, Sarada Publications, Ranchy: 1984

T.M.P. Mahadevan, *Contemporary Indian Philosophy*, Motilal Banarasidas Publication 1993

4. R.K.Shringy, *Philosophy of J. Krishnamurthy* (New Delhi: Munshiram Manohar
5. Periyar. *Why were women enslaved?*. Self-Respect Propaganda Institution, 1970.
6. Periyar. *Collected Works of Periyar*. Periyar Self-Respect Propaganda Institution, 1971.

Further Readings

1. Mohanty, J.N. *Contemporary Indian Philosophy: Series One*. Motilal Banarsidass, 2000.
2. Mohanty, J.N. *Contemporary Indian Philosophy: Series Two*. Motilal Banarsidass, 2002.
3. Lal, Basant Kumar. *Contemporary Indian Philosophy.* Motilal Banarsidass, 1992.

MODERN LOGIC

(Soft-Core) 3 Credits

Course Objectives:

Introduce the origin and development of logic, explain the laws of thought, and differentiate between deduction and induction.

Explore the uses of language, analyze its functions, and examine various forms of discourse.

Understand the fundamental assumptions of symbolic logic, grasp the use of symbolism, and differentiate between propositional and predicate calculus.

Master the concepts of propositional calculus, including truth functions, connectives, and truth-table methods.

Learning Outcome:

Students will comprehend the historical evolution of logic and its fundamental principles, enhancing their analytical skills.

Learners will develop a nuanced understanding of language functions, improving their communication and argumentation abilities.

Mastery of symbolic logic will enable students to apply rigorous reasoning in various contexts, fostering logical thinking.

Proficiency in propositional calculus will equip students with the skills to analyze and evaluate complex logical propositions effectively.

1. **Introduction**

   Origin and development of logic--- laws of thought- premises and conclusions—deduction and induction, truth and validity

2. **The Uses of Language**

   Three basic functions of language- the forms of discourse-emotive words-kinds of agreement and disagreement

3. **The Nature of Symbolic Logic**

   The fundamental assumptions of symbolic logic – the use of symbolism –
   Truth & validity – difference between propositional calculus and predicate
   Calculus.

4. **Propositional Calculus**

   Truth function – truth functional connectives and propositional variables and constants – direct truth – table method – case analysis as a decision procedure – tautology –contradictions – and contingencies – indirect (shorter) truth-table method – natural reduction conditional proof – RAA proof – CNF as a decision procedure – truth – tree technique.

5. **Predicated calculus**

   The inadequacy of propositional calculus – symbolic notions of predicate logic – propositions – functions – and propositions in predicate logic – quantifiers and their use – the inadequacy of traditional square of opposition – the use of the truth-tables in predicate calculus – natural deduction in predicate calculus – the use of generalization and instantiation.

6. **Axiom System**

Axiomatization of the propositional calculus – Principia Mathematics system-three properties of an axiom system: Consistency – Independence – and completeness.

7. Set Theory

Fundamental notions about set theory- the syllogism and the algebra of sets –sets and the relationship between them

Books for study:

P. Balasubramanian, *Symbolic Logic and Its Decision Procedures* (Madras: University of Madras Philosophical Series 30, 1990)

Irving M. Copi, Symbolic *Logic* (New York: MacMillan Publishing Co., 1997, Fifth Edition)

Bassoon and O'Connor, *Introduction to Symbolic Logic* (London: University Tutorial Press, 1970).

Philosophical Psychology

(Soft-Core) 3 Credits

Course Objectives:

This course explores the questions like If we understand the brain, do we understand the mind? How do psychological theories stand to neurological and sociological theories? Does the status of psychology as a science require that its theories not commit us to value judgments about how we live? Is that possible even when we theorise about topics such as mental health and illness? And what new ethical dilemmas might we face as we autonomous systems become more sophisticated?

Course Outcomes:

Upon successful completion of this course, students will demonstrate knowledge and understanding of the ethical implications of psychological theories, including arguments for and against these theories regarding perception and ethical issues in psychology. They will critically analyze the implications of these theories for the status of psychology as a science and explore various theories of the mind and methods of studying the mind. Through this exploration, students will develop a nuanced understanding of the interdisciplinary relationship between psychology, neuroscience, sociology, and ethics, enabling them to engage critically with complex ethical dilemmas posed by advancements in autonomous systems and psychological research.

Unit-1:

Introduction to Philosophy of Psychology

The Mind-Body Problem- Different approaches to Mind- Body problem

Dualist, materialist, idealist perspectives on Consciousness, Free Will and Determinism

Empiricism vs. Rationalism, Role of perception Reason and experience in knowledge acquisition.

Unit 2:

Constructivism and Realism

Study of perception, cognition, and reality

Philosophical Theories of Perception

Unit 3:

Hermeneutics and Phenomenological approach to Human Beings.

Ethics and Values in Psychology

Ethical Principles in Psychological Research, ethical reasoning skills in addressing moral challenges in psychology. Cultural Diversity and Psychology. Values and the Good Life, psychological constructs of happiness, meaning, and fulfilment.

Unit 4:

Behaviourism , Critiques of Behaviourism, Ontology of the Mind, Personal Identity and Persistence, Causality,States and Mental Events

Essential Readings

Churchland, Paul M. Neurophilosophy: *Toward a Unified Science of the Mind-Brain.* MIT Press, 1986.

Dennett, Daniel C. *Consciousness Explained*. Little, Brown and Company, 1991.

Feyerabend, Paul K. *Against Method.* Verso, 1975.

Kuhn, Thomas S. *The Structure of Scientific Revolutions.* University of Chicago Press, 2012.

Nagel, Thomas. *The View from Nowhere.* Oxford University Press, 1986.

Searle, John R. *Intentionality: An Essay in the Philosophy of Mind.* Cambridge University Press, 1983.

Solomon, Robert C. *Doing Philosophy: An Introduction Through Thought Experiments.* Pearson, 2004.

Ayer, A.J. "*The Argument from Illusion."* Foundations of Empirical Knowledge, sections 2-3. St. Martin's Press, 1940.

Moore, G.E. "*Visual Sense Data*." Some Main Problems of Philosophy, edited by James Paul, 39-50. Routledge, 2000.

Austin, J.L. *Sense and Sensibilia*. Oxford University Press, 1962.

Philosophy of Mind

(Soft-Core) 3 Credits

Course Objectives:

This course aims to provide students with a comprehensive understanding of the philosophy of mind, focusing on key concepts, theories, and debates concerning the nature of consciousness and the mind-body relationship. Throughout the course, students will develop critical thinking skills, enabling them to analyze and evaluate philosophical arguments regarding the mind-body problem and related issues. By exploring the historical development of ideas about the mind, students will gain an appreciation for how philosophical perspectives have evolved over time, from ancient dualism to contemporary functionalism and eliminativism. Moreover, students will learn to apply philosophical concepts to real-world phenomena, engaging with interdisciplinary perspectives from fields such as psychology and neuroscience.

Course Outcomes:

By the end of the course, students will be equipped to critically engage with ongoing debates in the philosophy of mind, demonstrating a nuanced understanding of consciousness, mental representation, and the nature of the self, while also recognizing the interdisciplinary connections that enrich our understanding of these profound philosophical questions.

Unit 1:

Dualism- The mind body Problem, Appeal, Approaches, Dualism of Mental and Physical Phenomena, Defense and Problems of Dualism,

Descartes, Mind-Brain Identity Theory, Behaviourism -Philosophical and Psychological, Identity Theory

Functionalism, Challenges to Functionalism, variations on Functionalism

Unit 2:

Folk Theories of Mind, Eliminativism, Defense of Folk Theories, Problems of Folk Theories

Privileged Access and problem of Other Minds

Folk Theory as Simulation, Theory vs Simulation, Mental simulation

Unit 3

Mental Representation, Language of Thought Hypothesis, Semantics of Mental states, Intentionality, Intentional stance and Neuro Philosophy.

Monism and Mental causation

Unit 4

Qualia and Consciousness, The qualia Problem, Functionalist defences , The representational Strategies, Emotions,Types of Emotions and the cognitive Approach

Essential Readings:

Descartes, René. *Meditations on First Philosophy*. Cambridge University Press, 1996.

Churchland, Paul M. *Neurophilosophy: Toward a Unified Science of the Mind-Brain.* MIT Press, 1986.

Dennett, Daniel C. *Consciousness Explained*. Back Bay Books, 1992.

Fodor, Jerry A. *The Language of Thought.* Harvard University Press, 1975.

Searle, John R. *The Rediscovery of the Mind*. MIT Press, 1994.

Chalmers, David J. *The Conscious Mind: In Search of a Fundamental Theory*. Oxford University Press, 1996.

Kim, Jaegwon. *Philosophy of Mind*. Westview Press, 1996.

Philosophy of Artificial Intelligence

Soft core 3 Credits

Course Objective:

The advancements of the past decade in the domain of Artificial Intelligence (AI) have been impressive. From AlphaGo's victory against one the best human Go players to self-driving vehicles, AI is already changing how we think and how we act in all spheres of human life. Progress in AI raises a host of complex philosophical questions, both in theoretical and practical philosophy. AI is being used to replace or supplement human judgement in crucial areas such as Healthcare, Public Administration, Human Resources and the Judicial System. Predictive algorithms choose to a large extent the content we are exposed to online and have, in so doing, a powerful influence on our mental life and on our democratic deliberations. After a few decades of stagnation, the new AI spring is propelled by various types of machine learning algorithms, including "deep learning" and "artificial neural networks". The causes of the AI renaissance and

the epistemic strengths and limits of different approaches to machine learning will be reviewed.

Learning Outcomes:

The current hype about AI makes it difficult to assess how transformative it will be. Powerful works of fiction such *Klara and the Sun (Kazuo Ishiguro,2021)*, *Machines like me (Ian MacEwan's, 2019)*, *Westworld(Michael Crichton, 1973)*, *Her* and *Ex Machina(Alex Garland,2014)* invite us to think about human life in a world shared which highly intelligent, autonomous and psychologically complex artificial agents. Grand claims about the ongoing cognitive development of AI and about its impacts will be examined with an open mind, and subjected to a deflationary critique. The hope is that students will be, at the end of the course, in a better position to exercise their own judgment on the status, potential and impact of AI on human life.

Unit I

1. **Computation and Human Intelligence.**
2. **Human Mind, Brain, Behavioral Programming.**
3. **Rational Thinking and Artificial Intelligence.**

Unit II

4. **Human Intellect, Artificial Intelligence and their Compatibility.**
5. **Ontology of Robotic Technology**
6. **Expediency of Robots at Present Time.**

Unit III

7. **Machine Making Human Moral Faculties.**
8. **Is Human Mind Superior to Artificial Intelligence?**
9. **The Possibility of Evolution of Artificial Intelligence.**

Unit IV

10. **Human Freedom and Artificial Intelligence**
11. **Can Political Philosophy Emerge from Artificial Intelligence?**
12. **Artificial Intelligence: Gender and Racist Discrimination?**

Unit V

13. **Ethics and Artificial Intelligence**
14. **Dignity of Human Labour vs Machine.**

Essential Readings:

Turing, A. M. (1950). Computing machinery and intelligence. *Mind,* 49, 433- 460: https://www.csee.umbc.edu/courses/471/papers/turing.pdf

Nagel, T. (1974). What is it Like to Be a Bat?. Philosophical Review, *83*(4), 435-450

Searle, John. R. (1980) Minds, brains, and programs. Behavioral and Brain Sciences, *3*(3): 417-457

Link : http://cogprints.org/7150/1/10.1.1.83.5248.pdf

Buckner, C. (2019). Deep learning: A philosophical introduction. Philosophy Compass, 14(10), 1-19

Link : https://onlinelibrary.wiley.com/doi/10.1111/phc3.12625

Russell, S. (2021). Human-Compatible Artificial Intelligence. Stephen Muggleton and Nick Chater (eds.), *Human-Like Machine Intelligence*, Oxford University Press, 1-21

Link : https://people.eecs.berkeley.edu/~russell/papers/mi19book-hcai.pdf

Bryson, J. (2010). Robots should be slaves. Dans Y. Wilks (dir.), et J. Benjamins (chapitre 11, 63-74), *Close Engagements with Artificial Companions: Key social, psychological, ethical and design issue*.

Link : http://www.cs.bath.ac.uk/~jjb/ftp/Bryson-Slaves-Book09.html

Darling, K. (2012). Extending Legal Protection to Social Robots: The Effects of Anthropomorphism, Empathy, and Violent Behavior Towards Robotic Objects. We Robot Conference 2012, University of Miami.

Link : https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2044797

Rini, R. (2017). Raising good robots. AEON.

Link : https://aeon.co/essays/creating-robots-capable-of-moral-reasoning-is- like-parenting

Wallach, W., Allen, C. & Smit, I. (2008). Machine morality: Bottom-up and Top-down approaches for modeling human moral faculties. *AI & Society*, *22*(4), 565-582.

Link : https://www.researchgate.net/publication/220414756_Machine_Morality_Bott om-up_and_Top-down_Approaches_for_Modeling_Human_Moral_Faculties

Maclure, J. (2021). AI, Explainability and Public Reason: The Argument from the Limitations

of the Human Mind. Minds and Machine.

Link : https://link.springer.com/article/10.1007/s11023-021-09570-x

Maclure, J. (2020). The new AI spring: a deflationary view. AI and Society, 35, 747-750

Link : https://link.springer.com/article/10.1007/s00146-019-00912-z

Reiman, J. (1995). Driving to the Panopticon: A Philosophical Exploration of the Risks to Privacy Posed by the Information Technology of the Future. *Santa Clara High Technology Law Journal*, *11*(1), 27-44.

Link : https://digitalcommons.law.scu.edu/cgi/viewcontent.cgi?article=1174&context =chtlj

Binns, R. (2018). What can political philosophy teach us about algorithmic fairness? IEEE Security & Privacy, 3, 16, 73-80.

Link: https://arxiv.org/pdf/1712.03586.pdf

Zoo, J., Schiebinger L. (2018). AI can be sexist and racist— it's time to make it fair. Nature, 559, 324-326

Link: https://www.nature.com/articles/d41586-018-05707-8

Schwitzgebel, E. et Garza, M. (2018). Designing AI with rights, consciousness, self-respect, and freedom.

Link : http://www.faculty.ucr.edu/~eschwitz/SchwitzPapers/AIRights2- 180604.pdf

James, A. (2020). Planning for Mass Unemployment. Chapter 6 of Ethics of Artificial Intelligence, Oxford University Press, 183-211

Link : https://oxford-universitypressscholarship

com.proxy3.library.mcgill.ca/view/10.1093/oso/9780190905033.001.0001/oso-9780190905033-chapter-7

Maclure, J., Russell, S. (2021). AI for Humanity: The Global Challenge. Lecture Notes in Computer Science, vol. 12. 116-126

Link: https://link.springer.com/chapter/10.1007/978-3-030-69128-8_8

Hagendorff, T. (2020). The ethics of AI ethics: an evaluation of guidelines. Mind. Mach. 30, 99–120

Link : https://doi.org/10.1007/s11023-020-0951

The Indian Philosophy of Beauty

Soft Core – 3 Credits

Objective

Beauty is commonly described as a feature of objects that makes them pleasurable to perceive. Such objects include landscapes, sunsets, humans and works of art. Beauty, art and taste are the main subjects of aesthetics, one of the major branches of philosophy. As a positive aesthetic value, it is contrasted with ugliness as its negative counterpart. One difficulty in understanding beauty is that it has both objective and subjective aspects: it is seen as a property of things but also as depending on the emotional response of observers. Because of its subjective side, beauty is said to be "in the eye of the beholder".

Outcome

After completing this Course, students will have a better understanding and appreciation of beauty for capturing the essence amidst all beautiful phenomena. They will also have the classical conceptions above beauty regarding the relation between the beautiful object as a whole and its parts: the parts should stand in the right proportion to each other and for constituting an integrated harmonious whole. Hedonist conceptions visualize a necessary connection between pleasure and beauty, & argue that for an object to be beautiful it should generate or cause disinterested pleasure. Other conceptions include defining beautiful objects in terms of their value, of a loving attitude towards them or their function.

Unit 1

The Place of a Philosophy of Beauty in the Indian Philosophy of Values

The Indian Approach to the Subject matter of Aesthetics

Unit 2

Beauty in Parts of Nature — its Character and Significance

Beauty in Art — its Character

Unit 3

The Problem of Cosmic Beauty

Divisions in the Philosophy of Beauty and their Configuration in India

Unit 4

The Significance of Art Creation

The Significance of Art Appreciation

The Artist, the Work of Art, and the Aesthete

Essential Reading

Ramachandran, T. P. (part 1) The *Indian Philosophy of Beauty*. Dr. S. Radhakrishnan Institute for Advanced Study in Philosophy, University of Madras, 1979.

----------(part 2) *The Indian Philosophy of Beauty*. Dr. S. Radhakrishnan Institute for Advanced Study in Philosophy, University of Madras, 1979.

Semester - IV

A Study of Arthasastra

Textual Study

Hard-Core: 4 Credits

Course Objective

To introduce the students to the philosophy of Kautilya's Arthasastra through a textual study of the work translated by Sri Shama Sastri. The limbs of the State, the duties of a King, Ministers, spies, taxation, agriculture, construction of forts, defence strategies etc. will be examined.

Course Outcome

On completing the Course, a student will appreciate the political thought of ancient Indian philosophy which blends artha, kama & dharma. An in-depth study of the work has significance for indviduals & those aspiring for administrative offices in the state & governing institutions.

Essential Reading:

ARTHASASTRA – Translated by Sri Shama Sastri, Mysuru: Oriental Research Institute, 1909.

INDIAN PHILOSOPHY OF VALUES

(Hard-Core) 4 Credits

Objectives:

To make students familiar with Indian Philosophical systems and their philosophical values, To make students develop a clear understanding of the major philosophical and Moral concepts within Indian philosophical studies Give exposure to various Indian texts.

To Improve critical reading of the texts, their rational and logical understanding and writing abilities. To help the students in understanding the significance of Indian philosophical values and moral values studies in their daily life, how to overcome the stress, how to manage their life and take challenges in life; hence there will be a focus on the dialectical and analytical method to understand Indian philosophy.

Outcomes

Students become aware of the various Indian Philosophical Concepts and moral values which help them to understand the society at large, students are able to do a comparative analysis of

all systems that further enhances their debating skills Students develop the ability to think critically and to read and analyze scientific literature Students develop strong oral and written communication skills through the effective presentation of Projects, Quiz as well as through Seminars.

1. An Introduction to Indian Philosophy of Values

Nature and place of moral thoughts in Indian philosophy- characteristics of Indian Philosophy of values.

2. **Notion of Values- Problem of Values in Indian thought**

   Ideal reality of value- value as existence- value as a quality- gradation of values- Pluralism of values.

3. **Basic Concepts in Indian philosophy of Values**

Purusharthas- VarnasramaDharmas-nature and types of *Purusharthas and Varnasrma Dharmas*- interaction between *purusharthas.*

4. **Concept of Dharma as a Moral Value**

   Dharma- analysis on Svadharma---desireless action- Manu's ideas of dharma, duty ethics of the *Bhagavad- Gītā* and Immanuel Kant.

5. ***Artha* as a Politico- Economical Value**

Kautilya's Ideas on Artha---Power as a Value- Plato and Kautilya's ideas on Artha.

6. ***Kama* as a Hedonistic Value**

Vatsyayana's 'kama sutras'- nature of desire- socio economic sanction for hedonism.

7. ***Moksha* as a Spiritual Value**

   The concept of *Moksha*- the Buddhist's and Jaina concept of spirituality- Sankara's View's on *Moksha*.

Essential Readings:

1. Santinath Gupta, *Indian Philosophy of Values*, Manohar Book Services, New Delhi, 1978.

2. M. Hiriyanna, The *Essentials of Indian Philosophy*, Motilal Banarasidas Publishers, New Delhi, 1985.

3. Dr. Sasi Prabhakar Kumar, *Facts of Indian Philosophical Thought,* Vidya Niddhi Publication, New Delhi, 1999.

4. R.L. Kashyap, *Veda Upanishad and Tantra in Modern Context*, 2004.

5. T.P. Ramachandran, *Hiriyanna (*New Delhi: Munshiram Manoharlal, 2001).

6. Rajendra Prasad (ed); *Historical- Developmental Aspects of Classical Indian Philosophy of Morals* (New Delhi: Centre for studies in Civilizations, 2008).

Social Epistemology

(Hard core) 4 Credits

Objective:

The "Social Epistemology" course aims to explore various aspects of epistemic injustice, ignorance, and expertise within social contexts. Students will examine the epistemology of democracy and its implications for knowledge production and distribution, investigating challenges and critiques related to democracy, elections, and trust within society. Additionally, the course will analyze different forms of ignorance and their impact on social dynamics, particularly focusing on issues related to race, gender, and power.

Outcomes:

By the end of this course, students will develop a nuanced understanding of epistemic injustice and its manifestations in social power dynamics, critically evaluating the role of expertise and ignorance in shaping individual beliefs and societal knowledge structures. They will gain insight into the epistemological foundations of democracy and its potential for promoting inclusive knowledge practices. Furthermore, students will critically assess the social background of trust, knowledge production, and forms of ignorance, including their implications for marginalized groups and power structures within society. Through this exploration, students will enhance their analytical skills and deepen their awareness of the

complex interplay between epistemology, social dynamics, and democracy in contemporary contexts.

Unit 1 Epistemic Injustice

Testimonial injustice
Fricker, “Rational Authority and Social Power”
Medina, *The Epistemology of Resistance* (excerpt)

Unit 2 Ignorance and Expertise
Guerrero, “Living with Ignorance in a World of Experts”
Elgin, “The Mark of a Good Informant”

Unit 3 The Epistemology of Democracy
Anderson, “Epistemology of Democracy”
Landemore, *Democratic Reason* (excerpts

Unit 4 Is Democracy Doomed?
Guerrero, “Against Elections”

Unit 5 Social Background of Trust and Knowledge
Jones, “The Politics of Self-Trust”
Wylie, “Feminist Philosophy of Science”

Unit 6 Forms of Ignorance
Mills, “White Ignorance”
Alcoff, “Epistemologies of Ignorance

Essential Readings:

Fricker, Miranda. *Epistemic Injustice: Power and the Ethics of Knowing,* chapter 1. Oxford University Press, 2007.

Hookway, Christopher. *"Some Varieties of Epistemic Injustice: Reflections on Fricker.*" In Social Epistemology, vol. 24, no. 2, 2010, pp. 151-163.

Fricker, Miranda. *"Replies to Alcoff, Goldberg, and Hookway on Epistemic Injustice."* In Social Epistemology, vol. 24, no. 2, 2010, pp. 167-171.

Mills, Charles. "*White Ignorance*." In Race and Epistemologies of Ignorance, edited by Shannon Sullivan and Nancy Tuana, State University of New York Press, 2007, pp. 11-38.

Fricker, Miranda. "*The Epistemological Significance of Ra*ce." In Journal of Philosophy, vol. 97, no. 7, 2000, pp. 337-355.

McKinnon, *“Epistemic Injustice”*, Philosophy Compass 11/8 (2016): 437-446

Alcoff, “*Epistemologies of Ignorance*: Three Types”, in Sullivan & Tuana eds., Race and

Epistemologies of Ignorance (2007)

Pettit, *"Groups with Minds of their Own*" (G&W, Ch. 11)

Lackey, "*Collective Epistemology*", in The Routledge Handbook of Collective

Intentionality, Jankovic and Ludwig, eds. (2017), pp. 196-208

Online Resources:

"Nature of Truth." Wi-Phi, www.wi-phi.com/video/nature-truth.

"Value of Knowledge." Wi-Phi, www.wi-phi.com/video/value-knowledge.

"Introduction to the Theory of Knowledge." Wi-Phi, www.wi-phi.com/video/introduction-theory-knowledge.

"Problem of Skepticism." Wi-Phi, www.wi-phi.com/video/problem-skepticism.

"Three Responses to Skepticism." Wi-Phi, www.wi-phi.com/video/three-responses-skepticism.

"New Responses to Skepticism." Wi-Phi, www.wi-phi.com/video/new-responses-skepticism.

"Analyzing Knowledge Part 1: The Gettier Problem." Wi-Phi, www.wi-phi.com/video/analyzing-knowledge-part-1-gettier-problem.

"Analyzing Knowledge Part 2: No False Lemma and No-Defeater Approaches." Wi-Phi, www.wi-phi.com/video/analyzing-knowledge-part-2-no-false-lemma-and-nodefeater-approaches.

"Analyzing Knowledge Part 3: Causal and Reliabilist Theories." Wi-Phi, www.wi-phi.com/video/analyzing-knowledge-part-3-causal-and-reliabilist-theories.

"Analyzing Knowledge Part 4: Tracking Theories." Wi-Phi, www.wi-phi.com/video/analyzing-knowledge-part-4-tracking-theories.

"Knowledge First Epistemology." Wi-Phi, www.wi-phi.com/video/knowledge-first-epistemology.

RESEARCH METHODOLOGY

(Hard-Core) 4 Credits

Course Overview:

This course provides an introduction to research methodology, covering essential concepts, approaches, and techniques for conducting research. Students will explore topics such as research design, data collection methods, and ethical considerations in research. The course aims to equip students with the foundational knowledge and skills necessary for effective and ethical research practice.

Course Outcomes:

By the end of the course, students will gain a comprehensive understanding of research methodology, including research design, data collection methods, and ethical considerations. They will develop practical skills in designing research projects, selecting appropriate methodologies, and addressing ethical concerns. Through hands-on exercises and discussions, students will enhance their ability to critically evaluate research methodologies and contribute to the advancement of knowledge in their respective fields.

1. **What is Research Methodology?**

(a) The term "research" (b) The methodology of research
(c) The finished products of research (d) Methods of philosophy

2. **Qualifications for Research in Philosophy**

(a) General qualifications for research (b) Heuristic motivation (c) Reflective
(d) ability (e) Special qualifications for research in philosophy (f) Capacity for
(g) high degree of generalization

3. **Topics for Research**

(a) Types of topics (b) Thinker or text-based topics (c) concept-based topics
(d) meta-philosophical topics (e) Inter-disciplinary topics

4. **Principles and Steps in Choosing a Topic**

(a) How to choose a topic? (b) Scope of topic for original contribution
(c) The nature of originality in philosophy (d) Identifying an area

5. Stages in the Execution of a Research Project

(a) The source of material (b) classification of data
(c) Organization of materials (d) Methods of organization
(e) Kinds of synthesis required for research

6. Presentation of thesis

(a) Form of the thesis and contents (b) introduction (c) Chapters
(d) titles, sub-titles, foot or end-notes (e) Citation of quotations
(f) Transliteration and bibliography

7. Critical Edition of Works

(a) The meaning of critical edition (b) material required for critical edition
(c) Equipment for a critical editor

8. Epistemology and Methodology of Research in Philosophy

(a) Epistemology as the methodology of metaphysics
(b) The distinction between epistemology and the methodology of research in philosophy

Essential Readings:

1. T. P.Ramachandran,*The Methodology of Research in Philosophy* (Madras: University of Madras)
2. Berel Lang (ed.), *Philosophical Style An Anthology about the Reading and Writing in Philosophy* (Chicago: Nelson-Hall, 1980)

INDIAN PSYCHOLOGY
3 Credits

Course Objective

The purpose of human birth is to enable the jivas attain permanent freedom from the sorrows of samsara & enjoy eternal bliss called moksa – the parama-purusartha. The Course will introduce students to the concepts of psychology in Classical Indian philosophy to reveal cause of bondage, sources & kinds of knowledge, criteria for truth, explanation for error, nature of Reality, jivas & jagat – their nature & inter-relation. The means to liberation differ among the schools of Indian philosophy due to their differences in metaphysics. Since mind is the cause of both bondage & liberation, the sadhanas will initiate a transformation in the psychological domain for conferring liberation through experiential knowledge of Reality.

Course Outcome

On completing the Course, the student will realize the purpose of human birth & appreciate the holistic Classical Indian philosophy which through psychology bestows bliss – posited as the highest goal of human life. The praxis of Classical Indian philosophy is beneficial both for the individual & society, is secular & spiritual, for here & the hereafter.

Unit 1

1. Features of Indian Philosophy: Vedas-Based, Combination of Religion & Philosophy, 4 Asramas, 4 Purusarthas – 3 Rnas & 5 Yajnas, Varna - Jati & Distinction, Moksa-Oriented. Astika & Nastika Traditions. Lower & Higher Knowledge (Apara & Para Knowledge). Vidya dadati vinayam. Ya vidya sa vimucyate. Avastha-traya Vicara & Yoga-Classification of Mental States. Maya, Antahkarana & Avidya Vrttis

Unit 2

a) Pramanas - Pratyaksa,; Anumana; Upamana; Sabda - Sruti, Smrti & Apta-Vakya; Arthapatti & Anupalabdhi

b) Brahman (Sat-Cit-Ananda), jivas, jagat - nature & inter-relation: Advaita - abheda model, Visistadvaita - bhedabheda model & Dvaita - bheda model; antahkarana, indriyas. Anatma-Vada, Pancaskandhas

Unit 3

a) Criteria for Truth & Theories of Error: Asat Khyati; Sat Khyati - Atma, Anyatha & Akhyati, Yathartha & Abhinava-Anyatha Khyati; Anirvacaniya Khati

b) Bondage - Karma: 4 Kinds of Action & 3 Kinds of Destiny, Samskaras. Jainism, Buddhism, Nyaya Yoga, Advaita, Visistadvaita & Dvaita.

Unit 4

Liberation: Daivi & Asuri Sampat, Ratna-traya of Jainism, Astanga-marga of Yoga & Buddhism, Sadhana-Catustaya & Sadhana Saptaka, Kinds - Krama, Sadyo, Jivanmukti, Videhamukti & Sarvamukti. Salokya, Samipya, Sayujya & Sarupya. Nature of a Jivmanmukta.

Essential Reading:

S.Chattejee & D.M.Datta, An Introduction to Indian Philosophy, Kolkatta: University of Calcutta, 1984

M. Hiriyanna, Outlines of Indian philosophy, New Delhi: Blackie & Son Ltd., 1979

S.Radhakrishnan, Indian philosophy, vols.! & @, London: George Allen & Unwin, 1962

CRITICAL THINKING

(Soft-core) 3 Credits

Course Objectives:

The "Critical Thinking" course aims to introduce students to the concept of critical thinking by establishing standards, exploring benefits, and addressing barriers to effective reasoning. Students will define arguments, distinguish truth from logical content, explain validity, and analyze deductive and inductive reasoning. The course will also examine sources of information, evaluate testimony, consider human limitations, and analyze social influences on reasoning. Additionally, students will integrate critical thinking with reading and writing, exploring techniques for critical reading and learning, and eliciting critical reactions in their academic work and beyond.

Learning Outcome:

By the end of this course, students will explore inference, identify fallacies, emphasize relevance, and evaluate sufficiency in arguments. They will understand the structure of arguments, assess their validity, and differentiate between deductive and inductive reasoning. Students will grasp the fundamentals of critical thinking, identify its applications, and recognize obstacles to effective reasoning. Additionally, students will recognize common fallacies, assess the strength of inferences, and apply principles of relevance and sufficiency in their analytical work. Through critical evaluation of sources and discernment of information reliability, students will recognize the impact of social factors on decision-making. Furthermore, students will enhance their reading and writing skills through critical analysis, fostering deeper comprehension and engagement with academic texts. Ultimately, students will develop decision-making skills by weighing various factors and making informed choices aligned with personal values, while internalizing intellectual standards and applying them to enhance the quality of their critical thinking processes.

1. **What is Critical Thinking?**

   (a) Introduction (b) Standards of critical thinking (c) critical thinking: benefits and barriers (d) summary

2. **Critical Thinking and Logic**

   (a) What is an argument? (b) Truth content and logical content (c) Validity (d) Deductive arguments and validity (e) Inductive arguments and strength

3. **Evaluating Arguments: Inference and Fallacies**

   (a) Linguistic phenomena

   na (b) Fallacies (c) The relevance of relevance (d) Sufficiency

4. **Information and Its Evaluation**

   (a) Sources of information (b) Testimony as a source of information (c) Reason and basic

   human limitations (d) Reason and social influences (e) Means of social influences

5. **Thinking, Reading and Writing Critically**

(a) Introduction (b) Critical thinking, and critical reading and learning (c) Critically thinking,

reading and writing (d) Some reactions

6. **Decision Making**

(a) Options (b) Consequences (c) Values (d) Risks

7. **Universal Intellectual Standards**

(a) Clarity (b) Accuracy (c) Precision (d) Breadth (e) Depth

Essential Reading

Alec Fisher, *Critical Thinking: An Introduction* (London: Cambridge University Press, 2001).

Madhucchanda Sen, *An Introduction to Critical Thinking* (Delhi: Pearson, 2010).

Exploring Modernity and Post Modernity

Soft core 3 Credits

Course Objectives:

The course provides a thorough exploration of modernity and postmodernity, focusing on their historical, philosophical, and cultural dimensions. Through analysis of key concepts and thinkers, students develop a nuanced understanding of Enlightenment ideals, critiques of meta narratives, and their impact on contemporary society. Emphasis is placed on refining critical thinking skills to articulate interpretations of modern and postmodern thought. Ultimately, the course aims to empower students to engage thoughtfully with these complex periods in human history.

Course Outcomes:

By the end of the course, students will be able to critically analyze the foundational concepts and key characteristics of modernity, including the Enlightenment ideals of reason, progress, and individualism, as well as the critiques and challenges posed by postmodern thought. Through engagement with seminal texts and theoretical frameworks, students will explore the transition from modernity to postmodernity, examining shifts in societal structures, cultural productions, and epistemological paradigms. Additionally, students will develop the ability to evaluate the implications of modernity and postmodernity for contemporary society and

culture, including their impact on politics, art, literature, and technology. Through discussions, assignments, and research projects, students will hone their critical thinking, analytical, and communication skills, enabling them to engage meaningfully with complex philosophical and social issues related to modernity and postmodernity in diverse contexts. Ultimately, the course seeks to foster a deeper appreciation for the complexities of historical and intellectual developments shaping the modern and postmodern world views, empowering students to navigate and contribute to ongoing debates surrounding these important periods in human history.

Unit 1: Foundations of Modernity

Introduction to Modernity

Enlightenment and Critique

The Modern Condition

Unit 2: Postmodernism and Society

Postmodernism in Context

Deconstruction and Margins

Political Theory in Postmodernity

Unit 3: Critiques and Applications

Critiques of Modernity

Philosophical Reflections on Postmodernity

Essential Readings:

Berger, Peter. *Facing up to Modernity*. New York, 1977.

Boyne, R. and A. Rattansi (eds.). *Postmodernism and Society.* London: MacMillan, 1990.

Derrida, Jacques. *Margins of Philosophy.* Trans. Alan Bass. Chicago: University of Chicago Press, 1985.

Foucault, M. "*What is Enlightenment?*" In Paul Rabinow (ed.), Foucault Reader. New York: Pantheon Books, 1984, pp. 32–50.

Lyotard, F. *Postmodern Condition: A Report on Knowledge*. Oxford: OUP, 1980.

Singh, R.P. *Modernity and Postmodernity.* New Delhi: Om Publications, 2002.

White, S.K. *Political Theory and Postmodernism.* Cambridge: Cambridge University Press, 1991.

Philosophical Counseling

Soft core 3 Credits

Objective:

The "Philosophical Counseling" course aims to examine the efficacy of philosophical counseling in comparison to traditional psychotherapy. Students will explore the philosophical underpinnings of counseling and its relationship with psychotherapeutic approaches, including an introduction to Buddhist psychology and its integration into counseling practices. Additionally, the course will investigate the role of philosophy in mental health care and its potential applications in diverse contexts.

Outcomes:

By the end of this course, students will understand the nature and scope of philosophical counseling and its distinctions from traditional psychotherapy, critically evaluating its potential benefits and limitations in addressing existential and psychological concerns. They will gain insight into the theoretical foundations of Buddhist psychology and its relevance to counseling practices. Furthermore, students will explore opportunities for integrating philosophical perspectives into mental health care across various contexts, including feminist, multicultural, and corporate settings, identifying effective philosophical therapies for promoting well-being and enhancing mental health outcomes. Through this exploration, students will develop a deeper understanding of the intersection between philosophy and mental health care, enriching their perspectives on counseling practices and therapeutic interventions.

Unit 1

Philosophical Counseling, The Efficacy of Philosophical Counselling

Five common philosophical criticisms of Psychiatry

The Relationship between Philosophical Counseling and Psychotherapy

Existential Psychotherapy

Philosophical Criticism of Existential Psychotherapy

Rogerian Therapy

Unit 2

The Life Examined in Philosophical Counselling

The Philosopher as Personal Consultant

What Philosophical Counselling Can't Do

How can Philosophy Benefit from Philosophical Practice?

Four Stages of Counseling

Unit 3

Buddhist Psychology and Counselling, Pathways of Mindfulness-Based Therapies

Nature of Counselling and Theoretical Orientations in Psychotherapy

Personality: Philosophical and Psychological Issues

Mind–Body Relationship and Buddhist Contextualism

Unit 4

The Role of Philosophy in Mental Health Care, Modularity of Philosophical Practice

Philosophical Counseling "Yesterday" & Today, Feminist and Multicultural Counseling

The Corporate Philosopher, Opportunities for Facilitators and Consultants

Cognitive Psychotherapy and Positive Psychotherapy

Essential Readings:

Raabe, Peter B. *Philosophical Counseling: Theory and Practice*. Praeger, 2001.

Yalom, Irvin D. *Existential Psychotherapy.* Basic Books, 1980.

Yalom, Irvin D. *The Theory and Practice of Group Psychotherapy*. Basic Books, 1995.

Van Deurzen, Emmy. *Existential Counselling and Psychotherapy in Practice*. Sage Publications, 2002.

Tong, Rosemarie. *Feminist Thought: A Comprehensive Introduction.* Westview Press, 1989.

Kourany, Janey S., James Sterba, and Rosemarie Tong. *Feminist Philosophies: Problems, Theories, and Applications*. Prentice Hall, 1992.

Five Common Philosophical Criticisms of Psychiatry." *Journal of the APPA*, City College, The City University of New York, 2010.

de Silva, Padmal. "*Buddhist Psychology: A Review of Theory and Practice*." Institute of Psychiatry, University of London, 1992.

Socio-Political Philosophy

Soft core 3 Credits

Objective:

In the "Political Philosophy" course, students will aim to understand Hegel's concepts of Monism and Geist, differentiate between Private and Public Morality, and analyze the role of the State. They will also analyze Marx's critique of Hegel's Idealism, comprehend Historical Materialism and class dynamics, and grasp the concept of Surplus Value. Additionally, students will examine Robert Nozick's perspective on the relationship between the Individual and Society, and explore Habermas' theories on Democracy and Rational Discourse, while evaluating Martha Nussbaum's Feminist Critique of Liberalism.

Outcome:

By the end of this course, students will grasp the foundational ideas of Hegelian philosophy and develop critical thinking skills in assessing moral and political structures. They will gain insights into Marxist theory, its historical context, and its implications for understanding socioeconomic systems. Additionally, students will evaluate Nozick's theories on individual rights and their implications for social organization and governance. Moreover, students will analyze the foundations of democratic governance and understand feminist perspectives on liberal political philosophy, enhancing their ability to engage critically with complex political and philosophical ideas.

Unit 1.

Hegel: Monism; Geist; Private Morality; Public Morality; State

Unit 2.

Marx: Critique of Hegel's Idealism; Historical Materialism; Bourgeois & Proletariat;

Background and Laws of Materialist Dialectics; Surplus Value

Unit 3.

Robert Nozick: Relation between Individual &Society

Unit 4.

Habermas, Democracy; Rational Discourse

Martha Nussbaum: Feminist Critique of Liberalism

Essential Readings:

David Mc Lellan, *The Thought of Karl Marx:An Introduction,* The Macmillan Press Ltd., London,1980.

Zoya Berbeshkina, Lyudmila Yakov eva, Dmitry Zerkin,*What is Historical Materialism?,* Progress Publishers, Moscow,1987

K. Marx & F. Engels, *Communist Manifesto, with explanatory notes by David Riazonov,* National Book Agency Pvt. Ltd. Kolkata, 2011

J Habermas, *The Philosophical Discourse of Modernity,* trans, F. Lawrence, Cambridge: MIT Press. 1987

J Habermas, *Knowledge and Human Interest,* trans, J Shairo, Boston: Beacon Press. 1971

R. Nozick,*Anarchy, State and Utopia*, Oxford, Basil Blackwell. 1974

M. Nussbaum, "*The Feminist Critique of Liberalism*" in Political Philosophy: The Essential Text, ed. Steven M Cahn, Oxford University Press, New York, 2005

Department of Mathematics

PONDICHERRY UNIVERSITY

UG Degree (BS Honours) with Research in Mathematics

NATIONAL EDUCATION POLICY (NEP 2020)

REGULATIONS-2023

1. INTRODUCTION:

- The NEP curriculum is implemented from the Academic Year 2023-24.

1.1. Major Highlights

- The Department of Mathematics launch Integrated UG (Honours/Honours with Research) with lateral entry– exit facility in all the years study.

1.2. Age Limit:

- As per UGC Norms.

2. SHORT-TITLES AND DEFINITIONS

Definitions

a) **"Credit**" One credit is equivalent to 15 hours of teaching (lecture or tutorial) or 30 hours of practical and/or field work or community engagement and service per semester.

b) "**Academic Year**" from June- May (2 semester).

c) "**Semester**" means 15-16 weeks of teaching-learning session of which two weeks shall be set apart for examination and evaluation;

d) **"Summer term"** is for 8 weeks during summer vacation. Internship/apprenticeship/work based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.

e) "**Grade**" means a letter grade assigned to a student in a Course for her/his performance at academic sessions as denoted in symbols of : O(outstanding), A+(Excellent), A(Very good), B+(Good), B(Above average), C(Average), P(Pass) F(Fail) and Ab(Absent) with a numeric value of O=10, A+=9, A=8, B+=7, B=6, C=5 P=4, and F=0, Ab=0;

f) "**Semester Grade Point Average (SGPA)**" is computed from the grades as a measure of the students' performance in agiven semester.

g) **"Cumulative GPA (CGPA)**" is the weighted average of all courses the student has taken in a given Programme;

Semester-III

MAJOR-3 MATH 203: INTRODUCTION TO REAL ANALYSIS – I

Course Objectives: (4 CREDITS)

1. To study the importance of the LUB property of the real number system
2. To study the property of convergence sequence

	Course Outcome
CO 1	To discuss about the Bolzano Weierstrass theorem and recursive sequences
CO 2	To study about convergence of infinite series and various tests of convergence
CO 3	To understand the algebra of convergent series and rearrangement of infinite series

Unit I: (Sections 1.1, 1.2 and 1.3)

Algebra of the Real Number system – Upper and lower bounds – LUB property and its applications – Archimedean property – Greatest integer function – Density of rational numbers – Existence of n^{th} roots of positive real numbers – Nested intervals theorem.

Unit II: (Sections 1.4, 2.1, 2.2, 2.3 and 2.4)

Absolute value and Triangle Inequality – Subsets of R defined by inequalities – Convergent sequences – Definition and examples – Properties of algebra of limits of sequences – Bounded sequences – Sandwich Lemma – Cauchy sequences – Cauchy completeness of R - Monotone sequences – Geometric sequence – The number e - Nested intervals theorem.

Unit III: (Sections 2.5, 2.6, 2.7 and 2.8)

Some important limits – Cesaro's Theorem – Sequences diverging to $+\infty$. – Existence of a monotone sequence of a real sequence – Bolzano Weierstrass Theorem – Sequences definedrecursively.

Unit IV: (Sections 5.1 and 5.2)

Convergence and sum of an infinite series – Geometric series – Cauchy criterion – Algebra of convergent series – Absolutely convergent series – Comparison Test – Harmonic p-series – D'Alembert's ratio Test – Cauchy's Root Test – Integral Test – Cauchy's Condensation Test – Abel's Summation by parts Formula – Dirichlet's Test – Leibmitz Test for alternating series.

Unit V: (Section: 5.3 and 5.4)

Rearrangement of an infinite series – Definition and examples – Riemann's Theorem – Cauchy product of two infinite series – Merten's Theorem – Abel's Theorem on Cauchy product – Existence of decimal expansion – characterization and rational numbers.

Text Book:

1. Ajith Kumar and S.Kumaresan, ***A Basic Course in Real Analysis***, CRC Press (2014)

Reference Books:

1. Robert G. Bartle, Donald R. Sherbert, *Introduction to Real Analysis*; John Wiley and sons (Fourth Edition).
2. Kenneth A. Ross, *Elementary Analysis : The Theory of Calculus*, springer , 2e (2013).
3. Ajithkumar,S.Kumaresan, Bhasa Kumar Sarma , *A Foundation Course in Mathematics*, Narosa– 2018.

MAJOR-4 MATH: 204: ELEMENTS OF DISCRETE MATHEMATICS

(4 CREDITS)

Course Objectives:

1. Able to understand the concepts of sets and determine whether a relation is a function and identify the domain and range of a function.
2. Understand the ideas of the basis step and the inductive step in a proof by Mathematical induction and recurrence relations

	Course Outcome
CO 1	To understand the basic concepts of Permutations and combinatorics
CO 2	To familiarize the applications of Difference sequences and Catalan numbers.
CO 3	To understand the concepts and significance of lattices and Partition of numbers.

Unit I: (Sections: 0.1, 0.2, 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 2.4, 2.5)

Statements – Compound Statements – Contrapositive statements – Proofs in Mathematics (Types of proofs) – Direct proofs – Proof by cases – Proof by contradiction – Logic – Truth tables – The Algebra of Propositions – Logical arguments –Sets – Operations on sets – Binary relations – Equivalence relations – Partial orders.

Unit II: (Sections: 3.1, 3.2, 3.3, 4.1, 4.2, 4.3)

Functions – Inverses and composition – One-to-one correspondence and the cardinality of a set – The Integers – The Division algorithm – Divisibility – The Euclidean Algorithm – Prime numbers.

Unit III: (Sections: 5.1, 5.2, 5.3, 5.4, 6.1, 6.2)

Mathematical induction – Weak form and strong form – Recursively defined sequences – Solving recurrence relations – The characteristic polynomials – Solving recurrence relations – Generating functions – The principle of inclusion-Exclusion – The addition and multiplication rules.

Unit IV: (Sections: 6.3, 7.1, 7.2, 7.5, 7.6, 7.7)

The pigeonhole principle–Permutations – Combinations –Repetitions – Derangements – The binomial theorem.

Unit V: (Sections: 8.1, 8.2, 8.3, 8.4)

What is an Algorithm – Complexity – Searching and sorting – Enumeration of permutation and combination.

Text Books

Edgar G. Goodaire, Michael M. Parmenter, Discrete Mathematics with Graph Theory (Third Edition), PHI Learning Private Ltd., New Delhi - 2011.

Reference Books

1. Richard Johnson bauth, Discrete Mathematics, 5th Edition, Pearson Education Asia, New Delhi, 2002.
2. Ralph. R. Grimaldi - Discrete and Combinatorial Mathematics: An applied Introduction - 4th Edition, Pearson Education Asia, Delhi, 2002
3. C.L. Liu, Elements of Discrete Mathematics, The Mc Graw-Hill, India 1985.
4. Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, Discrete Mathematical Structure, 4th Edition, Pearson Education Pvt. Ltd., New Delhi 2003

Semester-IV

MAJOR-5 MATH: 205: INTRODUCTION TO REAL ANALYSIS – II
(4 CREDITS)

Course Objectives:

1. To introduce the concept of limit and continuity of functions
2. To introduce the notion of differentiability and some fundamental results on differentiation.

	Course Outcome
CO 1	To learn some applications of differentiability of functions
CO 2	To introduce the Riemann theory of integration and the fundamental theorem of calculus
CO 3	To learn about pointwise and uniform convergences of sequence of functions

Unit I: (Sections 3.1, 3.2, 3.3, 3.4, 3.5 and 3.6 of [1])
Continuous functions– Algebra of continuous functions – ε-δ definition of continuity – Intermediate value theorem– Extreme value theorem– Monotonic function– Limit of a function – Limit at infinity.

Unit II: (Sections 4.1 and 4.2 of [1])
Differentiability of functions – Chain rule – Roll's theorem – Mean value theorems –Applications of mean value theorem – Inverse function theorem – Cauchy's form of mean value theorem.

Unit III: (Sections 4.3, 4.4, 4.5 and 4.6 of [1])
L'Hospital's rule–Darboux theorem – Taylor's theorem – Convex functions – Derivative test for convexity.

Unit IV: (Sections 6.1, 6.2, 6.3 and 6.4 of [1])
Riemann integration – Upper and lower sums –Properties of Riemann integration – Basic estimates for integrals – Fundamental theorem of calculus (I & II), Mean value Theorem for Integrals.

Unit V: (Sections 7.5 and 7.10 of [2])
Improper integrals (First and second kind) – Absolute Convergence – conditional convergence – integral test – Cauchy principal value.

Text book:

1. Ajith Kumar and S.Kumaresan, *A Basic Course in Real Analysis*, CRC Press (2014).
2. Richard R Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Co. Pvt Ltd, New Delhi, Indian Edition 1970.

Reference Books

1. R.G. Bartle and D.R. Sherbert, Introduction to Real Analysis, Third Edition, Wiley India edition, 2000.
2. Kenneth A. Ross, *Elementary Analysis: The Theory of Calculus*, springer, 2e (2013).

MAJOR-6 MATH: 206: GROUP THEORY (4 CREDITS)

Course Objectives:

1. To introduce the concept of Group and Homomorphisms.
2. To introduce the notion of special subgroups and Symmetric group.

	Course Outcome
CO 1	To learn some special sub groups like Normal subgroups.
CO 2	To introduce the Coset concepts and Lagrange's Theorem.
CO 3	To learn about Automorphisms.

Unit I

Introduction to Groups - Definition and Examples of Groups – Elementary Properties of Groups – Subgroups - Subgroup Tests - Examples of Subgroups.

Unit II

Cyclic Groups - Properties of Cyclic Groups - Classification of Subgroups of Cyclic Groups - Permutation Groups - Cycle Notation - Properties of Permutations.

Unit III

Isomorphisms - Cayley's Theorem - Properties of Isomorphisms – Automorphisms.

Unit IV

Properties of Cosets - Lagrange's Theorem and Consequences, Normal Subgroups - Factor Groups - Applications of Factor Groups.

Unit V

Group Homomorphisms - Properties of Homomorphisms - The First Isomorphism Theorem.

Text Book:

Joseph A. Gallian, Contemporary Abstract Algebra, 8th Edition, Cengage Learning India Private Limited. **Chapters 2,3,4,5,6,7,9(except Internal Direct Products) and 10.**

Reference books

1 M. Artin: Algebra, Prentice-Hall of India, 1991.
2. I.N.Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.

MAJOR-7 MATH: 207 ELEMENTS OF DIFFERENTIAL EQUATIONS
(4 CREDITS)

Course Objectives:

1. To understand ordinary and first order partial differential equations and their applications
2. To enable students to understand solving the first and second order ODES and first order PDEs.

	Course Outcome
CO 1	To solve a system of first order ODEs
CO 2	To analyze the stability of a Dynamical System using Differential Equations and their solutions
CO 3	To Solve First Order Partial Differential Equations

Unit I:

Exact differential equations- Integrating factors – Linear differential equations- Bernoulli equation – Modeling: Electric circuits – Orthogonal trajectories of curves.

Unit II:

Homogeneous linear equations of second order – Second order homogeneous equations with constant coefficients – Case of complex roots- Complex exponential function – Differential operators – Modeling: Free oscillations – Euler-Cauchy equation – Existence and uniqueness theory – Wronskian.

Unit III:

Non homogeneous equations – Solution by undetermined coefficients – Solution by variation of parameters – Modeling of electric circuits – Higher order linear differential equations – Higher order homogeneous equations with constant coefficients.

Unit IV:

Introduction: vectors, matrices, eigenvalues – Introductory examples – Basic concepts and theory – Homogeneous systems with constant coefficients, phase plane, critical points – Criteria for critical points, Stability.

Unit V:

Non-linear first order PDEs : Compatible systems- Solutions of Quasi linear equations
Charpit's method- Special Types of Charpits Method, -Integral surfaces through a given curve-The Cauchy problem for Quasi Linear case and nonlinear first order PDEs

Text Book

Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons, 1999.
Unit-I: Sections 1.5-1.8; Unit-II: Sections 2.1-2.7; Unit-III: Sections 2.8-2.10, 2.13, 2.14;
Unit-IV: Sections 3.0-3.4;
K. Shankara Rao, Introduction to Partial Differential Equations, PHI Publications,
3rd Edition. 2011. – Chapter 1

Reference Books

1. George F. Simmons, Differential Equations, Tata McGraw-Hill, New Delhi, 1972.
2. Boyce and Di Prima, Differential Equations and Boundary Value Problems, Wiley,10th edition 2012.
3. Earl A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall of India Private Ltd, 1991.

Semester-V

MAJOR-8 MATH: 308: TOPOLOGY OF METRIC SPACES

(4 CREDITS)

Course Objectives:

1. To study about some important inequalities and to introduce the notion of metric spaces
2. To study the Baire's category theorem, connected sets and homeomorphisms

	Course Outcome
CO 1	To learn complete metric spaces and to discuss some of the important results regarding completeness
CO 2	To introduce the notion of compactness and its properties
CO 3	To study about the improper integrals and varies tests of convergence for improper integrals

Unit I: (Section 3.10, 4.2, 4.3,5.3, 5.4, 5.5**)**

Metric Spaces – Definition – Examples – Holder inequality – Minkowski's inequality – Convergent sequence – Cauchy sequence – Equivalent metric spaces – Continuous functions on a Metric space – Open sets – Closed sets – Limit points.

Unit II: (Section 5.6, 6.1,6.2)

Oscillation of a function – $F_\sigma$set, $G_\delta$set – Dense and nowhere dense subsets –Baire's category Theorem – Subspaces – Connected sets – Connected subsets of R – Continuity and connectedness.

Unit III: (Section 6.3, 6.4)

Bounded sets – Totally bounded sets – Complete metric spaces – Cantor intersection theorem – Contraction mapping – Contraction mapping theorem.

Unit IV: (Section 6.5, 6.6, 6.7,6.8)

Compactness – Sequential compactness – Heine-Borel property – Finite intersection property- Continuity and compactness – Continuity of inverse functions – Uniform continuity.

Unit V: (Section 9.1, 9.2, 9.4)

Sequences and series of functions – The metric space C[a,b] – pointwise Convergence – Uniform Convergence – Cauchy's criterion for uniform convergence.

Text Book

R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Co. Pvt. Ltd., 1970.

Reference Books

1. Ajith Kumar and S. Kumaresan, *A Basic Course in Real Analysis*, CRC Press (2014).
2. R.G. Bartle and D.R. Sherbert, Introduction to Real Analysis, Third Edition, Wiley India edition 2000.
3. S. Kumaresan, Topology of Metric spaces, Second Edition, Narosa Publishing House, 2005.
4. Pawan K. Jain and Khalil Ahmad, Metric Spaces, (Second Edition), Narosa Publishing House 2004.

MAJOR-9 MATH:309: RING TEORY (4 CREDITS)

Course Objectives:

1. To introduce the concept of Rings and Homomorphisms of Rings.
2. To introduce the notion of special subrings and Integral Domains.

	Course Outcome
CO 1	To learn some special Integral Domain like ED, PID and UFD.
CO 2	To introduce the Quotient ring concepts and Fundamental Theorem.
CO 3	To learn about Fields.

Unit I

Introduction to Rings - Motivation and Definition of Rings – Examples of Rings – Properties of Rings – Subrings - Definition and Examples of Integral Domains – Fields - Characteristic of a Ring.

Unit II

Ideals - Factor Rings - Prime Ideals and Maximal Ideals - Definition and Examples of Ring Homomorphisms - Properties of Ring Homomorphisms - The Field of Quotients.

Unit III

Polynomial Rings - The Division Algorithm and Consequences - Principal ideal domain - Factorization of Polynomials - Reducibility Tests - Eisenstein's Criterion- Irreducibility Tests.

Unit IV

Unique Factorization in $Z[x]$ - Divisibility in Integral Domains – Irreducibles and Primes - PID Implies Irreducible Equals Prime.

Unit V

Unique Factorization Domains – PID Implies UFD – $F[x]$ Is a UFD – Euclidean Domains –ED Implies PID – ED Implies UFD.

Text Book:

Joseph A. Gallian, Contemporary Abstract Algebra, 8th Edition, Cengage Learning India Private Limited.
Chapter 12 to Chapter 18.

Reference books

1 M. Artin: Algebra, Prentice-Hall of India, 1991.
2. I.N.Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
3. David S. Dummit and Richard M. Foote, Abstract Algebra (Third Edition), John Wiley and sons, 2004

MAJOR-10 MATH: 310: MULTIVARIABLE CALCULUS (4 CREDITS)

Course Objectives:

1. To learn differentiation, partial differentiation, directional derivatives and gradients.
2. To learn about double and triple integrals.

	Course Outcome
CO 1	To apply the double and triple integrals to find volume and area.
CO 2	To learn maxima and minima of two and more variables
CO 3	To learn about some applications of integrals in other branches of sciences

Unit I (Sections: 1.5, 1.6, 2.1, 2.2, 2.3**):** The n-dimensional Euclidean space – Angle between the vectors - Graphs and level curves/ surfaces – Examples - Limits and continuity – Partial derivatives – Differentiability – The derivative matrix – The tangent planes.

Unit II (Sections: 2.4, 2.5, 2.6**):** The chain rule – Tangent to curves on surfaces - Algebra of derivatives - Gradients and directional derivatives – Tangent plane to a surface – Gradient and tangent planes – Implicit differentiation.

Unit III (Sections: 2.1, 3.2, 3.3, 3.4, 3.5**):** Higher order partial derivatives – Equality of mixed partial derivatives - Taylor's theorem – A second order Taylor formula - Maxima and minima – Critical points – First derivative test – Absolute maxima and minima on closed intervals - Second derivative test – Taylors formula near a critical point - Constrained extrema and Lagrange multipliers.

Unit IV (Sections: 5.1, 5.2, 5.3**):**
Volume and Cavalieri's principle – Double and iterated integrals – The double integral over a rectangle - Properties – Reduction to iterated integrals – The double integral over regions – Mean value theorem for double integrals.

Unit V (Sections: 5.4, 5.5, 5.6**):** Triple integrals over a box – Triple integrals by iterated integration – Double integrals in polar coordinates – Triple integrals in cylindrical and periodical coordinates – General change of variable formula – Applications of multiple integrals – Average value – coordinates of the center of mass – Moment of inertia.

Text Book : J.E. Marsden, A.J. Tromba and A. Weinstein, Basic Multivariable Calculus, Springer, 2004.

Reference Books

1. George B.Thomas, Jr. and Ross L. Finney, Calculus, 9th Edition, Pearson Education, 2006.
2. Richard Courant and Fritz John , Introduction to Calculus and Analysis, Volumes I & II, Springer, SIE, 2004.

MAJOR-11 MATH: 311: INTERNSHIP / COMPREHENSIVE EXAM WITH VIVO VOCE (4 CREDITS)

(Two Months in Industries / Universities / Research Institutes etc.)

Objective: The internship program for mathematics graduates aims to provide real-world experience, enhance mathematical skills, and offer opportunities to apply mathematical knowledge in various professional settings. The curriculum may enable mathematics undergraduates to work on practical projects.

Month 1: Foundation and Skill Development

Week 1-2: Orientation and Introduction to the Organization - Understanding the internship structure - Introduction to the team and projects - Introduction to specific mathematical problems in recent advancements of Mathematics

Week 3-4: Learning Basics in Program Specific Subject (e.g. Linear Algebra and Optimization, Differential Equations, Topology, Functional Analysis, Advanced Agebra, Graph Theory etc.)

Week 5-6: Mathematical Projects - Collaborate on real projects within the organization
- Apply mathematical concepts to solve problems - - Present project progress and results

Week 7-8: Final Project and Presentation - Work on an individual or group project
- Develop a presentation to showcase the project results - Presentation to the project supervisor.

Note: Students unable to arrange the above can make a project based on the first 2 years papers under the guidance of the Department faculties and should go through a comprehensive Exams and vivo under the approval of the Program Committee Meetings.

Evaluation Process:

1. Performance Assessment: Regular feedback from mentors on the intern's progress.
- Evaluation of assignments, projects, and tasks - Interns should have a mid-term review with their mentors to discuss their progress/improvement.

2. Final Evaluation: Evaluation of the final project, presentation, and report.
- Assessment of learning skills (with viva-voce).

3. Certificate of Completion: Successful interns may receive a certificate of completion, detailing their achievements and skills acquired during the internship.

Semester-VI

MAJOR-12 MATH: 312: FUNDAMENTALS OF COMPLEX ANALYSIS
(4 CREDITS)

Course Objectives:

1. To learn about complex numbers and to analyze limit, continuity and differentiation of functions of complex variables.
2. To learn about analytic functions and construction of analytic functions.

	Course Outcome
CO 1	To understand Cauchy theorem and Cauchy integral formulas and apply these to evaluate complex contour integrals
CO 2	To represent analytic functions as Taylor and Laurent series
CO 3	To learn and classify singularities, poles and residues and evaluate complex integrals using the residue theorem

Unit I: (Sections 1 to 23)

Complex conjugates - Exponential form – Products and powers in Exponential form- Arguments of Products and Quotients- Roots of Complex numbers- Regions in the Complex plane- Functions of a complex variable- Mappings- Mappings by the exponential function- Limits- Theorems on Limits- Limits involving point at infinity- Continuity- Derivatives, Differentiation Formulas, Cauchy-Riemann Equations, Sufficient conditions for Differentiability- Polar Coordinates.

Unit II: (Sections 24 to 36)

Analytic functions, Examples, Harmonic functions, uniquely determined Analytic functions, The Exponential functions, The Logarithmic Function, Branches and derivatives of Logarithms, Some Identities involving Logarithm, Complex Exponents, Trigonometric Functions, and Hyperbolic Functions.

Unit III: (Sections 37 to 54)

Derivatives of functions w(t), Definite Integrals, Some Examples, Upper bounds for Moduli, Anti derivatives, Cauchy-Goursat Theorem (Statement only) , Multiply Connected Domains, Cauchy Integral Formula, An extension of the Cauchy Integral Formula, Some Consequences of the Extension, Liouville's Theorm and The Fundamental Theorem of Algebra, Maximum Modulus Principle.

Unit IV: (Sections 55 to 62)

Taylor's Series, Proof of Taylor's Theorem, Examples, Laurent Series, Proof of Laurent's Theorem, Examples.

Unit V: (Sections 68 to 77)

Isolated Singular Points, Residues, Cauchy's Residue Theorem, Residue at Infinity, The Three Types of Isolated Singular Points, Residues at Poles, Examples, Zeros of Analytic Functions, Zeros and Poles, Behavior of Functions Near Isolated Singular Points.

Text Book:

James Ward Brown and Ruel V. Churchill. Complex Variables and Applications,. Tata McGraw - Hill Education. 8th Edition, 2009.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 9th Edition, 2011
2. H.A. Priestley, Introduction to Complex Analysis, Second Edition, Oxford University Press, 2003
3. John B. Conway, Functions of One Complex Variable, Springer, ISE, 1973
4. Serge Lang, Complex Analysis, Springer Publishing Company, 4th Edition, 2009.
5. S. Ponnusamy, Foundations of Complex analysis, (2nd Edition), Narosa, 2011.
6. V. Karunakaran, Complex Analysis, (2nd Edition), Narosa 2005.

MAJOR-13 MATH: 313: INTRODUCTION TO LINEAR ALGEBRA
(4 CREDITS)

Course Objectives:

1. To understand vector spaces by its definition and examples.
2. To know how to represent a linear transformation by a matrix

	Course Outcome
CO 1	To learn elementary operations on Matrices and how to apply them to find the solutions of a system of equations
CO 2	To learn the properties of determinant of matrices
CO 3	To know about inner products and orthogonalization

Unit I: Section 1.2 to 1.6

Abstract Algebra Concepts – Groups- Subgroups- Fields- examples Vector space- Subspace-linear combinations and systems of linear equations- Linear dependence and linear independence- Basis and dimension.

Unit II: Section 2.1 to 2.5

Linear Transformations- Null spaces- Range spaces- Dimension theorem- Matrix representation of linear transformation- composition of linear transformations and Matrix multiplication- Invert ability and Isomorphism- The change of coordinate matrix.

Unit III: Section 3.1 to 3.4

Elementary matrix Operations and elementary matrices- The rank of a matrix and matrix inverses- systems of linear equations- Theory and computation

Unit IV: Section 4.1 to 4.4 and 5.1 to 5.2, 5.4

Determinants of order 2 and order n- propertie4s of determinants- Important facts about determinants- Eigen values and Eigen vectors- Diagonalizability- Invariant spaces and Cayley- Hamilton theorem.

Unit V: Section 6.1, 6.2

Inner products and norms- The Gram-Schmidt orthogonalisation process and orthogonal complements.

Text Book

Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Linear Algebra, 4th Edition,
Printice Hall of India Pvt. Ltd., 2006

Reference Books

1. S. Kumaresan, Linear Algebra Geometric Approach, Prentice Hall of India Pvt. Ltd., 2000.
2. I. N. Herstein, Topics in Algebra, 2nd Edition, John Wiley & Sons, 2003.
3. David C. Lay, Linear Algebra and Applications (2nd Edition), Addison Wesley, 1997.
4. John B. Fraleigh, A First Course in Abstract algebra, (7th Edition), Pearson 2013.

MAJOR-14 MATH: 314: GRAPH THEORY (4 CREDITS)

Course Objectives:

1. To introduce the notion of graphs and the basic terminologies in graphs
2. To learn the concept of spanning trees, Cayley's formula and to introduce the concept of connectivity and edge connectivity of graphs

	Course Outcome
CO 1	To study about independent sets and matching and some of their properties
CO 2	To introduce the idea of Eularian and Hamiltonian graphs and their applications
CO 3	To study vertex coloring and edge coloring of graphs and some of the famous theorem in coloring problems

Unit I: (Sections 1.1-1.6, 4.1-4.3)
Graphs – Subgraphs – Isomorphism of graphs – Degrees of Vertices – Paths and Connectedness – Automorphism of a Simple Graph – Trees – Centers and Centroid.

Unit II: (Sections 3.1-3.3, 4.4,4.5)
Counting the Number of Spanning Trees – Cayley's Formula– Vertex Cuts and Edge Cuts – Connectivity and Edge-connectivity.

Unit III: (Sections 5.1-5.5)
Vertex Independent sets and Vertex Coverings – Edge-Independent Sets – Matchings and Factors –M-Augmenting Paths – Matchings in Bipartite Graphs – Halls Theorem on Bipartite graphs – Tutte's 1-Factor Theorem (without proof).

Unit IV: (Sections 6.1-6.3)
Eulerian graphs – Necessary and sufficient condition for Eulerian graphs – Hamiltonian graphs – Dirac theorem – Closure of a graph.

Unit V: (Sections 7.1,7.2,7.3.1, 7.6.2, 8.1-8.3)
Vertex Coloring – Chromatic Number –Critical Graphs – Brooks' Theorem – Edge Colorings of Graphs – Vizing's Theorem (without proof) – Planar and Nonplanar Graphs – Euler's Formula and its Consequences.

Text Book:-

1. R. Balakrishnan and K. Ranganathan, A Textbook of Graph Theory (Universitext), Second Edition, Springer New York 2012.

Reference Books:-

1. Bondy, J.A and Murthy, U.S.R, Graph Theory with Applications, Macmillan Press Ltd, New Delhi – (1976).Douglas B. West, Introduction to Graph Theory, Second Edition, PHI Learning Private Ltd, New Delhi-2011.
2. G. Chartrand, Linda Lesniak and Ping Zhang, Graphs and Digraphs, Fifth Edition, CRC press 2011.

MAJOR-15 MATH -315 LINEAR PROGRAMMING (4 CREDITS)

Course Objectives:

1 To learn the concept of LPP and Simplex Method
2 To learn the concept of Transportation and Assignment Model

	Course Outcome
CO 1	To study about Modeling with LPP and Simplex Method
CO 2	To study about Transportation Problem
CO 3	To study about Assignment problem and Duality

Unit – I: Modeling with Linear Programming (Chapter-2, Sections 2.1, 2.2, 2.4)
Two-Variable Linear Programming Model, Graphical LP Solution–Solution of a Maximization Model, Solution of a Minimization Model. Linear Programming Applications –Investment, Production Planning and Inventory Control, work force planning, Urban Planning,

Unit – II: The Simplex Method-I (Chapter-3, Sections 3.1, 3.2, 3.3)
LP model in Equation Form – Converting Inequalities into Equations with Nonnegative Righthand side, Dealing with Unrestricted variables. Transition from Graphical to Algebraic Solution, Iterative Nature of Simplex method, Computational Details of Simplex Method.

Unit – III: The Simplex Method-II (Chapter-3, Sections 3.4, 3.5,)
Artificial Starting Solution– Big-M-Method, Two-Phase Method. Special Cases – Degeneracy, Alternative Optima, Unbounded Solution, Infeasible Solution.

Unit – IV: Transportation Model (Chapter-5, Sections 5.1, 5.2, 5.3)
Definition of the Transportation Model, Nontraditional Transportation Models, The Transportation Algorithm, Determination of the Starting Solution, Iterative Computations of the Transportation Algorithm, Simplex Method Explanation of the Method of Multiplier.

Unit – V: Assignment Model and Duality (Chapter-5, Sections 5.4 & Chapter-7, Sections 7.4)
The Assignment Model, The Hungarian Method, Simplex Explanation of the Hungarian Method. Duality – Matrix Definition of the Dual Problem, Optimal Dual Problem.

Text Book:
1. Hamdy A Taha – Operations Research: An Introduction, 10th Edition, Pearson Prentice Hall, 2017.

Reference Books:
1. F. S. Hillier and G. J. Lieberman, *Introduction to Operations Research* (9th Edition),
Tata McGraw Hill, Singapore, 2009.
2. G. Hadley, *Linear Programming*, Narosa Publishing House, New Delhi, 2002.

Semester-VII

MAJOR-16 MATH 416: ADVANCED ALGEBRA
(4 CREDITS)

Course Objectives:

1. To learn isomorphism theorems group actions
2. To study about class equations and sylow theorems and its applications

	Course Outcome
CO 3	To know the direct product of groups and classifications of groups by applying the fundamental theorem finitely generated Groups
CO 4	To know the properties of Euclidean domain, Principal ideal domain and Unique factorization domain.
CO 5	To study the properties of Polynomial rings.

Unit I:
The isomorphism theorems -Composition Series - Transpositions and Alternating groups,

Unit II:
Group Actions: Group Actions and Permutation representations-Group acting on themselves by left multiplication-Cayley's theorem

Unit III:
Group acting on themselves by conjugation -The class equation- Automorphisms-The Sylow theorems- The simplicity of A_n.

Unit VI:
Direct and semi-direct products and abelian groups: Direct products- The fundamental theorem of finitely generated abelian groups.

Unit V:
Polynomial rings: Definitions and basic properties- Polynomial rings over fields- Polynomial rings that are unique factorization domains -Irreducible criteria.

Text Book:
David S. Dummit and Richard M. Foote, Abstract Algebra (Third Edition), John Wiley and sons, 2004.
Chapter 3 - Sections 3.3 to 3.5
Chapter 4 - Sections 4.1 to 4.6
Chapter 5 - Sections 5.1 and 5.2
Chapter 9 - Sections 9.1 to 9.4

Reference books

1 M. Artin: Algebra, Prentice-Hall of India, 1991.
2. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
3. N. Jacobson: Basic Algebra, Volumes I & II, W. H. Freeman, 1980.
4. S. Lang: Algebra, 3rd edition, Addison-Wesley, 1993.

MAJOR-17 MATH: 417 TOPOLOGY (4 CREDITS)

Course Objectives:

1. To introduce the notion of metric spaces and to characterize open sets in the real line
2. To study the concept of topological spaces and to study their properties like second count ability and separability

	Course Outcome
CO 1	To discuss in details about compactness of topological spaces and to prove the Tychnoff's theorem with some applications
CO 2	To study bout the equivalent versions of compactness in metric spaces
CO 3	To discuss some important theorems like Urysohn's lemma and the Tietze extension theorem. Also, we study about connected spaces

Unit I: (Revision of Sections 1-3, Section 4-8, 9-12)
Revision of sets - Functions - Product of sets – Relations – Countable sets – Uncountable sets – Partially ordered sets and lattices – Metric spaces – Definition and examples – Open sets and closed sets in metric spaces – Open subsets of real line.

Unit II: (Sections 16, 17 and 18)
Topological spaces -- Definitions and examples - Closure and related concepts – Open bases and open sub bases – Separability and second count ability -Lindloff's Theorem

Unit III: (Sections 21 – 23)
Compactness – Basic results -- Continuous maps on compact sets - Characterization of compactness by basic and sub basic open covers – Tychon off's theorem - Generalized heine – Bore theorem.

Unit IV: (Sections 24,26)
Compactness for metric spaces – Sequential compactness - Lebesgue covering lemma - Sequential compactness and compactness coincide on metric spaces - T_1spaces - Hausdorff spaces.

Unit V: (Sections 27,28,31,32)
Completely regular spaces and normal spaces – Urysohn's lemma and Tietze extension theorem- –Connected spaces – Components of a space.

Text Book

G.F.Simmons, an Introduction to Topology and Modern Analysis, McGraw-Hill Kogakusha, Tokyo, 1963

Reference Books

1. J. R. Munkres, Toplogy, Pearson Education Inc., Second Edition, 2000.
2. Stephen Willard, General Topology, Dover Publication 2004.
3. J. Dugundgi, Toplogy, Allyn and Bacon, Boston, 1966.
4. Fred.H. Croom, Principles of Topology, Dover publications, 2016.

MAJOR-18 **(4 CREDITS)**

MATH: 418: DIFFERENTIAL EQUATIONS AND SPECIAL FUNCTIONS

Course Objectives:

1. To study the qualities properties of ordinary differential equations.
2. To study the hypergeometric functions, Bessel functions and Legendre polynomials which arising as solution of ODEs

	Course Outcome
CO 1	To study the series solutions of ODEs,
CO 2	To study the existence and uniqueness of solutions of first order ODEs.

Unit I: [Chapter-4, Sections: 25, Chapter-5, Sections: 26, 27, 28, 29, 30 & Chapter -7, Sections: 40 of [1]]
Qualitative properties of solutions – The Sturm Separation Theorem, The Sturm comparison theorem– Eigen values and Eigen functions and vibrating string. Series solutions of first order equations – Second order linear equations – Ordinary points - Regular singular points

Unit II: [Chapter-5, Sections: 31 of [1] & Chapters: 4 & 7 of [2]]
Gauss Hypergeometric equations. Gauss's hypergeometric and Confluent hypergeometric functions, integral representations, differentiation formulas, transformation formulas, summations formulas.

Unit III: [Chapter-8, Sections: 44, 45, 46 47 of [1]]
Legendre polynomials – Properties of Legendre polynomials – Bessel functions- The Gamma function - Properties of Bessel Function.

Unit IV: [Chapter-10, Sections: 55, 56 of [1]]
Linear systems – Homogeneous linear system with constant coefficients.

Unit V: [Chapter-13, Sections: 68, 69 of [1]]
The existence and uniqueness of solutions – The method of successive approximations – Picards's theorem.

Text Book

1) G. F. Simmons, Differential Equations with Applications and Historical Notes, 2nd Edition, McGraw Hill Education(India) Company, 2003.
Sections: 22-30, 32-35, 37-38 and 55-56.
2) E. D. Rainville, Special *functions*, Macmillan, New York, 1960.

References

1. Earl Coddington and Norman Levinson, Theory of ordinary Differential equations, TATA McGraw Hill, 2017.
2. N. M. Temme, *Special functions: An introduction to the classical functions of mathematical physics*, John Wiley& Sons, New York, 1996.

Semester-VIII

MAJOR-19 MATH: 419: ADVANCED REAL ANALYSIS (4 CREDITS)

Course Objectives:

1. To study about functions of bounded variation, double sequence, double series and infinite products
2. To study about convergence of sequences and series of functions and their properties

	Course Outcome
CO 1	To prove some famous theorems like Weierstrass approximation theorem and stone Weierstrass theorem
CO 2	To study about differentiability of functions of several variables and to prove the contraction mapping theorem.
CO 3	To prove the important theorems- The inverse function and the implicit function theorem

Unit I:(Chapter:6 and Sections: 8.20 to 8.23, 8.26 and8.27 of [2])

Functions of bounded variation - Double sequences - Double series - Rearrangement theorem for double series- A sufficient condition for the equality of iterated series.

Unit II: (Chapter: 7 of [1], Subsections 7.1 to 7.25)

Sequence and Series of functions - Examples - Uniform convergence and Continuity - Uniform convergence and Integration - Uniform convergence and Differentiation - Double sequences and series - Iterated limits- Equicontinuous Families of Functions - Arzela – Ascoli Theorem

Unit III:(Chapter: 7 of [1] subsections: 7.26 to7.33 and chapter 8 of [1])

The Weierstrauss theorem for algebraic polynomials- The Stone - Weierstrauss Theorem - Power Series - The Exponential and Logarithmic Functions - The Trigonometric Functions - Fourier Series - The Weierstrauss theorem for the Trigonometric polynomials.

Unit IV: (Chapter:9 of [1], Subsections: 9.6 to 9.23)

Functions of Several Variables - Linear Transformation - Differentiation - The Contraction Principle.

Unit V:(Chapter: 9 of [1], Subsections:9.24 to 9.38)

The inverse function Theorem - The implicit Function Theorem - The Rank Theorem – Determinants.

Text Books

1. Walter Rudin, Principles of Mathematical Analysis- McGraw Hill International Editions, Mathematics series, 1976.
2. Apostol, Mathematical Analysis, Narosa Publishing House, Indian edition,2002.

Reference Books

1. Patrick M. Fitzpatrick Advanced Calculus, Amer. MATH. Soc. Pine and Applied Undergraduate Texts, Indian Edition, 2009.
2. Kenneth A. Ross, Elementary Analysis, The Theory of Calculus, Springer-Verlag,1980.
3. N.L.Carothers, *Real Analysis*, Cambridge University Press(2000)
4. G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill, 2017.

MAJOR-20 MATH 420: ADVANCED LINEAR ALGEBRA
(4 CREDITS)

Course Objectives:

1. To understand linear transformations Characteristic roots- Similarity of linear transformations, Invariant subspaces and matrices.
2. To understand triangular forms- Nilpotent transformations.

	Course Outcome
CO 1	To understand Jordan forms- Fundamental theorem on modules over PID.
CO 2	To understand Rational canonical form- Trace- Transpose & Determinants.
CO 3	To understand Hermitian - Unitary and Normal transformations - Real quadratic forms.

Unit I: Sections – 6.1,6.2, 6.3 [1] and 13.1-13.2 [2]
Field theory: Splitting fields and Algebraic closures. The Algebra of linear transformations-Characteristic roots- Similarity of linear transformations.

Unit II: Sections – 6.4 and 6.5 [1]
Invariant subspaces and matrices. Reduction to triangular forms.

Unit III: Sections – 6.6 and 4.5 [1]
Nilpotent transformations - Index of nil potency and invariant of nilpotent transformation. Jordan blocks and Jordan forms-

Unit IV: Sections - 6.7, 6.8 and 6.9 [1]
Modules - Cyclic modules - Fundamental theorem on modules over PID- Rational canonical form- Trace- Transpose and Determinants.

Unit V: Sections – 6.10 and 6.11 [1]
Hermitian - Unitary and Normal transformations - Real quadratic forms.

Text Book: 1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. Abstract Algebra (Third Edition) by David S. Dummit and Richard M. Foote,
(Sections 13.1-13.2)

Reference Books

1. M. Artin, Algebra, Prentice-Hall of India, 1991
2. N. Jacobson, Basic Algebra, Volumes I & II, W. H. Freeman, 1980.
3. S. Lang, Algebra, 3rd edition, Addison-Wesley, 1993
4. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra (2nd Edition)Cambridge University Press, Indian edition, 1997
5. Kenneth Hoffmann and Ray Kunze, Linear Algebra, (Second edition), Pearson, 2015
6. S. Friedberg, A. Insel and L. Spence, Linear Algebra, (4^{th} Edition) Pearson, 2015.

Minor-9 : MATH 427 : COMPLEX ANALYSIS (4 CREDITS)

Course Objectives:

1. To Learn and understand about the properties of Line integral and Zeros and Poles.
2. To discuss about the theorems on Series expansion, Residue and Factorization.

	Course Outcome
CO 1	To discuss about the Line integrals, Cauchy theorem and Cauchy integral formula
CO 2	To study about the Zeros and Poles of functions and the Maximum principle
CO 3	To study about the Calculus of Residues, Evaluation of Definite Integrals and Harmonic functions
CO 4	To study about Series Expansions and Partial Fractions and Factorization
CO 5	To study the Jenson Formula-Hadamard' Theorem and the Riemann Zeta Function

Unit I: [Chapter-4, Sections: 1 and 2]

A quick review of analytic function – Cauchy-Riemann equations. Line integrals-Cauchy's theorem for a Rectangle-Cauchy's theorem in a Disc-Cauchy's integral formula-Higher derivatives

Unit II: [Chapter-4, Sections: 3 and 4].

Local properties of Analytical Functions-Removable Singularities, Zeros and poles-The Maximum principle- The general form of Cauchy's theorem.

Unit III: [Chapter-4, Sections:5 and 6].

The Calculus of Residues-The Residue Theorem- The Argument principle-Evaluation of Definite Integrals. Harmonic functions- Poisson's formula- Schwarz's theorem- The Reflection Principle.

Unit IV: [Chapter-5, Sections: 1 and 2].

Power Series Expansions-Weierstrass's Theorem-The Taylor series-The Laurent's series. Partial Fractions and Factorization-Infinite Product-The Gamma function-Stirling formula.

Unit V: [Chapter-5, Sections: 3 and 4, Chapter-8, Sections: 1]

Entire Functions-Jenson Formula-Hadamard' Theorem. The Riemann Zeta Function-Extension of Riemann Zeta function to the Whole Plane-The Functional Equation-The Zeros of the Zeta Function. Analytic Continuation.

Text Book: L.V. Ahlfors, Complex analysis, Third Edition, McGraw Hill Book Company,1979.

References:

1. John. B. Conway, Functions of one Complex Variable, Second Edition, Narosa Publishing House, 2002.
2. B. C. Palka, An Introduction to the Complex function Theory, Springer, 1991.
3. H.A. Priestley, Introduction to Complex Analysis, Second Edition, Oxford University Press, 2003.
4. S. Ponnusamy, Foundations of Complex analysis, (2nd Edition), Narosa, 2011
5. Donald Sarason, Notes on Complex Function Theory, Hindustan Book agency, 1994.

Minor-10 : MATH 428: MEASURE AND INTEGRATION
(4 CREDITS)

Course Objectives:

1. Motivation to Lebesgue measure theory and the introduction of Lebesgue outer measure
2. To study about Lebesgue measurable sets and their properties.

	Course Outcome
CO 1	To introduce Lebesgue measurable functions and to prove important theorems like Egoroff's theorem and Lusin's theorem
CO 2	To study about the Lebesgue integrable functions and to prove some important convergence theorems
CO 3	To study about absolutely continuous functions and to prove the fundamental theorem of calculus for Lebesgue integral

Unit I: (Sections: 3.1, 3.2, 3.3, 3.6 of [1] and 2.1, 2.2 of [2])

Motivation to Lebesgue Measure Theory – General extension Theory – Algebra of sets – Examples – Finitely/Countably additive set functions – Ulam's Theorem – Continuity from below/above of measures – The Lebesgue outer measure m^* - Examples – Properties.

Unit II: (Sections: 2.3, 2.4, 2.5, 2.6, 2.7 of [2])

Lebesgue measurable sets – Examples – The set of all Lebesgue measurable sets M is an algebra - $m^*$is finitely additive over M – M is a sigma algebra – m^* is a measure on M – Outer and inner approximation of Lebesgue measurable sets by open and closed sets respectively –Continuity of the Lebesgue measure – Example of a nonmeasurable set – The Cantor Lebesgue function.

Unit III: (Sections: 3.1, 3.2, 3.3 of [2])

Lebesgue measurable functions – Examples – Pointwise limit of sequence of measurable functions – Simple functions – The simple approximation Lemma – The simple approximation Theorem – Egoroff's Theorem – Lusin's Theorem.

Unit IV: (Sections: 4.2, 4.3, 4.4, 4.5,5.3 of [2])

The Lebesgue integral of a simple function – The Lebesgue integral of a bounded measurable function over a set of finite measure – Properties – The Bounded Convergence Theorem - The Lebesgue integral of a nonnegative measurable function – Properties – Chebychev's inequality – Fatou's Lemma – Monotony Convergence Theorem – The general Lebesgue integral – The Lebesgue dominated Convergence Theorem – Characterization of Riemann integrable functions – Improper Riemann integrals and their Lebesgue integrals.

Unit V: (Sections: 6.1, 6.2, 6.3(upto6.3.6) of [1])

Review of functions of bounded variation –Absolutely continuous functions – Lebesgue's Theorem on differentiability of monotony functions – The Lebesgue singular function – Fundamental Theorem of Calculus [I and II] for the Lebesgue integral

Text Books:

1. Inder K. Rana, *An Introduction to Measure Theory and Integration ,(2e)*, Narosa (2007)
2. H. L. Roylan, P. M. Fitzpatrick, *Real Analysis –Fourth Edition,* Prentice Hall of India (2013).

Reference books:

1. De Barra.G, *Measure Theory and Integration,* 2e, New Age International Publishers (2013).
2. Howard J.Wilcox, *An Introduction to Lebesgue Integration and Fourier Series*, Dover (1995).
3. Paul R. Halmos, *Measure Theory,* Springer (1976).
4. N.L.Carothers, *Real Analysis,* Cambridge University Press(2000).
5. C.D. Aliprantis and O.Burkinshaw, *Principles of Real Analysis*,3e, Academic Press (Elsevier).

LIST OF MINORS FOR 4th Year (ANNEXURE - I)

Minor: MATH 421: CRYPTOGRAPHY (4 CREDITS)

Course Objectives:

1. To know various kinds of classical cryptography
2. To know about data encryption standards

	Course Outcome
CO 1	To know about public key crypto system
CO 2	To learn various methods of digital signatures
CO 3	To learn about hashing and its applications

Unit I:

Introduction: Overview of course- Classical cryptography [parts of Chapter 1].

Unit II:

Secret Key Encryption: Perfect Secrecy - One time pads [Chapter 2.1], Stream ciphers and the Data Encryption Standard (DES) [Chapter 3 (excluding 3.6)], The Advanced Encryption Standard (AES) - adopted September 2000.

Unit III:

Public Key Encryption: Factoring and the RSA encryption [Chapter 4.1 -4.4], Discrete log- Diffie-Hellman Key Exchange [Chapter 8.4 (only pages 270-273)].

Unit IV:

ElGamal encryption [Chapter 5 (only pages 162-164)] , Digital Signatures [Chapter 6 (excluding 6.5 - 6.6)], One-time signatures- Rabin and ElGamal signatures schemes- Digital Signature Standard (DSS).

Unit V:

Hashing: Motivation and applications- Cryptographically Secure Hashing. [Chapter 7.1-7.3,7.6], Message Authentication Codes (MAC)- HMAC- Network Security - Secure Socket Layer (SSL)- I Psec.,Secret Sharing- Definition. Shamir's threshold scheme [Chapter 11.1], Visual secret sharing schemes.

Text Book

D. R. Stinson,s Cryptography, Theory and Practice, CRC Press, 1995.

Reference Books

1. Richard A. Mollin, An Introduction to Cryptography, Chapman & Hall / CRC, Boca Raton, 2000.

2. Dominic Walsh, Codes and Cryptography, Oxford Science Publications, Clarendon Press, Oxford, 1988.

Minor: **MATH 422: NUMERICAL ANALYSIS (4 CREDITS)**

Course Objectives:

To find the roots using numerical methods.

To apply numerical techniques for solving systems of equations.

	Course Outcome
CO 1	To learn various interpolation techniques.
CO 2	To know numerical integration.
CO 3	Solve initial and boundary value problems in differential equations using numerical methods.

Unit I: Nonlinear Equations in One Variable:

Fixed point iterative method – convergence Criterion -Aitken's $\Delta 2$- process - Sturm sequence method to identify the number of real roots – Newton - Raphson's methods convergence criterion Ramanujan's Method - Bairstow's Method.

Unit II: Linear and Nonlinear System of Equations:

Gauss eliminations with pivotal strategy jacobi and Gauss Seidel Itervative Methods with convergence criterion. LU - decomposition methods – (Crout's, Choleky and DeLittle methods) – consistency and ill conditioned system of equations - Tri-diagonal system of equations – Thomas algorithm. Iterative methods for Nonlinear system of equations, Newton raphson, Quasi newton and Over relaxation methods for Nonlinear system of equations.

Unit III: Interpolation:

Lagrange- Hermite- Cubic-spline's (Natural, Not a Knot and Clamped)- with uniqueness and error term, for polynomial interpolation- Bivariate interpolation- Orthogonal polynomials Grams SchmidthOrthogoralization procedure and least square- Chebyshev and Rational function approximation.

Unit IV: Numerical Integration:

Gaussian quadrature, Gauss-Legendre- Gauss-Chebeshev formulas- Gauss Leguree, Gauss Hermite and Spline intergation – Integration over rectangular and general quadrilateral areas and multiple integration with variable limits.

Unit V: Numerical solution of ordinary differential equations:

Initial value problems- Picard's and Taylor series methods – Euler's Method- Higher order Taylor methods - Modified Euler's method - RungeKutta methods of second and fourth order – Multistep method - The Adams - Moulton method - stability - (Convergence and Truncation error for the above methods). Boundary - Value problems – Second order finite difference and cubic spline methods.

Text books

1. M. K. Jain, S. R. K. Iyengar and R.K. Jain, Numerical methods for scientific and Engineering computation, Wiley Eastern Ltd. 1993, Third Edition.
2. C.F. Gerald and P.O. Wheatley, Applied Numerical Methods, Low- priced edition, Pearson Education Asia 2002, Sixth Edition.
3. M.K. Jain, Numerical solution of differential equations, Wiley Eastern (1979), Second Edition.

Reference books

1. S.C. Chapra and P.C. Raymond, Numerical Methods for Engineers, Tata McGraw Hill, New Delhi,2000
2. S.S. Sastry , Introductory methods of Numerical analysis, Prentice - Hall of India, New Delhi, 1998.
3. Kendall E.Atkinson, An Introduction to Numerical Analysis (2nd Edition), Wiley, 2008.

Minor: MATH 423: NUMBERS THEORY (4 CREDITS)

Course Objectives:

1. To study primes
2. To study solution for congruences

	Course Outcome
CO 1	To understand Quadratic residues
CO 2	To study arithmetic functions
CO 3	To study continued fraction and its convergences

Unit II: Section : 1.1-1.3
Divisibility: Introduction -Divisibility- Primes.

Unit II: Section : 2.1-2.11
Solution of congruences – Congruences of higher degree – prime power moduli.

Unit III: Section :3.1-3.3
Quadratic Residues, Quadratic reciprocity law, Jacobi Symbol.

Unit IV: Section :4.1-4.3
Arithmetic functions-Recurrence functions, Mobious Inversion Formula, Irrational numbers, Irrationality of nth root of N, e and pi.

Unit V: Section : 5.6-5.11
Continued fractions and its convergence, representation of an irrational number by an infinite continued fraction. Some special quadratic surds.

Text Book

Treatment as in I. Niven, H.S. Zuckerman and H.L. Montgomery – An Introduction to the Theory of Numbers, New York, John Wiley and Sons, Inc., 2004, 5th Ed.

Books for Reference:

1. **T.M. Apostol** – Introduction to Analytic Number Theory, Narosa Publishing House, New Delhi.
2. **G.H. Hardy and E.M. Wright-** An Introduction to the Theory of Numbers, Oxford University Press, 1979, 5th Ed.

Minor: MATH 424: CALCULUS OF VARIATIONS (4 CREDITS)

Course Objectives:

1. To learn about functionals and solving related variational problems by Euler's equation
2. To understand and solve the variational problems functionals depending on higher order derivatives

	Course Outcome
CO 1	To study about the general variational of a functional and the Weierstrass Erdmann conditions
CO 2	To study and understand about canonical form of Euler equations and other transformations, Noether's Theorem and conservation laws
CO 3	To learn about second variation and Legendre conditions of a functional

Unit I:

Functionals- some simple variational problems-The variation of a functional- A necessary condition for an extremum-The simplest variational problem-Euler's equation-The case of several variables-A simple variable end point problem-The variational derivative-Invariance of Euler's equation.*[Chapter-1]*

Unit II:

The fixed end point problem for n-unknown functions - Variational problem in parametric form- Functionals depending on higher order derivatives-Variational problems with subsidiary conditions. *[Chapter-2]*

Unit III:

The general variational of a functional- derivation of the basic formula- End points lying on two given curves or surfaces- Broken extremals- The Weierstrass Erdmann conditions. *[Chapter-3]*

Unit IV:

The canonical form of Euler equations- First integrals of the Euler equations- The Legendre transformation- Canonical transformations- Noether's Theorem- The principle of least action- Conservation laws- The Hamilton Jacobi equation-Jacobi theorem.*[Chapter-4]*

Unit V:

The second variation of a functional- The formula for the second variation, Legendre conditions- Sufficient conditions for a weak extremum. *[Chapter-5]*

Text Book:

I.M. Gelfand and S.V.Fomin, *Calculus of Variations*, Dover Publications, 2000.

Reference Books:

1. A.S. Gupta, *Calculus of Variations with Applications*, Prentice-Hall of India, 2008.
2. M.L. Krasnov, G.I. Makarenko and A.I. Kiselev, *Problems and Exercises in the Calculus of Variations*, Mir Publishers, Moscow 1975.

Minor: MATH- 425- GALOIS THEORY (4 credits)

Objectives:
To study Polynomial rings, Field theory, Splitting fields and Algebraic closures, Galois Theory and Composite extension and simple extensions.

	Course Outcome
CO 1	To study about the various extension fields and splitting field
CO 2	To study and understand about Solvable by radicals
CO 3	To learn about finite and cyclotomic fields and Wedderburn Theorem

Unit I: Field theory: Basic theory of field extensions-Algebraic Extensions.

Unit II: Splitting fields and Algebraic closures - Separable and inseparable extensions - Cyclotomic polynomials and extensions.

Unit III: Galois Theory: Basic definitions- The fundamental theorem of Galois Theory - Solvable by radicals.

Unit IV: - Galois groups over the rationales. Finite Fields- Wedderburn's theorem(First proof only)

Unit V: Classical straightedge and compass constructions, Cyclotomic extensions and Abelian extensions, Galois group of polynomials.

Text Book:
1. Abstract Algebra (Second Edition) by David S. Dummit and Richard M. Foote, Wiley Student Edition (1999) for Units I to III, (Chapter 13), (Sections 14.1 to 14.3 and 14.5-14.6).

2. Topics in Algebra by I.N. Herstin (Section 5.6 - 5.8), and (Section 7.1 -7.2).

Reference books
1. M. Artin: Algebra, Prentice-Hall of India, 1991.
2. N.Jacobson: Basic Algebra, Volumes I & II, W.H.Freeman, 1980.
3. S.Lang: Algebra, 3rd edition, Addison-Wesley, 1993.

Minor: MATH 426: LATTICE THEORY (4 CREDITS)

Course Objectives:

1. To explain the basic theory of partially ordered sets
2. To elaborate on basics of well-ordered sets

	Course Outcome
CO 1	To apply key properties of Lattices
CO 2	To categorize the important types of lattices
CO 3	To discuss the Boolean algebras with their applications

Unit I: Partially Ordered Sets: (Chapter: 1**)**
Basic Definitions – Duality – Monotone Maps – Down-Sets and the Down Map – Height and Graded Posets – Chain Conditions – Chain Conditions and Finiteness – Dilworth's Theorem – Symmetric and Transitive Closures – The Poset of Partial Orders.

Unit II: Well- Ordered Sets: (Chapter: 2**)**
Well-Ordered Sets – Ordinal Numbers – Transfinite Induction – Cardinal Numbers – Ordinal and Cardinal Arithmetic – Complete Posets.

Unit III: Lattices: (Chapter: 3**)**
Closure and Inheritance – Semilattices – Arbitrary Meets Equivalent to Arbitrary Joins – Lattices – Meet-Structures and Closure Operators – Properties of Lattices – Irreducible Elements – Completeness – Sublattices – Denseness – Lattice Homomorphisms – Ideals and Filters – Prime and Maximal Ideals.

Unit IV: Modular and Distributive Lattices: (Chapter: 4**)**
Quadrilaterals – The definitions and Examples – Characterizations – Modularity and Semi modularity – Partition Lattices and Representations – Distributive Lattices.

Unit V:Boolean Algebras: **(**Chapter: 5**)**
Boolean Lattices – Boolean Algebras – Boolean Rings – Boolean Homomorphisms – Characterizing Boolean Lattices – Complete and Infinite Distributivity

Text Book:-

1. Steven Roman, Lattices and Ordered Sets, Springer Science, 2008.

   Chapters: 1,2,3,4,and 5.

Reference Books:-

1. Garrett Birkhoff, Lattice Theory, American Mathematical Society, Colloquim Publications, 1948.

Semester-IX

MAJOR-21 HARD CORE: MATH 521 - FUNCTIONAL ANALYSIS
(4 Credits)

Objectives:

To study Normed Linear Spaces, Continuity, Equivalent norms, Hahn-Banach theorem for real vector spaces, Closed and open maps, Separable Hilbert spaces, Orthogonal projections

	Course Outcome	**Level**
CO 1	explain the concepts of normed linear space (NLS), continuity of alinear map, Lp-space, Banach, Hilbert spaces, four pillars	Remember & Understand
CO 2	demonstrate the convergence in the different types of spaces	Apply
CO 3	analyze the properties of different types NLS	Analyze
CO 4	determine the linear functional in terms orthonormal basis	Evaluate
CO 5	Obtain the open mapping theorem from closed graph theorem and vice-versa	Create

Unit-I Sections: 1.2.3, 1.2.5, 2.1, 2.1.1, 2.1.2, 2.1.4

Review of linear spaces – Linear functionals – hyperspaces – projections – Cauchy Schwarz inequality – Holder's inequality –Minkowski inequality – Normed linear spaces – Definition and examples – Basic properties – Semi norms and quotient spaces – product spaces and the graph norm.

Unit-II Sections:3.1, 3.1.1, 3.2, 3.2.1, 3.4.1, 2.2, 2.2.1, 2.2.2, 2.2.3, 2.4

Bounded linear Maps – Properties – Norm of a bounded linear Map – Banach spaces – Completeness of $l_p(1 \leq p \leq \infty), L_p[a,b], C[a,b], BV[a,b]$ – Completeness of the space of all bounded linear Maps – The completeness of the quotient space – The completion of a normed linearspace – Completeness and absolutely convergent series – Finite dimensional normed linear spaces – Riesz Lemma.

Unit-III Sections: 5.1, 5.2, 5.3, 5.4, 3.4, 6.1

The Hahn – Banach Extension Theorem anditscorollaries – The Hahn Banach Separation Theorem – Convergence of sequence of operators – The uniform Boundedness principle – The Banach Steinhauss Theorem – Weakly bounded sets – Schauder basis and separability.

Unit-IV Sections: 7.1, 7.2, 7.3, 8.1, 8.1.2

The closed graph Theorem – The bounded inverse theorem – The open mapping Theorem – The dual of $l_p(1 \leq p < \infty)$, the dual of $(C_{00}, ||.||_p)$ when $(1 \leq p < \infty)$ - The dual of $(C, \|.\|_\infty)$.

Unit-V Sections: 2.1.5, 4.1, 4.2, 4.3, 4.4, 2.5, 2.6, 3.3

Inner product spaces – Orthonormal sets –Gram Schmidt Orthogonalization process – Bessel's inequality – Hilbert spaces - Parseval's Theorem – Example of a nonseparable Hilbert space – Best approximation Theorems – Projection Theorem – Riesz Fischer Theorem – The Riesz representation Theorem.

Text Book:

1. M.Thamban Nair, *Functional Analysis: A First Course*, Prentice Hall of India, 2002.

Reference Books:

1. Joseph Muscat, *Functional Analysis*, Springer(2008).
2. BalmohanV.Limaye, *Functional Analysis*, New Age International Publishers (2014).
3. Erwin Kreyszig, *Introductory Functional Analysis with Applications*, John Wiley(2007).
4. Martin Schecter, *Principle of Functional Analysis*, American Mathematical Society (2009)
5. BelaBollobas, *Linear Analysis:An Introductory Course*,2e, Cambridge Univ. Press (1999).
6. Bryan P. Rynne and Martin.AYoungson, *Linear Functional Analysis*, Springer (2008).

MAJOR-22 MATH 522: PARTIAL DIFFERENTIAL EQUATIONS
(4 Credits)

Objectives:
To study first order PDEs, Non-linear first order PDEs, Classification of second order PDEs, Wave Equations**,** Laplace equations, Heat Equations.

	Course Outcome	Level
CO 1	understand the relation between the theory and modelling in the problems arising in various fields, such as, economics, finance, applied sciences and etc	Remember Understand
CO 2	Enhance their mathematical understanding in representing solutions of partial differential equations.	Apply
CO 3	classify the partial differential equations and transform into canonical form	Analyze
CO 4	determine the solution representation for the three important classes of PDEs, such as Laplace, Heat and wave equation by various methods.	Evaluate
CO 5	Formulate fundamentals of partial differential equations, like Green's function, maximum principles, Cauchy problem, to take a research career in the area of partial differential equations	Create

Unit – I: First Order PDEs

Surfaces and their Normals, Curves and tangents - Genesis of first order PDE- Classification of Integrals- Linear equations of first Order - Integral surface passing through a curve – Cauchy problem for first order PDE – Orthogonal Surfaces.

Non-linear first order PDEs : Compatible systems- Solutions of Quasi linear equations

Charpit's method- Special Types of Charpits Method, -Integral surfaces through a given curve-The Cauchy problem for Quasi Linear case and nonlinear first order PDEs.

Unit – II: Second Order PDEs

Genesis of Second order PDEs- Classification of second order PDEs- Canonical forms of Hyperbolic- Elliptic and parabolic type PDEs, Linear PDE with constant coefficients – Method of finding CF and particular integral- Homogeneous linear PDE

Unit – III **Hyperbolic PDEs / Wave Equation**

Derivation of One –dimensional wave equations- Initial Value Problem – D'Alembert Solution, Method of separation of variables, Forced Vibration, Solution of non-homogeneous equation Uniqueness of solution of wave equation.

Unit – IV: Elliptic PDEs/Laplace Equations

Derivation of Laplace equations & poisson equation- Boundary value problems- Properties of Harmonic functions- Spherical Mean, Mean value theorem- Maximum and minimum principles- Separation of variables- Dirichlet problem and Neumann problems for a rectangle and circle (Upto 2.10 in Text Book 1). Application - Irrotational Flow of an Incompressible Fluid (Section 2.13)

Unit – V: Heat Equations

Diffusion Equation, Boundary Conditions - Elementary solution- Solution by separation of variables- Classification in n-variables- Families of equipotential surfaces

Text Books

1. K. Shankara Rao, Introduction to Partial Differential Equations, PHI Publications, 3rd Edition. 2011.
2. T. Amarnath, An Elementary Course in Partial Differential Equations, Narosa Publishing House, 2010.

Reference Books

1. I. N. Sneddon, Elements of Partial DifferentiaI Equations, McGraw Hill, International Edition, 1986.
2. F. John, Partial Differential Equations, Springer Verlag, 1975.
3. Lawrence C. Evans, Partial Differential Equations, Graduate Studies in Mathematics, 1998.

LIST OF MINORS FOR 5th Year (ANNEXURE - II)

Minor:12-19 MATH 531: DIFFERENTIAL GEOMETRY (4 CREDITS)

Course Objectives:

1. To learn about parametric curves, level curves and the notion of curvation of plane curves
2. To study about the properties of space curves, Serret Frenet equations and the four vertex theorem

	Course Outcome
CO 1	To study about surfaces, quadratic surfaces, triple orthogonal systems
CO 2	To calculate the length of curves on surfaces and surface area
CO 3	To study about the normal and principle curvature of curves on a surface and Euler's theorem

Unit I: [Sections: 1.1 to 1.4 and Sections 2.1,2. 2.]

Curves- arc length- Reparametrization-Level curves - Curvature - Plane curves.

Unit II: [Sections 2.3 and Sections 3.1 to 3.3.]

Space curves-Torsion- Serret Frenet equations- Simple closed curves- The Isoperimetric Inequality- The Four vertex Theorem.

Unit III: [Sections 4.1 to 4.7]

Smooth surface- Tangents, normal and orient ability- Examples of surfaces- Quadratic surfaces- Triple orthogonal systems- Applications of Inverse function theorem

Unit IV: [Sections: 5.1 to 5.5]

Lengths of curves on surfacesa- First fundamental form- Isometries of surfaces- Conformal mapping of surfaces- Surface area- Equiareal maps and a theorem of Archimedes.

Unit V: [Sections: 6.1 to 6.4]

The Second Fundamental form- The Curvature of curves on a surface- The normal and principal curvature- Euler's theorem- The geometric interpretation of principal curvatures.

Text Book:

1. Andrew Pressley, *Elementary Differential Geometry*, Springer, 2004.

Reference Books:

1. Christian Bar, *Elementary Differential Geometry*, Cambridge University Press, 2011.
2. Thomas F. Banchoff and Stephen T. Lovett, *Differential Geometry of Curves and Surfaces*, A.K Peters/CRC press, 2010.
3. W. Klingenberg, *A course in Differential Geometry*, Springer-Verlag, New York, 1978.

Minor:12-19 MATH 532: NUMERICAL ANALYSIS FOR ORDINARY DIFFERENTIAL EQUATIONS (4 Credits)

Objectives:
To study various numerical methods to solve ordinary differential equations such as Euler's method, Gaussion quadrature and Error Control.

Unit-I
Euler's method - Trapezoidal rule - Theta method.

Unit-II
Adams - Bashforth method - Order and convergence - Backward differentiation formula.

Unit-III
Gaussion quadrature - Explicit Runge - Kutta scheme - Implicit Runge Kutta scheme - Collocation.

Unit-IV
Stiff equations - Linear stability domain and A- Stability -- A-stability of RK and multistep methods.

Unit-V
Error Control - Milne Device - Embedded Runge Kutta method.

Text Book

1. Arieh Iserles, A First Course in the Numerical Analysis of Differential Equations, Cambridge University press, 2nd edition, 2008.

Reference Books:

1. Richard L. Burden and J.Douglas faires, Numerical Analysis(9th Edition), Cengage Learning India, 2012.

Minor:12-19 MATH 533: q-SERIES IN NUMBER THEORY
(4 CREDITS)

Course Objectives:

1. To understand basic hypergeometric series
2. To study unilateral series

	Course Outcome
CO 1	To study bilateral series
CO 2	To study theta function identities
CO 3	To study classical theta functions

Unit I

Introduction to Basic hyper Geometric series- Bionomial theorem- q- bionomial theorem Heine's Trasformation formula- Jackson transformation formula

Unit II

Jacobi's triple product identity and its applications and Quintuple product identity and Gaussian polynomials.

Unit III

Bilateral Series- Ramanujan I Ψ 1summation and related identities- Ramanujan theta function identities involving Lambert series.

Unit IV

q- series and theta functions Entries 18 to 30 Chapter 16 of Ramnujan's notebook.

Unit V

Classical theta functions to hypergeometric series and its applications.

Text Book

1. Gasper and Rahman, Basic hyper geometric series, Cambridge University press 1990.(Unit I-III)
2. BC Berndt Ramanujans notebooks Part II Springer Verlag New York 1991.(Unit IV-V)

Minor: 12-19 MATH 534: INTEGRAL TRANSFORMS AND THEIR APPLICATIONS (4 CREDITS)

Course Objectives:

1 To learn and understand Laplace and Hankel transforms with properties and Applications.
2 To learn and understand Mellin and Z transform with properties and Applications

	Course Outcome
CO 1	To study about Laplace transform and Inverse Laplace transform
CO 2	To study about Applications of Laplace transform
CO 3	To study Hankel transform with properties and to solve the PDE
CO 4	To study Mellin transform with properties and to solve the summation series
CO 5	To study and understand about Z- transform with properties and to apply for solving the difference equations

Unit I: Laplace Transforms (Sections-3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8)
Laplace transforms - Definition and Examples, Basic Properties of Laplace Transforms, The Convolution Theorem and Properties of Convolution, Differentiation, and Integration of Laplace Transforms. The Inverse Laplace Transform and Examples, Tauberian Theorems and Watson's Lemma.

Unit II: Applications of Laplace Transforms (Sections-4.1, 4.2, 4.3)
Applications of Laplace Transforms to the Solutions of Ordinary Differential Equations, Partial Differential Equations, Initial and Boundary Value Problems.

Unit III: Hankel Transforms (Sections-7.1, 7.2, 7.3, 7.4)
Introduction, The Hankel Transform and Examples, Operational Properties of the Hankel Transform, Applications of Hankel Transforms to Partial Differential Equations.

Unit IV: Mellin Transforms (Sections- 8.1, 8.2, 8.3, 8.4, 8.6)
Introduction, Definition of the Mellin Transform and Examples, Basic Operational Properties of Mellin Transforms, Applications of Mellin Transforms, Application of Mellin Transforms to Summation of Series.

Unit V: Z Transforms (Sections-12.1, 12.2, 12.3, 12.4, 12.5, 12.6)
Introduction, Dynamic Linear Systems and Impulse Response, Definition of the Z Transform and Examples, Basic Operational Properties of Z Transforms, The Inverse Z Transform and Examples, Applications of Z Transforms to Finite Difference Equations.

Text Book

1. Lokenath Debnath and Dambaru Bhatta, Integral Transforms and Their Applications, Third Edition, CRC Press, Taylor and Francis Group, A Chapman and Hall Book, 2015.

Reference Books:

1. Ian N. Snedden, The Use of Integral Transforms, McGraw Hill, 1972
2. B. Davies, Integral Transforms and Their Applications, Springer, Texts in Applied Mathematics 41, Third Edition,2009.
3. Alexander D. Poularikas, Transforms and Applications Handbook, Third Edition, CRC Press, Taylor and Francis Group, 2010.

Minor:12-19 MATH-535 Wavelet Theory and Applications

(4 Credits)

Course Objectives:

1. To introduce the idea of Fourier series, Fourier transform and Wavelet theory.
2. To study the notion of MRA and some applications in real life applications

	Course Outcome
CO 1	Understand the concept of orthogonal and orthonormal bases in function spaces
CO 2	Learn Fourier transform and wavelet transform.
CO 3	Learn applications of wavelets to the real-world problems

Unit-I: Fourier Series and Fourier Transforms

Fourier cosine and sine series, Fourier series, Differentiation and integration of Fourier series, Absolute and uniform convergence of Fourier series, The complex form of Fourier series. Fourier and inverse Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier sine and cosine transforms, Linearity property, Change of scale property, Shifting property, Modulation theorem, Convolution. [Ruch & Patrick: 2.1,2.2, 2.3, 2.4]

Unit–II: Fourier Transforms and Wavelets

Discrete Fourier transform of a digital signal, Inverse discrete Fourier transform, Window Fourier transform, Short time Fourier transform, Admissibility condition for a wavelet, Wavelet series, Classes of wavelets: Haar, Morlet, Maxican hat, Meyer and Daubechies wavelets; Wavelets with compact support. [Chui: 3.1, 3.2, 3.3, 3.4, 3.6]

Unit-III: Haar Scaling Function and Wavelet, Time-Frequency Analysis

Orthogonal functions, Orthonormal functions, Function spaces, Orthogonal basis functions, Haar scaling function, Haar spaces: Haar space V_0, general Haar space V_j; Haar wavelet, Haar wavelet spaces: Haar wavelet space W_0, general Haar wavelet space W_j; Decomposition and reconstruction, Time-frequency analysis, Orthogonal and orthonormal bases. [Ruch & Patrick: 3.1,3.2, 3.3, 3.4, 3.5]

Unit–IV: Discrete Wavelet Transforms

Stationary and non-stationary signals, Haar transform, 1-level Haar transform, Multi-level Haar transform, Conservation and compaction of energy, Multiresolution analysis, Decomposition and reconstruction of signals using discrete wavelet transform (DWT). [Primer: Ch2: 2.1, 2.2, 2.3, 2.4

Unit–V: Applications

Multiresolution analysis, Applications in signal compression, Analysis and classification of signals using DWT, Signal de-noising: Image and ECG signals. [Ruch & Patrick: 5.1, 4.1, 4.2, 4.6, 4.8, 4.9]

Text Books:

1. Charles K. Chui (1992). *An Introduction to Wavelets*. Academic Press.
2. David K. Ruch & Patrick J. Van Fleet (2009), *Wavelet Theory***:** *An Elementary Approach with Applications*. John Wiley & Sons.
3. James S. Walker (2008). *A Primer on Wavelets and Their Scientific Applications* (2nd edition). Chapman & Hall/CRC, Taylor & Francis.

References:

1. Ingrid Daubechies (1999). *Ten Lectures on Wavelets*. SIAM
2. Michael W. Frazier (1999). *An Introduction to Wavelets Through Linear Algebra*. Springer-Verlag.
3. Stéphane Mallat (2008). *A Wavelet Tour of Signal Processing* (3rd edition). Academic Press.

David F. Walnut (2008), An Introduction to Wavelet Analysis, Springer, 2008.

Minor:12-19 MATH-536 GRAPHS AND ALGEBRAS

(4 Credits)

Unit-I: **Algebraic structures from graphs**: Isomorphism of graphs – Isomorphism as a relation – Automorphism of graphs – Graphs and Groups –The spectrum of a graph – Characteristic polynomial – Adjacency Algebra.

Unit-II: **Graphs defined on groups:** Cayley Graph – Circulant graph – Power graph – Commuting graph, commuting graph – Non-generating graph – Nilpotence graph – Solvability graph – Engel graph – Aut(G)-invariant graph.

Unit-III: **Graphs defined on rings**: Zero-divisor Graph of a ring-Introduction – Basic Properties of zero-divisor Graphs – Total graph of a ring- Introduction – Basic properties of total graphs.

Unit-IV: **Properties of Graphs defined on rings**: Girth of zero-divisor graph of a commutative ring – Diameter of zero-divisor graph of a commutative ring – Girth of total Graph of a commutative ring – Diameter of total graph of a commutative ring.

Unit-V: **More graphs on rings**: Cayley graphs – Co-maximal graphs – Unit graphs – Cozero-divisor graphs – Jacobson graphs – Intersection graphs – Annihilator graphs.

Text Book:-

1. Gary Chartrand, Ping Zhang, Introduction to Graph Theory, Tata McGraw-Hill, 2006. (Unit-I)
2. Norman Biggs, Algbraic Graph Theory, Second Edition, Cambridge University Press, 1993. (Unit-I)
3. Peter J. Cameron, Graphs defined on groups, International Journal of Group Theory, 11(2), 2022, 53-107. (Unit-II)
4. David F. Anderson, T. Asir, Ayman Badawi, T. Tamizh Chelvam, Graphs from rings, Springer Switzerland, 2021. (Unit-III,IV,V)

Reference Books:-

1. Chris Godsil and Gordon Royle, Algebraic Graph Theory, Springer 2009.
2. R. Balakrishnan and K. Ranganathan, A Textbook of Graph Theory (Universitext), Second Edition, Springer New York, 2012.

Minor: 12-19 MATH-537: Probability and Statistics (4 Credits)

Objectives:

To study the basics of Probability density function, Special distributions, Distributions of functions of random variables, Sampling theory and Statistical inference.

Unit I: The probability set function – Random variables – Probability density function – Distribution function – Mathematical expectation – Special mathematical expectations – Chebyshev's Inequality – Conditional probability – Marginal and conditional distributions – Stochastic independence. *[Chapters 1 and 2 (except 1.1and 1.2) of the text book]*

Unit II: Some special distributions: The Binomial and related distributions – The Poisson distribution – The Gamma and Chi-Square Distributions – The Normal distribution- The Bivariate normal distribution. *[Chapter -3 of the text book]*

Unit III: Distributions of functions of random variables - Sampling theory – Transformations of variables of the discrete type – Transformations of variables of the continuous type – The b, t and F distributions- Distributions of order statistics- The moment generating function technique. *[Chapter 4 [sections 4.1 to 4.7] of the text book.]*

Unit IV: The distributions of $\bar{X}$ and nS^2/σ^2 - Expectations of functions of random variables – Limiting distributions: Limiting moment generating functions – The Central limit theorem. *[Chapter-4 [sections 4.8 and 4.9] and Chapter-5 of the text book.]*

Unit V: Introduction to statistical inference: Point Estimation – Confidence intervals for means – Confidence intervals for differences of means - Confidence intervals for variances. *[Chapter-6 of the text book]*

Text Book:

Robert V. Hogg and Allen T. Craig , *Introduction to Mathematical Statistics* (Fifth Edition) Pearson Education, 2005.

Reference Books:

1. Paul L.Meyar, *Introductory to Probability and Statistical Applications*, Oxford&IBH Publishers Co. Pvt .Ltd, 1969.
2. Arnold Naiman, Gene Zirkel and Robert Rosenfield, *Understanding Statistics*, McGraw- Hill, 1986.
3. William Feller, *An Introduction to Probability Theory and its Applications, Vol.I*, John Wiley, Third Edition, 2008.
4. A.Mood, F.Graybill, and D.Boes, *Introduction to the Theory of Statistics*, Tata McGraw Hill (Third Edition) 2008.

Minor:12-19 MATH 538: ALGEBRAIC NUMBER THEORY (4 CREDITS)

Course Objectives:

1. To study about the application of unique factorization in integers
2. To find the primes of Gaussian integers

	Course Outcome
CO 1	Construction of transcendental numbers using Liouville's theorem
CO 2	To study about the integral basis and discriminant of algebraic number fields
CO 3	To study about Dedekind domains.

Unit I: Elementary Number Theory (Sections 1.1 and 1.2)

Integers – Greatest common divisor – Infinitude of primes – Unique factorization in Z – Fermat's little theorem – Euler's Φ function and Euler's theorem – Multiplicative property of Φ function – Applications of unique factorization – The equation $x^2 + y^2 = z^2$ – The equation $x^4 + y^4 = z^2$ – The equation $x^4 – y^4 = z^2$ – Fermat numbers and their properties.

Unit II: Euclidean Rings(Sections 2.1, 2.2 and 2.3)

Preliminaries: Units, Associates, Irreducible elements, Norm map, Unique factorization domain, Principal ideal domain, Euclidean domain – Gauss' lemma – Gaussian integers – Units and primes in the ring of Gaussian integers – Eisenstein integers – Units in the ring of Eisenstein integers – Factorization of 3 – Order of $Z[\rho] / (\lambda)$.

Unit III: Algebraic Numbers and Integers (Sections 3.1, 3.2 and 3.3)

Basic concepts – Algebraic number – Algebraic integer – Minimal polynomial Count ability of algebraic numbers – Liouville's theorem for R – Algebraic number fields – Theorem of the primitive element –Liouville's theorem for C – Characterization of algebraic integers.

Unit IV: Integral Bases (Sections 4.1, 4.2 and 4.3)

The norm and the trace – Integral basis for an algebraic number field – Algebraic integers of $Q(\sqrt{-5})$ – Existence of an integral basis – Discriminant of an algebraic number field – Index – Determination of an integral basis for the ring of integers of a quadratic number field.

Unit V: Dedekind Domains (Sections 5.1 and 5.2)

Integral closure – Integrally closed ring – Noetherian ring – Dedekind domain – Characterizing Dedekind domains.

Text Book

J. E. Smonde and M. RamMurty, Problems in Algebraic Number Theory,
Graduate Texts in Mathematics, Volume 190, Springer Verlag, New York,1999.

Reference Books:

1. Pierre Samuel and Allan J Silberger, Algebraic Theory of Numbers, Dover Pub. Inc, 2008.

Minor:12-19 MATH 539: ADVANCED TOPICS IN TOPOLOGY AND ANALYSIS
(4 CREDITS)

Course Objectives:

1. To study metrization theorem.
2. To study about the dual of $L^p[a,b]$.

	Course Outcome
CO 1	To learn the quotient topology and path connectedness
CO 2	To learn Urysohn Metrization theorem and compactification
CO 3	To learn about the completeness of $L^p[a,b]$

Unit I: (Sections 22,25, relevant parts from section 24 of [1])

Quotient topology and quotient maps - Examples of quotient spaces - Path connectedness - Standard results - Example of a connected but not path connected space- Locally connected spaces.

Unit-II: (Sections29, 34,38, 43,44 of [1])

The Uryshon's metrization theorem – Locally compact spaces-One point compactification - Stone- Cech compactification – The uniform metrric on Y^J and the Space filling curve.

Unit-III: (Sections 39, 40,41 of [1])

Local finiteness- Countably locally finite refinement of open coverings of metric spaces – Paracompactness - Standard results - Metric spaces are paracompact.

Unit-IV: (Chapter:7 of [2])

L^p- spaces – Completeness - Dual of $L^p[a,b]$for $1 \leq p < \infty$.

Unit-V: (Sections 8.1, 8.2 and 8.3 from Chapter:8 of [2])

Weak sequential convergence of $L^p[a,b]$ – the Riemann Lebesgue lemma – the Radon Riesz theorem - weak sequential compactness of $L^p[a,b]$.

Text Books:

1. James R. Munkres, Topology by James R. Munkres, Pearson, 2nd edition, 2000.
2. H.L.Royden, and P.M. Fitzpatrick, Real Analysis, (Fourth Edition) PHI Learning Private Limited, 2013.

Reference Books:

1. James Dugundji, General Topology, Allyn and Bacon, Inc.(1966).
2. Inder K. Rana, *An Introduction to Measure Theory and Integration, (2e)*, Narosa (2007).
3. B.V. Limaye, Functional Analysis, Wiley Eastern, New Delhi, 1981.

Minor:12-19 MATH 540: ADVANCED TOPOLOGY

(4 CREDITS)

Course Objectives:

1. To study about the notions of local connectedness, local compactness and one point compactification
2. We study about nets, filters and quotient topology

	Course Outcome
CO 1	We study about Stone -Cech Compactification and some Metrization theorems
CO 2	To learn about space filling curve and the imbedding theorem for compact metrizable spaces
CO 3	To study about fundamental groups and covering spaces

Unit I: (Sections- 25 and 29 of [1])

Connected components- Local connectedness - Locally path connected spaces- Local compactness, One point Compactification, Uryshon Metrization Theorem.

Unit II:(Chapter-10 of [2] and Sections- 22 and 36 of [1])

Nets and Filters- Quotient topology- Introduction to topological groups.

Unit III:(Sections-38, 39, 40, 41 and 42 of [1])

The Stone -Cech Compactification- Locally finite spaces- Nagata- Smirnov Metrization theorem- Paracompactness- Smirnov Metrization theorem.

Unit IV: (Sections-44 48 and 49 of [1])

The Peano space-filling curve – Barie Spaces – Nowhere differentiable functions.

Unit V: (Sections 48, 49, of [1])

Homotopy of paths- The fundamental group- Covering spaces- The fundamental group of the circle.

Text Books:

1. James R. Munkres, Topology, Second edition, Pearson Education Inc.,(2002).
2. K.D.Joshi, Introduction to General Topology, First edition (revised), New Age International Publishers, 2004.

Reference Books:

1. Stephen Willard, General Topology, Dover, 2004.

Minor:12-19 MATH 541: COMMUTATIVE ALGEBRA (4 Credits)

Objectives:
To study the basics of Prime ideals, Operation on sub-modules, Tensor product and Noetherian rings.

Unit-I
Prime ideals- Maximal ideas- Nil radical- Jacobson radical- Operation on ideals- Extension and contraction.

Unit-II
Operation on sub-modules- Direct sum and product- Finitely generated modules- Exact sequences- Tensor product- Restriction and extension of Scalars.

Unit-III
Rings and Modules of Faction and Primary decomposition Local properties extended and contracted Primary decomposition.

Unit-IV
Integral dependence and chain conditions.

Unit -V
Noetherian rings and Artinian rings

Text Book
M. K. Atiyah and I. G. Macdonald, Introduction to Commutative Algebra, Addison-Weseley, 1994.

Reference Books

1. H. Matsumura, Commutative Ring Theory, Cambridge University Press,1989.
2. I. Kaplansky, Commuatavie Rings, University of London press,1966.
3. O. Zariski and P. Samuel, Commutative Algebra, Springer 1976.

Minor:12-19 MATH-542 DISCRETE DYNAMICAL SYSTEMS (4 Credits)

Objectives:
To study the basics of Orbits, Symbolic dynamics, Topological Conjugacy and The dynamics of Complex functions.

Unit-I
Orbits - Phase portraits- Periodic points and stable sets. Sarkovskii's theorem

Unit-II
Attracting and repelling periodic points- Differentiability and its implications – Parametrized family of functions and bifurcations- The logistic map.

Unit-III
Symbolic dynamics - Devaney's definition of Chaos - Topological Conjugacy.

Unit-IV
Newton's method-Numerical solutions of differential equations.

Unit-V
The dynamics of Complex functions- The quadratic family and the Mandelbrot set.

Text Book
Richard A. Holmgren, A First Course in Discrete Dynamical Systems, Springer Verlag (1994).

Unit-I [Chapters: 1, 2, 4 and 5], Unit-II [Chapters: 6, 7 and 8], Unit-III [Chapters: 9, 10 and 11], Unit-IV [Chapters: 12 and 13], Unit-V [Chapters 14 and 15].

Reference Books:

1. Robert L.Devaney, A First Course in Chaotic Dynamical Systems, Addison-Wesley Publishing Company, Inc. 1992.

Minor: 12-19 MATH-543 ADVANCED SEPCIAL FUNCTIONS

(4 Credits)

Course Objectives:

1. To learn and understand about generalized hypergeometric function and their properties
2. To learn and understand about Laguree and Hermite polynomials including properties

1.

	Course Outcome
CO 1	To study and discuss about GHF and various properties and summation formulas
CO 2	To study about Laguree Polynomials and Hermite Polynomials their properties
CO 3	To study about Appell hypergoemetric function of two variables with properties

Unit I: (Chapter 4)

Basics and Introduction to Gauss's hypergeometric and Confluent hypergeometric functions, integral representations, differentiation formulas, transformation formulas, contiguous function relations, summations formulas. **(12 hours)**

Unit- II (Chapter 5)

Generalized Hypergeometric Functions: The function pFq, The contiguous function relations, A simple integral, The pFq with unit argument, Saalschutz' theorem, Whipple's, Dixon's, **(12 hours)**

Unit- III (Chapter 11)

Hermite Polynomials- Definition, recurrence relation, Rodrigues formula, orthogonality property, generating relations and general properties. **(12 hours)**

Unit IV (Chapter 12)

Laguree Polynomials-. Definition, recurrence relation, Rodrigues formula, orthogonality property, generating relations and general properties **(12 hours)**

Unit V: (Chapter 9 of Ref 2)

Appell's hypergoemtric function of two variables, Transformation formulas, integral representation of Euler and Laplace type **(12 hours)**

Text Books :

1. E. D. Rainville, Special functions, Macmillan, New York, 1960. (Chapter 5)
2. W.N. Bailey, Generalized Hypergeometric Series, Cambridge University Press, Cambridge, (1935)

Reference Books:

1. W.N. Bailey, Generalized Hypergeometric Series, Cambridge University Press, Cambridge, (1935)
2..L.J. Sater, Generalized Hypergeometric function, Cambridge University Press, London and New York, 1966

Minor: 12-19 MATH-544 ADVANCED FUNCTIONAL ANALYSIS

(4 CREDIT)

Objectives:

To study the basics of Canonical isometry, Compact operators, Eigen values and the eigen spectrum of a linear operator, The adjoint of an operator and Spectral results for Hilbert's space operators.

Unit-I

Duals of $\mathcal{C}[a,b]$ and $L_p[a,b]$– Separability – The Canonical isometry – The transpose of a bounded linear Map – Reflexivity – Weak convergence – Schur's Lemma – EberleinShmulyan Theorem – Best approximation in reflexive spaces.

Unit-II

Compact operators – Examples – Properties – The completeness of the space of compact operators – Compactness of the transpose.

Unit-III

Eigen values and the eigen spectrum of a linear operator – examples – spectrum and resolvent set – Spectral radius – Spectral Mapping Theorem – Resolvent Identity – The specrtral radius formula – The RieszSchauder Theory.

Unit-IV

The adjoint of an operator – Existence – Compactness of the adjoint operator – Sesquilinearfunctionals – Closed range Theorem.

Unit-V

Self-adjoint, normal, unitary operators – Numerical range and numerical radius – Spectral results for Hilbert's space operators – Properties of the Spectrum.

Text Book:

1. M.Thamban Nair, *Functional Analysis: A First Course*, Prentice Hall of India, 2002.

Unit-I Sections: 8.1.3, 8.1.4, 8.2.1, 8.2.2,8.2.3
Unit-II Sections: 9.1, 9.2, 9.3
Unit-III Sections: 10.1, 10.2, 10.2.1, 10.2.2, 10.2.3, 10.4
Unit-IV Sections: 11.1, 11.1.1, 11.1.2
Unit-V Sections: 11.2, 12.1, 12.1.1, 12.2

Reference Books:

1. Joseph Muscat, *Functional Analysis*, Springer (2008).
2. BalmohanV.Limaye, *Functional Analysis*,3e, New Age International Publishers (2014).
1. Erwin Kreyszig, *Introductory Functional Analysis with Applications*, John Wiley (2007).
2. Martin Schecter, *Principles of Functional Analysis*, American Mathematical Society (2009)
3. BelaBollobas, *Linear Analysis: An Introductory Course*,2e, Cambridge Univ. Press (1999).
4. Bryan P. Rynne and Martin.AYoungson, *Linear Functional Analysis*, Springer (2008).

Minor: 12-19 MATH-545 NON-COMMUTATIVE RINGS AND REPRESENTATIONS (4 Credits)

Objectives:

To study the basics of Modules, Semi simple rings, Structure theory of ring and substantial study of Representations.

Unit-I Modules

Modules - Artinian and Notherian modules - Tensor products - Restricted and induced modules. - Indecomposable modules – Completely reducible module - Schur Lemma.

Unit-II Radical

Semi simple rings - The radical of a rings – The properties of Jacobson radical

Unit-III Group algebras - The Jacabson radical of Group Algebra – Maschke's Theorem.

Unit-IV Structure theory

Structure theory of ring - Density theorem - Widderburn-Artin theorem for semi simple rings.

Unit-V Representations

Representations - linear representation - Matrix representation - Equivalent representation - Invariant subspaces - Irreducible representations - Direct sum of representations - Induced representation – restricted representation - Tensor product of representations - Inner products of representation.

Text Book

1. I. N Herstein, Non-Commutative Rings, The Mathematical Association of America, 5th Edition, 2005 (Chapter 1: Units I-III, Chapter 2: Unit IV and Chapter 5: Unit V)

Reference Books:

1. William Fulton and Joe Harris, Representation Theory - A First Course, Springer International Edition, Springer-Verlag, New York, 2004.
2. Jacobson, Basic Algebra II, Hindustan Publishing Corporation (India), 1983.
3. Charles W. Curtis and Irving Reiner, Representation Theory of Finite Groups and Associative Algebras, Inter Science Publishers, 1962.

Minor: 12-19 MATH-546: ALGEBRAIC GRAPH THEORY (4 Credits)

Objectives:
To study the objectives of Linear Algebra in Graph Theory, Spanning Trees and Associated Structures, The Multiplicative Expansion and Chromatic Polynomial.

Unit -I: Linear Algebra in Graph Theory – The Spectrum of a Graph – Characteristic polynomial – Adjacency Algebra - Reduction Formula for χ – Regular Graphs and Line Graphs – Circulant Graph – Spectrum of the Strongly Regular Graph – Cycles and Cuts – The Incidence Matrix – The Laplacian Spectrum.

Unit -II: Spanning Trees and Associated Structures – Kirchhoff's Law – Thomson's Principle – The Tree-Number – A Bound for the Tree Number of Regular Graphs – Determinant Expansions – Elementary Graphs.

Unit -III: Vertex-Partition and the Spectrum – Color Partition – Wilf's Theorem on the Chromatic Number of a Graph – Coloring Problems – The Chromatic Polynomial – Recursive Relation for the Chromatic Polynomial – Quasi-Separable Graphs – Subgraph Expansions – The Rank Polynomial.

Unit -IV: The Multiplicative Expansion – Whitney's Theorem on Counting Subgraphs – The Induced Subgraph Expansion – Baker's Theorem.

Unit -V: The Tutte Polynomial – The λ-operator – The Deletion-Contraction Property – Chromatic Polynomial and Spanning Trees – The Chromatic Invariant.

Text Book:-

1. Norman Biggs, Algbraic Graph Theory, Second Edition, Cambridge University Press, 1993.

Reference Books:-

1. Chris Godsil and Gordon Royle, Algebraic Graph Theory, Springer 2009.
2. R. Balakrishnan and K. Ranganathan, A Textbook of Graph Theory (Universitext), Second Edition, Springer New York 2012.

Minor: 12-19 **MATH 547: FIXED POINT THEORY (4 CREDITS)**

Course Objectives:

1. We study about metric convexity and some of its consequences
2. We learn about set valued contractions and hyper convexity

	Course Outcome
CO 1	To study about normal structures in metric spaces
CO 2	We prove some of the important theorems like Brouwer's Theorem and Schauder's Theorem
CO 3	To study about non-expansive maps and the structure of fixed points sets

Unit I (I Sections: 2.5,3.1 to 3.4**):** Metric convexity and convexity structure-Bananch contraction principle and its extensions-The Casristi-Ekelandprincipleand its equivalent.

Unit II (Sections 3.5,3.6, 4.1 to 4.5**):** Set valued contractions-Generalised contractions-Hyperconvexity-Propertiesof hyper convex spaces.

Unit III (Sections: 4.6, 4.7, 5.1 to 5.4**):** Approximate fixed points-Isbell's hyper convexhull-Normal structures in metric spaces-Structure of fixed point sets-Uniform normal structures- Uniform relative normal structure-

Unit IV (Sections: 5.5 to 5.7 , 7.1 to 7.6**):** Quasi normal structure-stability and normal structure- Ultrametric spaces- Continuous mappings in Banach spaces-Brouwer's Theorem-Schauder's Theorem- Stability of Schauder's theorem—Continuous mappings in hyper convex spaces.

Unit V (Sections8.1 to 8.8**):** Basic theorems for nonexpansive maps-Stability results in arbitrary spaces- The Gobel_Karlovitz Lemma-Orthogonol Convexity-Structure of fixed point set-Asymptotically regular mapppings.

Text Book: M. A. Khamsuans W.A. Kirk, An Introduction to Metric Spaces and Fixed Point Theory, John Wiley & Sons, 2001.

Reference Books:

1. Kazimierz Goebel and W. A. Kirk, *Topics in Metric Fixed Point Theory*, Cambridge University Press, 1990.
2. M.C.Joshi and R.K.Bose, *Some topics in Nonlinear Functional Analysis*, John Wiley &sons 1986.

Minor: 12-19 **MATH 548 GRAPH COLORING (4 CREDITS)**

Course Objectives:

1. To study perfect graphs, color critical graphs and greedy coloring of graphs
2. To introduce the four-color problem and some new coloring parameters like list coloring and precoloring extension.

	Course Outcome
CO 1	To study the edge coloring, Tait coloring and total coloring of graphs and some of their properties
CO 2	We introduce the concept of graph homomorphism, Grundy coloring and achromatic coloring of graphs and establish some of the basic properties
CO 3	We introduce T-coloring, L(2,1)-coloring, Radio coloring and Hamiltonian coloring of graphs

Unit I: Vertex Colorings and Bounds of the Chromatic number (Sec: 6.1, 6.3, 7.1-7.2) : The Chromatic Number of a Graph– Perfect Graphs – Color-Critical Graphs – Upper Bounds and Greedy Colorings –The Chromatic Number of Cartesian Products.

Unit II: Coloring Graphs on Surfaces & Restricted Vertex Colorings (7.4, 8.1- 8.3**):** The Four Color Problem – The Conjectures of Hajós and Hadwiger – Chromatic Polynomials –Uniquely Colorable Graphs – List Colorings – Precoloring Extensions of Graphs.

Unit III: Edge Colorings of Graphs (9.1-9.3, 10.1-10.4, 10.6 **):** The Chromatic Index and Vizing's Theorem – Class One and Two Graphs – Tait Colorings – Nowhere-Zero Flows – Total Colorings of Graphs.

Unit IV: Complete Colorings (12.1-12.3**):** The Achromatic Number of a Graph – Graph Homomorphisms – The Grundy Number of a graph.

Unit V: Colorings, Distance and Domination (14.1-14.4**):** T-Colorings – L(2,1)-Colorings – Radio Colorings – Hamiltonian Colorings.

Text Book: Gary Chartrand, Ping Zhang, Chromatic Graph Theory, Chapman & Hall/CRC press, 2009.

Reference books:

1. Douglas B. West, Introduction to Graph Theory, Second Edition, PHI Learning Private Ltd, New Delhi-2011.
2. G. Chartrand, Linda Lesniak and Ping Zhang, Graphs and Digraphs, Fifth Edition, CRC press 2011.
3. Michael Molloy and Bruce Reed, Graph Colouring and the Probabilistic Method, Springer 2002.
4. Tommy R. Jensen and Bjarne Toft, Graph Coloring Problems, John Wiley and Sons, 1995.

MATH-901 Research Methodology (4 Credits)

(Pre-Ph.D Course for all the Ph.D. Students of Department of Mathematics)

UNIT -1: Introduction: Meaning of Research - Objectives of Research - Motivation in Research- Research Methods versus Methodology -Research and Scientific Method - Criteria of Good Research - Defining the Research Problem - Selecting the Problem- Necessity of Defining the Problem - Technique Involved in Defining a Problem.

UNIT -2: Research Design: Meaning of Research Design - Need for Research Design - Research Methodology Features of a Good Design -Important Concepts Relating to Research Design - Different Research Designs - Basic Principles of Experimental Designs.

UNIT -3: Data Collection: Collection of Primary Data - Observation Method - Interview Method - Collection of Data through Questionnaires - Collection of Data through Schedules -Difference between Questionnaires and Schedules - Some Other Methods of Data Collection Guidelines for Constructing Questionnaire/Schedule.

UNIT -4:Computer Applications : Features for data analysis, generating charts/graphs & other features-Presentation tool: Introduction to presentation tool, features & functions, creating presentations

Unit – 5 : Report Writing: Significance of Report Writing - Different Steps in Writing Report - Layout of the Research Report - Types of Reports - Oral Presentation - Mechanics of Writing a Research Report - Precautions for Writing Research Reports.

Use of Latex (and/or) MS Office for generating, storing and interpreting data
Report Writing using either Latex or MS Office

Text Book:

Kothari C.R, Research Methodoloy – Methods and Techniques , New Age International, New Delhi.

Unit –1: Chapters 1 & 2, Unit –2 : Chapter 3, Unit – 3 : Chapter 6 , Unit – 4 & 5 :Chapter 14

Reference Book:

Ranjit Kumar, Research Methodology – A step by step Guide for Beginners,
Pearson Education, Delhi.
Chawla D and Sondhi N,Research Methodology Concepts and cases,Vikas Publishing House Pvt. Ltd., New Delhi.

MULTIDISPLINARY COURSE

MATH 100: BASIC MATHEMATICS
(3 CREDITS)

Course Object:

To learn the basic of Mathematical logics, combinatorics and the algebra of matrices.

CO 3	To introduce the idea of matrices and learn above
CO 4	To introduce the basic concept of permutation-Combinations
CO 5	The learn logics, truth table and basic set theory.

Unit I:
Linear System – Matrices – dot Product – Matrix multiplication – properties of Matrix operations – Matrix transformation.

Unit II:
Solution of linear system of equations – row echelon form – reduced row echelon form – Polynomial interpolation – inverse of a matrix – linear systems.

Unit III:
Logic – truth table – algebra of propositions- logical arguments – sets- operations on sets.

Unit IV:
Principle of inclusion – exclusion – the addition and multiplication rules – pigeonhole principles.

Unit V:
Permutations – Combinations – Elementary Probability.

Text Book:

1. Bernard Kolman, Dred. R. Hill, Introductory Linear Algebra, 8th edition – peasson, India 2011.
2. Edgar G. Goodaire, Michael. M. Parmenter, Discrete Mathematics with Graph Theory, 3e PHI, India, 2011.

SKILL ENHANCMENT COURSE

SEC-1 MATH 111 LATEX FOR MATHEMATICS (3 CREDITS)

Course Objectives:

1. To learn about the Latex software
2. To prepare a Latex document, to make scientific article and project report.

	Course Outcome
CO 1	**To enable to prepare documents in Latex using different kind of fonts in different sizes**
CO 2	**To learn how to prepare any kind of Mathematical equations.**
CO 3	**To know how to construct various kind of tables, lists in Latex.**

Unit I:

Installation of the software LaTeX Understanding Latex compilation

Unit II:

Creating different kind of documents - Creating Title, sections, subsections, Using various types and sizes of fonts.

Unit III:

Creating Tables, enumeration list, itemized list.

Unit IV:

Constructing Mathematical equations,

Unit V:

Including pictures in a document- Inserting foot notes and references

Reference books

1. L. Lamport: A Document Preparation System, User's Guide and Reference Manual, Addison - Wesley, New York, second edition, 1994.
2. M.R.C. van Dongen: LATEX and Friends, Springer-Verlag Berlin Heidelberg 2012.
3. Stefan Kottwitz: LATEX Cookbook, Packt Publishing 2015.

David F. Griffths and Desmond J. Higham: Learning LATEX (second edition), Siam 2016.

SEC-2 **MATH 211 SCILAB FOR MATHEMATICS (3 CREDITS)**

Course Objectives:

1.To learn about the SCILAB free and Open source software

2.To familiarize with commands, operations and how to evaluate and compute mathematical equations using SCILAB.

3. To learn to plot functions using SCILAB

	Course Outcome
CO 1	**To enable learners to Install the FOSS SCILAB into their Desktops/Laptops**
CO 2	**To learn to familiarize with various SCILAB Commands to perform calculations**
CO 3	**To evaluate, compute various Mathematical equations and Plotting functions**

Unit-I: SCILAB Basics: Overview of SCILAB – Get started – Basic elements of the language – Matrices

Unit-II: SCILAB Programming, Looping and Branching – Functions – Plotting

Unit-III: SCILAB for Differential Calculus

Unit-IV: Scilab for Integration

Unit-V: Scilab for Linear Algebra

Text Books:

1. Introduction to SCILAB – Michael Baudin From SCILAB Consortium, 2010
2. SCILAB Online Materials:
3.https://help.scilab.org/docs/5.5.2/en_US/section_33491857221a48388b878311e9f4b67e.html

Reference Books:

1. https://www.scilab.org/tutorials
2. SCILAB help documentation – Statistics
3.https://www.scilab.org/sites/default/files/Basic%20Statistics%20and%20Probability%20with%20SCILAB%20-%20Gilberto%20E.%20Urroz%20-%202001.pdf

SEC-3 **MATH 121** **Mathematical Methods with MATLAB (3 CREDITS)**

	Course Outcome	**Level**
CO 1	To know basics of MATLAB.	
CO 2	To understand different data types and their uses.	
CO 3	To understand script files, function files and language specific feature.	
CO 4	To know application of MATLAB in some branches of Mathematical Sciences.	
CO 5	To visualize some graphics and toolboxes.	

Unit-I: Basics of MATLAB (Sec: 1.1, 1.6 (1.6.1, 1.6.3-1.6.6), 2.2-2.6, 2.8, 2.9)

Programming, Basics of MATLAB, Input-output, File types, General commands, Creating and working with arrays of numbers, Printing simple plots, Creating; saving and executing a script file, Creating and executing a function file, Arrays and matrices, Symbolic computation Importing and exporting data.

Unit–II: Interactive Computation (3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8)

Matrices and vectors, Matrix and array operations, Character strings, A special note on array operations, Command-Line functions, Built-in functions, Saving and loading data, Plotting simple graphs.

Unit-III: Scripts and Functions (4.1, 4.2, 4.3, 4.4, 4.5)

Script files, Function files, Language-specific features, Advanced data objects, Publishing reports.

Unit–IV: Applications in Mathematical Sciences (5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7)

Linear Algebra, Curve fitting and interpolation, Data analysis and statistics, Numerical integration, Ordinary differential equations, Nonlinear algebraic equations, Partial differential equations.

Unit–V: Graphics and Toolbox (6.1, 6.2, 6.3, 6.4, 6.6, 6.7, 8.1, 8.2, 8.5)

Basic 2-D plots, Using subplot for multiple graphs, 3-D plots, Handle graphics, Saving and printing graphs, Animation, The symbolic math toolbox, Numeric versus symbolic computation, Using MuPAD notebook.

Text Book:

1. Rudra Pratap (2010), Getting Started with MATLAB, Oxford University Press.

References:

1. Gilat A (2012), Matlab An Introduction with Applications (4th Edition), John Wiley.
2. R K Bansal, A K Goyal, M K Sharma, MATLAB and its Applications in Engineering, 2nd Edition, Pearson.
3. S S Alam S N Alam (2019), Understanding MATLAB A Textbook for Beginners, Wiley India.

MINOR COURSES OFFERED FOR MATHEMATICS STUDENTS

MATH 200: NUMERICAL METHODS (4 Credits)

Course Objectives:

1. To understand different types of errors.
2. To obtain numerical solutions of algebraic and transcendental equations.

	Course Outcome
CO 1	To learn about various interpolating and extrapolating methods.
CO 2	To perform differentiation and integration using numerical methods.
CO 3	To apply various numerical methods in solving systems of equations.

Unit I (Sections: 1.2, 1.3, 2.1,2.2,2.3**):** Roundoff errors and computer arithmetic-The rate of convergence of a sequence of real numbers- Bisection method-Fixed point iteration method-Newton's Method-Secant Method-Method of False position.

Unit II (Sections: 2.4,2.5,3.1,3.2,3.4**) :** Error Analysis for iterative methods-Accelerating convergence-Muller's Method-Lagrange's interpolation polynomial-Divided Differences-Newton's divided difference formula-Cubic Spline interpolation.

Unit III (Sections: 4.1, 4.3,4.4**):** Numerical differentiation-Numerical Integration-Trapezoidal rule – Simpson's rules-Composite Numerical integration

Unit IV (Sections: 6.1,6.2,6.4,6.5,6.6**):** System of linear equations-Gauss elimination method-Gauss Jordan Method-Pivoting strategies-LU factorization- Crout's Method.

Unit V (Sections: 7.1,7.2,9.2**):** Norms of vectors and matrices-Jacobi iterative method-Gauss Seidel iterative method-The power method.

Text Book: Richard L. Burden and J. Douglas Faires, Numerical Analysis, (7^{th} edition) CENGAGE Learning 2001.

Reference Books

1. Brian Bradle, A Friendly Introduction to Numerical Analysis , Pearson India, 2007
2. M.K.Jain, S.R.K.Iyengar and R.K Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers 2012.
3. Sauel D Conte and Carl de Boor, Elementary Numerical Analysis(3e), Tata Mcgraw Hill.

MATH 201 : PYTHON (4 Credits)

Course Objectives

1. To be able to model and solve mathematical problems using Python.
2. To explore the practical benefits of open-source resources in numerical and symbolic mathematical software systems.

Course Outcomes

CO 1	To apply mathematical problem-solving involving both numerical and symbolic computation.
CO 2	To create tables and generate a variety of function plots while gaining an understanding of visualizing shapes, geometrical patterns, and fractals.
CO 3	To understand the use of Python in diverse branches of Mathematical Sciences.

Unit I: Drawing Shapes, Graphing and Visualization : Drawing diverse shapes using code and Turtle; Using matplotlib and NumPy for data organization, Structuring and plotting lines, bars, markers, contours and fields, managing subplots and axes; Pyplot and subplots, Animations of decay, Bayes update, Random walk.

Unit II: Numerical Solutions of Mathematical Problems: NumPy for scalars and linear algebra on n-dimensional arrays; Computing eigenspace, Solving dynamical systems on coupled ordinary differential equations, Functional programming fundamentals using NumPy.

Unit III: Symbolic Solutions-I : Symbolic computation and SymPy: Differentiation and integration of functions, Limits, Solution of ordinary differential equations, Computation of eigenvalues, Solution of expressions at multiple points (lambdify), Simplification of expressions.

Unit IV: Symbolic Solutions-II : Factorization, Collecting and canceling terms, Partial fraction decomposition, Trigonometric simplification, Exponential and logarithms, Series expansion and finite differences, Solvers, Recursive equations.

Unit V: Document Generation with Python : Pretty printing using SymPy; Pandas API for IO tools: interfacing Python with text/csv, HTML, LaTeX, XML, MSExcel, OpenDocument, and other such formats; Pylatex and writing document files from Python with auto-computed values, Plots and visualizations.

Text Books

1. Peter Farrell, Math Adventures with Python, No Starch Press, US 2019.
2. Farrell, Peter and et al. The Statistics and Calculus with Python Workshop, 1st edition, Packt Publishing 2020.
3. Amit Saha, Doing Math with Python, No Starch Press, US 2015.

Reference Book

1. Sam Morley, Applying Math with Python, 2nd edition, Packt Publishing 2022.
2. Online resources and documentation on the libraries, viz
https://patrickwalls.github.io/mathematicalpython/
https://matplotlib.org, https://sympy.org,
https://pandas.pydata.org, https://numpy.org, https://pypi.org,

MATH 202 : ELEMENTS OF MECHANICS (4 Credits)

Course Objectives:

1. To Introduce the concepts of space, time and paths; Equations of Motion
2. To make the students understand the moving frames of references, Rotating frames.
3. To enable the students to learn Rigid Body motions.

	Course Outcome
CO 1	Students apply the concepts of motion in one and two dimensions and rigid body motions.
CO 2	Students understand the particles moving in a rotating frame of reference.

Unit I:Newton's laws and Central forces: Introduction, Space, time, and paths, forces, Newton's second law, One-dimensional motions, Particle motion in two and three dimensions, Moving frames of reference Central forces and angular momentum, The scalar equations of motion in place polar coordinates, the equation of path, Condition for stability of circular orbits, General examples.

Unit II:Energy and Rotating frames: The one-dimensional case, the general case, Conservation of energy, Application to central forces, Motion of a particle on a surface under gravity. Two dimensional Rotating Frame, Angular Velocity Vector, Particle moving in a rotating frame of reference, Motion on the surface of the earth.

Unit III:Many-particle systems, Rigid bodies: equations: Motion of centre of mass, Angular momentum and moment of force, Rigid bodies: degrees of freedom, the angular velocity.

Unit IV:Rigid bodies: equations: The equations of motion, Angular momentum and angular velocity, Calculation of the inertia tensor, Application to calculation of angular momentum, Energy.

Unit V:Soluble problems in rigid body motion: Bodies with dynamical symmetry, Bodies with axial symmetry: top, Precession, General rotation of a rigid body fixed at one point, Rolling spheres.

Text Book: Mary Lunn, A First Course in Mechanics, Oxford New York, Tokyo, Oxford University Press 1991.

Reference Books

1. Mechanics -P. Duraipandian S. Chand Limited, 1995
2. Classical Mechanics: Goldstein, Pearson Education India 2002
3. Classical Mechanics: Rana & Joag, Rana, Tata McGraw-Hill Education, 2001

MATH 300: MATHEMATICAL MODELLING (4 Credits)

Course Objectives:

1. To understand different mathematical models
2. To provide students with a solid foundation solving real life problems with mathematical models.

Course Outcomes: After completing this course, students will be able:

CO1	To understand fundamentals of different mathematical models.
CO2	To apply mathematical models in diverse fields of real-life applications
CO3	To know the applications of mathematical models in the fields of academia and industries.

Unit I: History of Mathematical Modeling, Latest development in Mathematical Modeling, Merits and Demerits of Mathematical Modeling, Quantitative and Qualitative approach of modeling, Conceptual and Physical models, stationary and nonstationary models, distributed and lumped models, models in real world problems

Unit II: Introduction to difference equations, Non-linear Difference equations, Steady state solution and linear stability analysis. Discrete dynamical systems: equilibrium and long-term behavior, Linear Models, Growth models, Decay models, Drug Delivery Problem, Linear Prey-Predator models, Volterra's principle, Lanchester combat model.

Unit III: Application of first order differential equations to acceleration-velocity model, Growth and decay model. Introduction to Continuous Models, Drug Distribution in the Body, Interacting population models, Epidemic Models (SI, SIR, SIRS, SIS, SEIR), Steady State solutions, Linearization and Local Stability Analysis, logistic, predator-prey model, Competition models.

Unit IV: Introduction to compartmental models, Lake pollution model (with case study of Lake Burley Griffin), Exponential growth of population, Limited growth of population, Limited growth with harvesting, Battle model and its analysis.

Unit V: Spline, Random numbers, Generating discrete and continuous random variables, Multiple Regression, Variance reduction techniques, Statistical validation techniques, Markov chain, Monte Carlo methods and applications.

Text Book

1. Barnes, Belinda & Fulford, Glenn R., Mathematical Modelling with Case Studies, Using Maple and MATLAB, 3rd edition, CRC Press, Taylor & Francis Group 2015.
2. J. N. Kapur, Mathematical Modeling, New Age International 2005.

Reference Books:

1.Albright B., Mathematical Modeling with Excel, Jones and Bartlett Publishers 2010.
2. F. R. Marotto, Introduction to Mathematical Modeling using Discrete Dynamical Systems, Thomson Brooks/Cole 2006.
3. Willy, Mathematical modelling and simulation: introduction for scientist and engineers, , Kai Velten 2008.

MATH 301: AUTOMATA THEORY (4 Credits)

Course Objectives:

1. To introduce finite state automata – deterministic and non-deterministic.
2. To learn the concept of grammars and regular expressions and their relations.

	Course Outcome
CO 1	To introduce the concepts of finite state automata – deterministic and non-deterministic
CO 2	To familiarize the concept of grammars and regular expressions and their relations
CO 3	In addition, to introduce context free grammars, Pushdown automata and their relations

UNIT I (Sections 1.5, 2.1-2.3**) :** Alphabets, strings, and languages. Finite Automata deterministic and non-deterministic finite automata - Properties of transition functions - The equivalence of DFA and NFA.

UNIT II (Sections 3.1,3.2,3.4**):** Regular expressions, finite automata and regular expressions – algebraic laws for regular expressions.

UNIT III (Sections 4.1,4.2**):**Regular languages and their relationship with finite automata, pumping lemma for regular languages - closure properties of regular languages.

UNIT IV (Sections 5.1.5.2.5.4**):**Context Free Grammars - parse trees - ambiguities in grammars and languages.

UNIT V (Sections 6.1-6.4**):**Pushdown automata - the language of a Pushdown automata – Equivalence of Pushdown automata and context free grammar - deterministic PDA.

Text book

1. John E. Hopcroft, Rajeev Motwani and J.D. Ullman, Introduction to Automata Theory Languages and Computation, Third Edition, Pearson Addison-Wesley, 2006.

Reference books

1. J.A. Anderson, Automata theory with modern applications, Cambridge University Press, 2006.
2. H.R. Lewis, C.H. Papadimitriou, C. Papadimitriou, Elements of the Theory of Computation, 2nd Ed., Prentice-Hall, NJ, 1997.
3. K L P Mishra and N Chandrasekaran, Theory of Computer Science Automata, Languages and Computation, Third Edition, Prentice Hall India, New Delhi, 2006.

MATH 302 :VECTOR ANALYSIS

Course Objectives:

1. To learn about the geometry of curves and surfaces in R^3.
2. To learn curl of a vector field and the divergence of a scalar field.

	Course Outcome
CO 1	To learn about some applications of vector analysis to other branches of sciences
CO 2	To learn about evaluating line and surface integrals over curves and surface respectively
CO 3	To learn about integral theorems in vector analysis.

Unit I (Sections: 1.1-1.6 and 4.1-4.4) **:** Vectors in the plane and space- The inner product and the distance-The cross product and the planes-Curves in the plane and space-Tangents, velocity and speed-Arc length- Vector fields-flow lines-Divergence and curl

Unit II (Sections: 6.1, 6.2**) :** Line Integrals-Line integrals of gradient fields-Independence of parametrization-Line integrals along geometric curves- Work done by a force field-parametrized surfaces- tangent plane.

Unit III (Sections: 6.3, 6.4**) :** Area of a surface-Integral of a scalar function over a surface-Surface integral-The surface integral for Graphs-Surface integral for fluid flow-Area of a shadow.

Unit -IV (Sections: 7.1, 7.2**):** Green's Theorem-Area of a region in Green's Theorem-Vector form of Green's theorem-Gauss Divergence Theorem in the plane-Stokes Theorem for graphs-Circulation and curl.

Unit-V (Sections: 7.3, 7.4**) :** Gauss Theorem-Divergence and Flux-Path independence and the Fundamental Theorem of Calculus-Conservation of vector fields-Curl and gradient-Cross derivative test in the plane-Antiderivative of vector fields-Divergence and Curl.

Text Book: J.E Marsden, A.J Tromba, and A. Weinstein, Basic Multivariable calculus, Springer, 2004.

Reference Books

1. Howard Anton, Irl Bivens, Stephens Davis, Calculus 10e, Wiley India.
2. James Stewart, Calculus, Early Transendentals, 7e CENGAGE India.
3. George B. Thomas, Maurice D Weir, Joel Hass, Frank R Giordono, Thomas calculus 11e, Pearson India.

NEP MINOR COURSES

[to other departments STAT & PHY, etc….]

Minor: MATH-121: BASIC CALCULUS (4 CREDITS)

Course Objectives:

1. Able to Analyze the Derivatives of functions.
2. To understand the idea of applications of Derivatives

	Course Outcome
CO 1	To solve Asymptotes, concavity & convexity point of inflexion
CO 2	Able to solve differentiation using Leibnitz rule
CO 3	To determine the Exponent and Logarithmic functions

Unit I:

Quick review of Derivative of some familiar functions Application of Derivatives - Increasing decreasing functions - Maxima minima-Error –Approximation- Optimization-Newton method- Mean value theorems.

Unit II:

Asymptotes- Test of concavity& convexity point of inflexion- Multiple point training curves in Cartesian & Polar co-ordinates. Successive differentiation- Leibnitz rule- Problems and examples.

Unit III:

Definite integrals - Properties of definite integrals - Integral as the limits of a sum- Evaluation of integrals- Area and the mean value theorem-The fundamental theorem(without proof)- Substitution in definite integrals.

Unit IV:

Integration by parts (theorem and examples) – Integration of rational fractions-Reduction formulas.

Unit V:

Areas between curves- Finding volume by slicing- Volumes of solids of revolution - Disk and washers- Cylindrical shell- Lengths of plane curves- Areas of surface of revolution.

Text Book

2. George B.Thomas, Maurice D.Weir and Joel Hass, Thomas' Calculus 12th Edition, Pearson Education, 2015.

Reference Books

6. Richard Courant and Fritz John, Introduction to Calculus and Analysis, Vol.I, Springer 1999.
7. Serge Lang A First course in Calculus 5th edition, Springer, 1999.
8. N. P. Bali, Integral Calculus, Laxmi Publications, Delhi 1991.
9. Richard Courant and Fritz John, Introduction to Calculus and Analysis, Volumes I & II Springer, SIE, 2004.
10. Serge Lang A First course in Calculus 5th edition, Springer, 1999.

Minor: MATH-122: BASIC ALGEBRA AND THEORY OF EQUATIONS
(4 CREDITS)

Course Objectives:

1. To introduce the idea of matrices and to learn about the algebra of matrices
2. To solve system linear equations using matrix Theory

	Course Outcome
CO 1	To learn the relation between the co-efficient and roots of polynomial equations.
CO 2	To learn various methods for solving polynomial equations and study the nature & position of roots.
CO 3	Analytic Methods for solving the polynomial equation of degrees 3 & 4.

Unit I: (Sections 1.1, 1.2, 1.3,1.4,1.5 of [1])

Linear systems - Matrices - Dot product and Matrix multiplication - Properties of Matrix operation, Matrix transformations.

Unit II: (Sections 1.6,1.7,1.8[1])

Solutions of Linear systems of equations - Row echelon from reduced row echelon form – Polynomial interpolation - The inverse of a Matrix. - Linear Systems and inverses - LU- Factorization Method.

Unit III: (Sections 5.1,5-2,.5.3 of [2])

Division algorithm - Relation between roots and coefficients - Sum of the powers of the roots.

Unit IV: (section 5.4,5.5,5.6 ,5.7 of [2])

Reciprocal equations - Transformation of equations: - Multiple roots - Nature of position of roots - Sturm's Theorem.

Unit V: (Sections 5.8,5.9,5.10 of [2])

Cardan's Method for solving Cubic equations – Ferrari's Method for solving biquadratic equations - New Newton's Method- Horner's Method

Text Books

1. Bernard Kolman Drid R. Hill, Introductory Linear Algebra, (8e),Pearson India (2011)
3. S. Arumugam and A Thangaand Isaac, Set Theory Number System and Theory of Equations, New Gamma publishing house(1997.).

References:

1. Theory of Equations, Hari Kishan, Atlantic Publishers, 2022

2.Theory of Equations, Lalji Prasad, New Revised Edition, 2016

Minor: MATH-221: FUNDAMENTALS OF REAL ANALYSIS
(4 CREDITS)

Course Object:

1. To study the importance of the lub property of the real number system
2. To study the property of convergence sequence

CO 3	To learn some applications of differentiability of functions
CO 4	To introduce the Riemann theory of integration and the fundamental theorem of calculus
CO 5	To learn about pointwise and uniform convergences of sequence of functions

Unit I:[Sections: 3.1, 3.2, 3.3, 3.4]

Convergent sequence Examples – convergent sequences – Limit Theorems – Monotoriesequences Bolzano – Weinerstrars Theorem.

Unit II: [Sections: 3.7, 9.2, 9.3]

Infinite Series – The Cauchy criterion - Examples - Comparison Test - Limit Comparison Test - The Canchy Condensation Test - Absolute Convergence - The root Test – The ratio Test - The Integral Test- Alternating Serier Test - Abel's Test.

Unit III: [Sections: 4.1 4.2, 4, 3].

Limits of function – Examples – Sequence version of the limit of a function - Limit Theorems -One-sided limits.

Unit IV: [Sections: 5.1,5-2, 5·3]

Continuous functions - Examples – Algebra - Continuous functions on intervals - Continuous functions - Intervals Maximum Minimum Theorem – Location of Roots Theorem – Bolzanos Intermediate value theorem

Unit V: [Sections: 6.1,6.2,6.4]

Differentiable functions - Algebra of differentiable functions – Chain Rule - Interior Extremum Theorem - Rolle's Theorem -Mean value Theorem - First derivative Test - Darboux's Theorem - Taylor's Theorem.

Text book:

R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis 4e Wiley India, 2016.

Reference Books

1. Richard R Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Co. Pvt Ltd, New Delhi, Indian Edition 1970.
2. Kenneth A. Ross, *Elementary Analysis: The Theory of Calculus*, springer, 2e (2013).

Minor: MATH-222: INTRODUCTION TO DIFFERENTIAL EQUATIONS
(4 CREDITS)

Course Objectives:

1. To understand ordinary and first order partial differential equations and their applications
2. To understand the first and second order ordinary differential equations and their solution procedures.

	Course Outcome
CO 1	To solve a system of first order ODEs
CO 2	To analyze the stability of a Dynamical System using Differential Equations and their solutions
CO 3	To Solve First Order Partial Differential Equations

Unit I: [Sections 1.5-1.8 from [1]**]**
Exact differential equations- Integrating factors – Linear differential equations- Bernoulli equation – Modeling: Electric circuits – Orthogonal trajectories of curves.

Unit II: [Sections 2.1-2.7 from [1]**]**
Homogeneous linear equations of second order – Second order homogeneous equations with constant coefficients – Case of complex roots- Complex exponential function – Differential operators – Modeling: Free oscillations – Euler-Cauchy equation – Existence and uniqueness theory – Wronskian.

Unit III: [Sections 2.8-2.10, 2.13, 2.14 from [1]]
Non homogeneous equations – Solution by undetermined coefficients – Solution by variation of parameters – Modeling of electric circuits – Higher order linear differential equations – Higher order homogeneous equations with constant coefficients.

Unit IV: [Sections 3.0-3.4 from [1]]
Introduction: vectors, matrices, eigenvalues – Introductory examples – Basic concepts and theory – Homogeneous systems with constant coefficients, phase plane, critical points – Criteria for critical points, Stability.

Unit V: Chapter 1 from [2]
Non-linear first order PDEs : Compatible systems- Solutions of Quasi linear equations
Charpit's method - Special Types of Charpits Method,

Text Book

1. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons, 1999.
2. K. Shankara Rao, Introduction to Partial Differential Equations, PHI Publications,
3rd Edition. 2011. – Chapter 1

Reference Books

1. George F. Simmons, Differential Equations, Tata McGraw-Hill, New Delhi, 1972.
2. Boyce and Di Prima, Differential Equations and Boundary Value Problems, Wiley,10th edition 2012.
3. Earl A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall of India Private Ltd, 1991.

Minor: MATH-321: CALCULUS OF SEVERAL VARIABLES
(4 CREDITS)

Course Objectives:

1. To learn about differentiation, partial differentiation and to calculate directional derivatives and gradients
2. To learn about maxima and minima of two and more variables.

	Course Outcome
CO 1	To apply the double and triple integrals to find volume and area of curves
CO 2	To apply line and surface integrals for computing over curves and surface
CO 3	To learn about integral theorems in vector calculus

Unit I: [Sections: 14.1, 14,2,14,3 and 14.4]
Functions of several variables-Level set and graphs-Limit and continuity-Two path test for nonexistence of a limit-Partial derivatives-The chain rule..

Unit II: **[Sections: 14.5, 14.6, 14.7 and 14.8]**
Directional derivatives and gradient vectors- Gradients and tangents to level curves- Tangent planes and normal lines- Linear approximation- Extreme values and saddle points- Second derivative test for local extrema-Lagrange multipliers.

Unit III: [Sections: 14.10, 15.1 and 15.2]
Taylor's formula for two variables- Double integral over rectangles- Fubini's Theorem for calculating double integrals- Area, moments and centre of mass

Unit IV: [Sections: 15.3, 15.4 and 15.5]
Double integrals in polar form-Changing Cartesian integrals into polar integrals- Finding area in polar coordinates – Triple integrals in rectangular coordinates- Volume in triple integrals – Mass and moments in three dimensions.

Unit V: [**Sections: 15.6 and 15.7**]
Triple integrals in Cylindrical and spherical coordinates- Changing the order of integration in cylindrical and spherical coordinates.

Text Book:
George B. Thomas, Maurice D Weir, Joel Hass , Frank R Giordono, ***Thomas calculus 11e,*** Pearson India.

Reference Books:

1. Howard Anton, Irl Bivens, Stephens Davis, ***Calculus*** 10e, Wiley India.
2. James Stewart, ***Calculus, Early Transendentals,*** 7e CENGAGE India.

Minor: MATH-322: INTRODUCTION TO LINEAR ALGEBRA
(4 CREDITS)

Course Objectives:

1. To understand linear transformations Characteristic roots- Similarity of linear transformations and matrices.

	Course Outcome
CO 1	To understand vector spaces, basis and dimensions
CO 2	To understand Matrices and their Trace- Transpose & Determinants.
CO 3	To understand Inner product and orthogonality

Unit I: [Sections 1.2 to 1.6**]**
Abstract Algebra Concepts – Groups- Subgroups- Fields- examples Vector space- Subspace-linear combinations and systems of linear equations- Linear dependence and linear independence- Basis and dimension.

Unit II: [Sections 2.1 to 2.5**]**
Linear Transformations- Null spaces- Range spaces- Dimension theorem- Matrix representation of linear transformation- composition of linear transformations and Matrix multiplication- Invert ability and Isomorphism- The change of coordinate matrix.

Unit III: [Sections 3.1 to 3.4**]**
Elementary matrix Operations and elementary matrices- The rank of a matrix and matrix inverses- systems of linear equations- Theory and computation

Unit IV: [Sections 4.1 to 4.4 and 5.1 to 5.2, 5.4**]**
Determinants of order 2 and order n- propertie4s of determinants- Important facts about determinants- Eigen values and Eigen vectors- Diagonalizability- Invariant spaces and Cayley- Hamilton theorem.

Unit V: [Sections 6.1, 6.2**]**
Inner products and norms- The Gram-Schmidt orthogonalization process and orthogonal complements.

Text Book

Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Linear Algebra, 4th Edition,
Printice Hall of India Pvt. Ltd., 2006

Reference Book

1. S. Kumaresan, Linear Algebra Geometric Approach, Prentice Hall of India Pvt. Ltd., 2000.
2. I. N. Herstin, Topics in Algebra, 2nd Edition, John Wiley & Sons, 2003.

Minor: MATH-429: VECTOR CALCULUS (4 CREDITS)

Course Objectives:

1. To learn about curvature and torsion of a space curve.
2. To learn about the fundamental theorems by Green, Stoke and Gauss..

	Course Outcome
CO 1	To apply the double and triple integrals to find volume and area of curves
CO 2	To apply line and surface integrals for computing over curves and surface
CO 3	To learn about integral theorems in vector calculus

Unit I: [Sections: 13.1, 13,2,13,3, 13.4 and 13.5]

Vector functions- Modelling projectile motion- Arc length and the unit tangent vector- Curvature and the unit normal vector- Torsion and the unit binormal vector.

Unit II: **[Sections: 16.1 and 16.2]**

Line integrals- Mass and moment calculations- Vector fields- work, circulation and flux- Gradient vector field- work over a smooth curve- Flow integrals and circulation for velocity fields- Flux across a plane- Flux across a smooth closed curve..

Unit III: [Sections: 16.3 and 16.4]

Path dependence of line integrals – The fundamental Theorem of line integrals- Exact differential forms- Green's Theorem in the plane (normal form and tangential form)-Divergenc(flux density)-The Green's Theorem area formula.

Unit IV: [Sections: 16.5, and 16.6]

Surface area and surface integrals- Orientation- Moments and masses of thin shells- Flux across a surface- Parametrized surfaces- Area of a smooth surface- Parametric surface integral- Finding the center of mass.

Unit V: [**Sections: 16.7 and 16.8**]

The Curl of a vector field- Stoke's Theorem- Conservative fields and Stoke's theorem – The Divergence Theorem- The proof of divergence theorem for special regions- Properties of Curl and divergence.

Text Book:

George B. Thomas, Maurice D Weir, Joel Hass , Frank R Giordono, ***Thomas calculus 11e,*** Pearson India.

Reference Books:

1. Howard Anton, Irl Bivens, Stephens Davis, ***Calculus*** 10e, Wiley India.
2. James Stewart, ***Calculus, Early Transendentals,*** 7e CENGAGE India.

Minor: MATH-430: INTRODUCTION TO COMPLEX ANALYSIS

Course Objectives:

1. To study and learn analytic functions and the theory of power series
2. To understand and learn about the conformal mappings and elementary transformations

	Course Outcome
CO 3	To study and learn line integrals, Cauchy's theorem and Cauchy's integral formula
CO 4	To classify zeros and poles and understand Maximum principle
CO 5	To find residues and evaluate complex integrals and definite integrals using the residue theorem and to represent functions as Taylor and Laurent series

Unit I: [Sections 12.1-12.5;**]** Complex numbers- Complex plane - Polar form of complex numbers- Powers and roots – Derivative- Analytic function - Cauchy- Riemann equations. Laplace's equation - Geometry of Analytic Functions- Conformal mapping.

Unit II: [Sections 12.6-12.9;] Exponential function - Trigonometric functions- Hyperbolic functions – Logarithm- General power - Linear fractional transformation.

Unit III: [Sections 13.1-13.4**]** Line integral in the complex plane - Cauchy's integral theorem - Cauchy's integral formula - Derivatives of analytic functions.

Unit IV: [Sections 14.1-14.4**]** Sequences- Series- Convergence tests - Power series - Functions given by power series - Taylor series and maclaurin Series

Unit V: [Sections 15.1-15.4**]** Laurent series - Singularities and zeros, Infinity - Residue integration method evaluation of real integrals.

Text Book:

Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons, 1998.

Reference Books

1. L. Ahlfors, Complex Analysis, McGraw-Hill International Edition, 1979.
2. R.V. Churchill, Complex Variables and Applications, 4th Edition, Mc Graw –Hill, 1948.
3. A.Mood, F.Graybill, and D.Boes, *Introduction to the Theory of Statistics*, Tata McGraw Hill (Third Edition) 2008.
4. George Grätzer, Lattice Theory: Foundation, Springer Basel AG, 2011.

MATHEMATICS Syllabi
for B. Tech Programs of
Computer Science, Banking Technology, Electronics, Green Energy and Nano Science Departments

MATHE 111	Mathematics-I	Sem- 1	3L:1T:0P:4 C

Course Objective: T*o comprehend the mathematical concepts of matrices, ordinary differential equations, multivariablecalculus and problem-solving.*

Course Contents:

MODULE I LINEAR ALGEBRA(MATRICES) : Rank of a matrix - Consistency of a system of linear equations - Characteristic equation of a matrix - Eigen values and Eigen vectors - Properties of Eigen values and Eigen vectors - Cayley-Hamiltontheorem (excluding proof)- Verification- Application (Finding Inverse and Power of a matrix)- Diagonalization of a matrix by orthogonal and similarity transformation- Quadratic form – Nature of Quadratic Form- Orthogonal reduction of quadratic form to canonical form.

MODULE II ORDINARY DIFFERENTIAL EQUATIONS : Differential Equations of First Order- Exact equations- Leibnitz's linear equations- Bernoulli's equation- Equations solvable for p- Clairaut's equation- Differential equations of Higher order- Linear differential equations of higher order with constant coefficients- Euler's linear equation of higher order with variable coefficients- Method of variation of parameters.

MODULE III MULTIVARIABLE CALCULUS (DIFFERENTIATION) : Partial differentiation- Partial derivatives of first order and higher order- Partial differentiation of implicit functions- Euler's theorem on homogeneous functions - Total derivative - Jacobian Properties - Taylor's series for functions of two variables- Maxima and minima of functions of two variables.

MODULE IV MULTIVARIABLE CALCULUS (MULTIPLE INTEGRALS) : Double integration (Cartesian form and Polar form)-constant limits- variable limits- over the region R- Changeof variables in double integrals (Cartesian to polar)- Appli- cation of double integral- Area by double integration- Change of Order of Integration- Triple Integration (Cartesian- Spherical and Cylindrical)- constant limits- variable limits- over the region R- Application of triple integral- Volume by triple integration.

MODULE V MULTIVARIABLE CALCULUS (VECTOR CALCULUS) : Vector Differential Operator- Gradient - Properties - Directional derivative - Divergence and curl Properties and relations- Solenoidal and Irrotational vector fields - Line integral and Surface integrals - Integral Theorems (excluding Proof) - Green's theorem - Stoke's theorem - Gauss divergence theorem.

Text Books:

1. Veerarajan T., "Engineering Mathematics - I & II ", Tata McGraw-Hill, New Delhi, 2014 &; 2015.
2. Dr. M.K. Venkataraman, "Engineering Mathematics – Volume I and Volume II", The NationalPublishingCompany, Chennai 2008.

References:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd,2011.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 9thEdition, 2011
4. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.

ONLINE / NPTEL Courses:

1. Differential equations for engineers: https://nptel.ac.in/courses/111106100
2. Calculus of Several Real Variables: https://nptel.ac.in/courses/111104125
3. Engineering Mathematics - I: https://nptel.ac.in/courses/111105121
4. Matrix Analysis with Applications: https://nptel.ac.in/courses/111107112

MATHE 121	Mathematics- II	Sem-2	3L:1T:0P:4C

Course Objective:

- *To formulate and solve partial differential equations, Laplace, Fourier transforms within the engineeringdomain.*

Course Contents:

MODULE I PARTIAL DIFFERENTIAL EQUATIONS (12 Hrs)

Formation of partial differential equations, Solutions of standard types of first order partial differential equations, Lagrange s linear equation, Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

MODULE II LAPLACE TRANSFORM (12 Hrs)

Existence conditions, Transforms of elementary functions , Properties, Transform of unit step function and unitimpulse function , Transforms of derivatives and integrals , Transforms of Periodic Functions , Initial and final value theorems.

MODULE III INVERSE LAPLACE TRANSFORM (12 Hrs)

Inverse Laplace Transforms Properties, Convolution theorem, Application - Solution of ordinary differential equations with constant coefficients - Solution of simultaneous ordinary differential equations.

MODULE IV FOURIER TRANSFORM (12 Hrs)

Fourier Integral theorem (statement only) , Fourier transform and its inverse, Properties: Fourier sine and cosine transforms, Properties, Convolution and Parseval s identity.

MODULE V FOURIER SERIES (12 Hrs)

Dirichlet s conditions , Expansion of periodic functions into Fourier series- Change of interval, Half-range Fourier series, Root mean square value - Parseval s theorem on Fourier coefficients, Harmonic analysis.

Text Books:

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2015.
2. Veerarajan T, "Transforms and Partial Differential Equations", Tata McGraw-Hill, New Delhi, 2012.

References:

1. Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd,2011.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 9th Edition,2011.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.

ONLINE / NPTEL Courses:

1. Laplace Transform: https://nptel.ac.in/courses/111106139
2. Partial Differential Equations: https://nptel.ac.in/courses/111101153
3. Advanced Engineering Mathematics: https://nptel.ac.in/courses/111107119

MATHE 122	Subject Title APPLIED LINEAR ALGEBRA – SEM 2	L T P C 3 0 0 3

Learning Objectives:

1. To learn the properties of a linear transformation and to analyze a linear system of equations
2. To solve linear equations and understand the applications of linear algebra in engineering

Learning Outcome:

On completion of the course, the students will be able to:

1. Solve a linear system of equations using direct and iterative methods and Eigenvalue problems
2. Formulate linear equations for real life problems and solve them

Components of Teaching Type: *Classroom Based Teaching*

Unit I: Vector spaces

Vector spaces – Subspaces – Linear combinations and linear system of equations. Linear independence and Linear dependence – Basis and Dimension

Unit II: Linear Transformations

Linear Transformation – Null space, Range space - Dimension theorem - Matrix representations of Linear Transformations. Eigenvalues and Eigenvectors of a linear transformation – Diagonalization of linear transformations – Application of diagonalization in a linear system of differential equations.

Unit III: Orthogonal vectors

Inner Product Spaces –Norms - Orthogonal vectors – Gram Schmidt orthogonalization process – Least Square Approximations

Unit IV: Linear system of equations

Solution of linear system of equations – Direct method: Gauss elimination method – Pivoting – Gauss Jordan method -LU decomposition method – Cholesky decomposition method Iterative methods: Gauss-Jacobi and Gauss-Seidel – SOR Method

Unit V: Eigenvalue problems

Eigenvalue Problems: Power method – Inverse Power method - Jacobi's rotation method Generalized Inverses QR decomposition - Singular Value Decomposition method

Text and Reference Books:

1. **Stephen H. Friedberg, Insel A.J. and Spence L.E., "Linear Algebra", 4th. Edition, Prentice - Hall of India, New Delhi, 2003.**
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical Methods for Scientific and Engineering Computation", New Age International (P) Limited, New Delhi, 2003.
3. Strang G., "Linear Algebra and its Applications", Thomson (Brooks/Cole), New Delhi, 2005.
4. Kumaresan. S., "Linear Algebra – A Geometric Approach", PHI, New Delhi, 2010.
5. Faires J.D. and Burden R., "Numerical Methods", Brooks/Cole (Thomson Publications), New Delhi, 2002.

MATHE 211	Subject Title DISCRETE MATHEMATICS SEM-3	L T P C 3 1 0 4

Learning Objectives:

1. To develop a foundation of set theory concepts and explore a variety of various mathematical structures by focusing on mathematical objects, operations, and resulting properties
2. To develop formal logical reasoning techniques and concept of relation through various representations

Learning Outcome:

On completion of the course, the students will able to:

1. *Construct* proofs using direct proof, proof by contraposition, proof by contradiction, and proof by cases.
2. Demonstrate the ability to solve problems using counting techniques and combinatory in the context of discrete probability.

Components of Teaching Type: Classroom based Learning

Unit I: Set Theory : Introduction, Combination of sets, Multisets, Ordered pairs. Proofs of some general identities on sets. Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Recursive definition of relation, Order of relations. Functions: Definition, Classification of functions, Operations on functions, Recursively defined functions, Growth of Functions, Natural Numbers: Introduction, Mathematical Induction, Variants of Induction, and Induction with Nonzero Base cases. Proof Methods, Proof by counter – example, Proof by contradiction.

Unit II: Algebraic Structures

Definition, Groups, Subgroups and order, Cyclic Groups, Cosets, Lagrange's theorem, Normal Subgroups, Permutation and Symmetric groups, Group Homomorphisms, Definition and elementary properties of Rings and Fields, Integers Modulo n.

Unit III: Partial order sets

Definition, Partial order sets, Combination of partial order sets, Hasse diagram. Lattices: Definition, Properties of lattices – Bounded, Complemented, Modular and Complete lattice. Boolean Algebra: Introduction, Axioms and Theorems of Boolean algebra, Algebraic manipulation of Boolean expressions. Simplification of Boolean Functions, Karnaugh maps, Logic gates, Digital circuits and Boolean algebra.

Unit IV: Propositional Logic

Proposition, well-formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Theory of Inference Predicate Logic: First order predicate, well-formed formula of predicate, quantifiers, Inference theory of predicate logic.

Unit V: Trees

Definition, Binary tree, Binary tree traversal, Binary search tree. Graphs: Definition and terminology, Representation of graphs, Multigraphs, Bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph coloring Recurrence Relation & Generating function: Recursive definition of functions, Recursive algorithms, Method of solving recurrences. Combinatory, Introduction, Counting Techniques, Pigeonhole Principle.

Text Books:

1. **Elements of Discrete Mathematics – Liu and Mohapatra, McGraw Hill Publications, 2017**
2. **Discrete Mathematical Structures – B. Kolman, R.C. Busby, and S.C. Ross, PHI Publications, Third edition, 2016**
3. Discrete Mathematical Structures with Application to Computer Science – Jean Paul Trembley and R Manohar, McGraw-Hill Publications, 2017
4. Discrete and Combinatorial Mathematics – R.P. Grimaldi, Addison Wesley, 2006
5. Discrete Mathematics and Its Applications, Kenneth H. Rosen, McGraw-Hill 8th edi, 2021

MATHE 212	Numerical Techniques	Sem-3	2L:0T:2P:3C

Course Objectives:

- *Cover certain basic, important computer oriented numerical methods for analyzing problems that arise in engineering and physical sciences.*
- *To obtain solutions to a few problems that arise in their respective engineering courses.*
- *To Impart skills to analyze problems connected with data analysis,*
- *Solve ordinary and partial differential equations numerically*

Course Contents:

MODULE I Interpolation 9 Hours

Interpolation by polynomials, error of the interpolating polynomial, piecewise linear and cubic spline interpolation.

MODULE II Numerical Integration 9 Hours

Numerical integration, Simpson rule, composite rules, error formulae, Gaussquadrature.

MODULE III System of Linear Equations 9 Hours

Solution of a system of linear equations, implementation of Gaussian elimination and Gauss- Seidel methods, partial pivoting, row echelon form, LU factorization, Cholesky's method, ill- conditioning, norms.

MODULE IV Non-linear Equation 9 Hours

Solution of a nonlinear equation, bisection and secant methods. Newton-Raphson method, rateof convergence, solution of a system of nonlinear equations.

MODULE V Numerical solution of Ordinary Differential Equations

Euler and Runge-Kutta methods, multistep methods, predictor-corrector methods, order of convergence, finite difference methods, numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations. Eigenvalue problem, power method, QR method, Gershgorin‟s theorem. Exposure to software packages.

Text Books:

1. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering,2012, New Age International Ltd., 6th Edition.
2. R.L. Burden and J. D. Faires, Numerical Analysis, , 2012, 4th Edition, Brooks Cole.

Reference Books:

1.E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999).

2.Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing (2022).

3.R. Agor, Elements of Mathematical Analysis, Khanna Publishing House, 2015.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand different numerical integration techniques, and numerically solve differential equations.
2. Perform various matrix computations and solve simultaneous linear equations.
3. Find roots of a transcendental equation using different methods.
4. Implement different interpolation schemes.
5. Understanding of Eigenvalue problem and power method.

MATHE 213	Mathematics – III	Sem-3	3L:1T:0P:4C

Course Objectives:

• The course aims to equip students with the ability to apply mathematical concepts to Engineering problems.

Unit – I: Probability (12 hrs)

Sample space and Events, Axioms of Probability, Conventional Probability, Bayes' Theorem, Independent Events, Random Variables, Discrete and Continuous Random Variables – Probability Mass Function – Probability Density Function – Cumulative Distribution Function – Expectation and Variance, Standard probability Distribution – Bernoulli, Binomial, Poisson, Geomtric and Normal Distributions.

Unit – II: Statistics and applications (12 hrs)

Measures of Central Tendency – Mean- Median-Mode; Measure of Dispersion – Range – Variance-Standard Deviation; Moments, Skewness and Kurtosis, Correlation and Regression – Rank Correlation
Curve Fitting by the Method of Least Square, Fitting of Straight lines, Second degree parabolas and more general curves. Test of Significance: Large sample test for single proportion, Difference of proportions, Single Mean, Difference of Means and Difference of Standard Deviations

Unit -III - Application of PDEs (16 hrs)

Second-order linear PDE and their classification, Initial and boundary conditions, D'A lembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.

Unit IV - Numerical Methods (10 hrs)

Numerical integration, Simpson rule, composite rules, error formulae, Solution of a system of linear equations, implementation of Gaussian elimination and Gauss- Seidel methods, Cholesky's method, Solution of a nonlinear equation, bisection and secant methods. Newton-Raphson method, rate of convergence, solution of a system of nonlinear equations.

Unit V - Numerical solution to ODE (10 hrs)

Euler and Runge-Kutta methods, multistep methods, predictor-corrector methods, order of convergence, finite difference methods, numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations. Eigenvalue problem, power method, QR method

Text Book:

1. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
2. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering, 2012, New Age International Ltd., 6th Edition.
3. R.L. Burden and J. D. Faires, Numerical Analysis, 2012, 4th Edition, Brooks Cole.

Reference Books:

1. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2021.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. R. Agor, Elements of Mathematical Analysis, Khanna Publishing House, 2015.

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PONDICHERRY UNIVERSITY

PUDUCHERRY 605 014

M.P.A.

DRAMA AND THEATRE ARTS

Syllabus & Regulations

Department of Performing Arts

I SEMESTER

DRAM 411 DRAMATIC LITERATURE - CLASSICAL INDIAN

Course Number : DRAM 411
Course title : DRAMATIC LITERATURE – CLASSICAL INDIAN

Credits	: 3 Credits
No. of contact hours (per week)	: 3 Hours
Type of the Course	: Hard core
General Information	: Theory
Semester & Year	: I Semester
Prerequisite	: NIL
Regular Teaching	: Yes
Practical if applicable	: No
Seminars	: Yes
Assignment	: Yes
Test	: Yes

Course Objectives and outcome of the Course:

This course introduces Natyashastra, Tolkappiam, Silappathikaram and some of the major Indian Sanskrit plays and its' authors. Out of these students will get the richness of the Indian dramatic grammar and Sanskrit plays and their effectiveness in the performance Culture of the Indian society.

Content and concept of the course:

Unit-1: An introduction and History of Indian Theatre and Drama

Unit-2: Classical Plays and Playwrights of India

Unit-3: Types and form of classical plays-play analysis based on Dhasarupaka

Unit-4: Classical plays Part 1-

Bhasa's Urubhangam,

Kalidasa's Abhijana Sakunthalam,

Unit-5: Classical plays Part 2-

Sudraka's Mircchakadikam

Mahendravarma Pallava's Mattavilasa Prahasana

Materials, Supplies, Text books and/or recommended or Required Readings:

1. Abhinavagupta, & M Ramakrishna Kavi. (1934). *Natyasastra*. Oriental Inst.

2. AdyaRangacharya. (1980). *The Indian Theatre*. National Book Trust.
3. Bharata Muni. (1956). *Natyasastra.* (M. Ghosh, Trans.). Manisha Granthalaya.
4. Brandon, J. R., & Banham, M. (1997). *The Cambridge guide to Asian theatre*. Cambridge University Press.
5. K. Vallaivaaranar. (n.d.). *Tholkappium : Meippattial (Uraikalam)*. Madurai.
6. Kārttikēcu Civattampi. (1981). *Drama in ancient Tamil society.* NCBH.

DRAM 412 CLASSICAL INDIAN THEATRE

Course Number : DRAM 412
Course title : CLASSICAL INDIAN THEATRE

Credits	: 3 Credits
No. of contact hours (per week)	: 3 Hours
Type of the Course	: Hard core
General Information	: Theory
Semester & Year	: I Semester
Prerequisite	: NIL
Regular Teaching	: Yes
Practical if applicable	: No
Seminars	: Yes
Assignment	: Yes
Test	: Yes

Course Objectives and outcome of the Course:

Introduction to Classical Indian Theatre mainly covers origin of drama, theatrical elements in Natyasastra, and Silapathikaram and Tholkappiyam (Maippadugal). The outcome of the course will give firm base for students to understand their native theatre.

Content and concept of the course:

Unit-1: Dramaturgies of India - Introduction to Natyasastra, Thollkappiyam-Meippattiyal, Chilapathikaram- Arangetu Kathai.

Unit-2: Natyadharmi and Lokdharmi, Nirupana and Natyasastra-Tolkappiayam /

Unit-3: Bhava: Anubhava, vibava, styi Bhava and Sanchari Bhava - Concept of Rasas: Natyasastra-Thollkappiyam.Dasrupaka, SandhyangaVikalpa (Panchasandhis) - Vrithivikalpa - Prakrtis (Type of characters), BhumikaVikalpa (different roles),

Unit -4: Ahbhinayas:Ankia, Vachika, Aharya and Satvika Abhinaya

Unit- 5: AranketruKathai - Silapathikaram&Tholkappiyam – Meippattiyal

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Abhinavagupta, & M Ramakrishna Kavi. (1934). *Natyasastra*. Oriental Inst.
2. Bharata Muni. (1956). *Natyasastra.* (M. Ghosh, Trans.). Manisha Granthalaya.
3. Brandon, J. R., & Banham, M. (1997). *The Cambridge guide to Asian theatre*. Cambridge University Press.
4. K. Vallaivaaranar. (n.d.). *Tholkappium : Meippattial (Uraikalam)*. Madurai.
5. K.Sundaramoorthy. (1974). *Early Sanskrit Literary theories and Tholkappium*. Sarvodaya Ilakkiya Pannai.
6. Van, R., & Brandon, J. R. (1993). *Sanskrit drama in performance*. Motilal Banarsidass Publ.

DRAM 413 THEATRE ARCHITECTURE

Course Number : DRAM 413
Course title : THEATRE ARCHITECTURE

Credits	: 3 Credits
No. of contact hours (per week)	: 3 Hours
Type of the Course	: Hard core
General Information	: Theory
Semester & Year	: I Semester
Prerequisite	: NIL
Regular Teaching	: Yes
Practical if applicable	: No
Seminars	: Yes
Assignment	: Yes
Test	: Yes

Course Objectives and outcome of the Course:

Studying different kinds of performing art spaces and Theatrical architecture will enhance the spatial aspect of theatre practice.

Content and concept of the course:

Unit-1: Introduction to Theatre Architecture - Primitive Theatre - Greek Athenian Period, Greek Hellenistic Period, Greco- Roman Period, Roman Theatre

Unit-2: Middle Ages (Medieval Theatre Architectures) - Elizabethan Theatre – Restoration Period - Victorian Period Theatre.

Unit-3: Theatre in the Modern Ages – Proscenium, Thrust, Arena, Sandwich, Open Air Theatre - New Trends in Theatre Architecture – Chamber Theatre, Etc.,

Unit-4: Indian Classical Theatre in Natyasastra: Ancient Indian Concepts of Theatre and Theatre Buildings - Theatre Space of Indian Ritualistic Performances - Concepts of Vikrsta, Chasustra and Tryasara. Koothambalam - Kerala, Stages used in Theruk-k-koothu of Tamilnadu

Unit-5: Theatre Structure of NOH, Kabuki of Japan, Chinese Opera - Theatrical Elements in Silapathikaram (ArangketruKathai)/spatial aspects in the Traditional Theatre of Tamilnadu

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. *Bharatha's Natyasastra* (M. Ghosh, Trans.). (1984). The Asiatic Society.
2. Brandon, J. R., & Banham, M. (1997). *The Cambridge guide to Asian theatre*. Cambridge University Press.
3. Brockett, O. G., & Hildy, F. J. (2007). *History of the theatre*. Allyn And Bacon.
4. Hammond, M. (2006). *Performing architecture: opera houses, theatres and concert halls for the twenty-first century*. Merrell.
5. J.R.Brandon. (1974). *Theatre in the South-East Asia*. Harvard University Press.
6. Maruoka, D., & Yoshikoshi, T. (1982). *Noh*. Hoikusha.
7. Panchal, G. (1984). *Koothambalam and Kudiattam*. Sangeet Natak Akedemy.
8. *Silappathikaram.* (R.S. Pillai, Trans.). (1989). Tamil University Tanjore.

DRAM 414 TRADITIONAL ACTING

Course Number : DRAM 414
Course title : TRADITIONAL ACTING

Course Number	: DRAM 414
Course title	: TRADITIONAL ACTING
Credits Hours	: 3 Credits
No. of contact hours (per week)	: 6 Hours
Type of the Course (hard/soft core)	: Hard core
General Information	: Practical
Semester & Year	: I Semester

Regular Teaching	: Yes
Practical if applicable	: Yes
Assignment	: Yes
Test	: Yes
Practical Record	: Yes

Course Objectives and outcome of the Course:

The teaching objective of this course is to provide practical knowledge of any one of a South Indian regional Traditional Theatre form like; Therukuthu, Sri Sangaradas Swamigal Musical Drama, Koodiyattam, Kathakali, Theiyam, Yakshagana, Veethi Bhagavatham, etc., and also provide the practical knowledge through arranging workshop to Puppet Theatre from local region. The students learn the basic craft, technique, skills and Creative Expressions in these forms for strengthening their regional sensibility and ability in Acting.

Content and concept of the course:

Unit-1: Basics of Movements in the chosen Traditional Folk/Classical Theatre form: Adavus, Rhythm in movements, Techniques of Expressions; Physical,Vocal and Mental state of various characters - Singing with Sruti (Harmonium) and movements with Tala -Mituthangam/ Thavil and Cymbal .

Unit 2: Training to do a character in the chosen Episode/ Story of that particular Folk/Classical Theatre form – the details of his/her role including Dialogue, Songs, Rhythm and movements.

Unit-3: Selecting few dramatic scenes from Folk Theatre of Tamilnadu and practices with required percussionists and then run through with make-up and other necessary performance's accessories.

Unit-4: Field study (Tour) to a village performance /festival. Different form of Therukuthu and text in Therukuthu.

Unit-5: Learning Therukuthu/ Bayalatta / Veethi Bhagavatham **/** any one folk theatre through a workshop with a Traditional Master/Expert and doing the Performance in the end of the Workshop. - Submitting a Record note Book.

Materials, Supplies, Text books and/or recommended or required Readings:

1. Balawanta Garagi. (1962). *Theatre in India*. Theatre Arts Books.
2. *Enact*. (n.d.). Sangeet Natak Academi & NSD Pubn.
3. M.Ramasamy. (n.d.). *Therukuthil Nadippu*. Thanjavur Tamil University Publication.

4. Manohar Laxman Varadpande. (1979). *Traditions of Indian theatre*. Abhinav Publications.
5. Tarla Mehta. (1999). *Sanskrit play production in ancient India*. Motilal Banarsidass.
6. *Theatre India*. (n.d.). NSD Publication.

DRAM 415 MIME AND MOVEMENT

Course Number : DRAM 415
Course title : MIME AND MOVEMENT

Credits Hours	: 3 Credits
No. of contact hours (per week)	: 6 Hours
Type of the Course (hard/soft core)	: Soft core
General Information	: Practical
Semester & Year	: Odd/Even
Regular Teaching	: Yes
Practical if applicable	: Yes
Assignment	: Yes
Test	: Yes
Practical Record	: No

Course Objectives and outcome of the Course:

To develop creative expression with the basic movements of the hand, body and head as well as with foot work and bodily movements to create new movement patterns, creative dance and choreography

Content and concept of the course:

Unit-1: Basic Movement, Study of body anatomy, movements, rhythmic patterns with footwork

Unit-2: Mime – Traditional and Modern Mime – pantomime. Whole body exercises.

Unit-3: Choreography - Advanced exercises for body flexibility, Complex combination of movements of different parts of the body

Unit-4: Composition, Symmetry and Asymmetry - Choreography in mime- Mime Skits.

Unit-5: Designing choreography for performance, emotional expressions through body, working on stylized movements

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Ann Cooper Albright, & Gere, D. (2003). *Taken by surprise: a dance improvisation reader*. Wesleyan University Press.
2. Cynthia Jean Novack. (1990). *Sharing the dance: contact improvisation and American culture*. University Of Wisconsin Press.
3. Gelb, M. (2003). *Body learning: An introduction to the Alexander techniques* (4th ed.). Aurum Pr Ltd.
4. Iliev, A. (2014). *Towards a Theory of Mime*. Routledge.
5. Kaltenbrunner, T., & Procyk, N. (1998). *Contact improvisation: moving, dancing, interaction: with an introduction to new dance*. Meyer & Meyer Pub.
6. Lecoq, J. (2015). *The moving body: teaching creative theatre*. Bloomsbury.
7. Per Bari Rolfe. (2019). *Mimes on miming: writings on the art of mime*. Charlemagne Press.
8. Richards, T., Jerzy Grotowski, & Firm, P. (1995). *At work with Grotowski on physical actions*. Routledge.
9. Schneer, G. (1994). *Movement improvisation: in the words of a teacher and her students*. Human Kinetics.

DRAM 416 SCENE WORKS

Course Number : DRAM 416
Course Title : SCENE WORKS

Credit Hours	: 2 Credits
No. of Contact Hours (Per week)	: 2 Hours
Type of the Course	: Hard Core
Nature of the Course	: Practical
Semester	: I Semester
Prerequisite	: Nil
Regular Teaching	: Yes
Practical if applicable	: Yes
Seminars	: Nil
Assignment	: Yes
Test	: Yes

Course Objectives and Outcome:

This Scene study is a technique used to teach acting. One or more actors perform a dramatic scene and are then offered feedback from teachers, classmates, or each other. Scene Study is a very broad description for an acting class that will vary depending on the teacher or school that teaches it. Its foundation is in the performance of a "scene" or a segment of a play by the students. From this performance the instructor gives notes and suggestions to improve the student's acting. Scene Study is instrumental for actors to get experience being directed. For beginning actors, the Scene Study class may also include acting exercises that help them develop their technique

Content and concept of the course:

Unit-1: what is scene-concept and ideology of Scene, Elements of scene, what the characters and the relations, character dimensions, situations and actions

Unit-2: Scenes in different art forms – visualizing a scene; Building the scene, process of scene making for stage, adopting story or incident to the stage and making a script for stage scene.

Unit-3: Presenting a scene in stage, understanding is stage, stage geography, stage psychology, Stage -behavior, business, postures and gestures, entry and exits, falls, and improvisation.

Unit-4: Understanding the different genre of acting, working with any one scene from any script for practical performance making.

Unit-5: Preparation of a script of a Scene their own from a / story / play / news under the guidance of course teacher and presentation on stage to the Public.

Materials Supplies, Text book and / or recommended or required Readings

1. Adya Rangacharya. (1998). *Introduction to Bharata's Nāṭyaśāstra*. Munshiram Manoharlal Publ., C.
2. AdyaRangacharya. (1971). *The Indian Theatre*. National Book Trust.
3. Autor: Prasanna. (2013). *Indian method in acting*. National School Of Drama.
4. Manohar Laxman Varadpande. (1987). *History of Indian theatre*. Abhinav Publications.
5. Subramanium, P. (1996). *Bharatha Kala (Kotpadu)*. Vaanathi Publishers.

II SEMESTER (HARD CORE)

II SEMESTER (HARD CORE)				
SL.NO.	**COURSE CODE**	**COURSE TITLE**	**CREDIT**	**COURSE MODE**
1	DRAM 421	Theories of Western Theatre and Dramatic Literature	3	T
2	DRAM 422	Theories of Acting	3	T
3	DRAM 423	Theatre Exercises	3	P
4	DRAM 424	Lighting Design	3	P
5	DRAM 425	Set Design	3	P
		Total Credits	**15**	

DRAM 421 THEORIES OF WESTERN THEATRE AND DRAMATIC LITERATURE

Course Number : DRAM 421

Course title : THEORIES OF WESTERN THEATRE AND DRAMATIC LITERATURE

Credits Hours	: 3 Credits
No. of contact hours (per week)	:3 hours
Type of the Course (hard/soft core)	: Hard core
General Information	: Theory
Semester & Year	: II Semester
Prerequisite	: NIL
Regular Teaching	: Yes
Practical if applicable	: No
Seminars	: Yes
Assignment	: Yes
Test	: Yes

Course Objectives and outcome of the Course:

The course explores the western dramatic literature and outline history. Basics of Play analysis and Play reading should be thought in reference to western Drama.

Content and concept of the course:

Unit-1: Introduction and history of Western theater And Drama

Unit-2: Aristotelian Poetics and Greek plays to Modern plays

Unit-3: Ancient plays: Antigone- Sophocles

Unit-4: Renaissance plays: King Lear – Shakespeare

Unit-5: Modern Plays: Enemy of the People– Ibsen, Waiting for Godot – Beckett

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Aristotle. (2013). *Poetics*. Oxford University Press.
2. Carlson, M. (1996). *Theories of the theatre : a historical and critical survey, from the Greeks to the present*. Cornell University Press.
3. Hinchliffe, A. P. (1979). *Drama criticism : development since Ibsen ; a casebook*. London Macmillan.
4. Manfred Pfister. (2000). *The theory and analysis of drama*. Cambridge Univ. Press.

5. Tian, M. (2018). *The use of Asian theatre for modern Western theatre : the displaced mirror*. Palgrave Macmillan.
6. Trussler, S. (1994). *The Cambridge illustrated history of British theatre*. Cambridge University Press.

DRAM 422 THEORIES OF ACTING

Course Number : DRAM 422
Course title : THEORIES OF ACTING

Credits Hours	:3 Credits
No. of contact hours (per week)	:3 Hours
Type of the Course (hard/soft core)	: Hard core
General Information	: Theory
Semester & Year	: II Semester
Regular Teaching	: Yes
Practical if applicable	: No
Seminars	: Yes
Assignment	: Yes
Test	: Yes

Course Objectives and outcome of the Course:

In this course introduces the major acting theories, covers the Indian and Western concepts. All the students of performing arts must know these fundamental concepts and aesthetic principal to understand the creative process of performance.

Content and concept of the course:

Unit-1: Definition of Acting, History of Acting and Actor. Emergence of Actor – Classical Theories

Unit-2: Acting in Classical forms-Tragedy, Comedy, Farce, and Burlesque. Acting in Shakespearian Theatre, Acting Styles in French Comedy, Melodramatic Acting,

Unit-3: Naturalism and the Emergence of Realistic Actor, Stanislavsky's System of Acting, Chekov's Psychological Gestures.

Unit-4: Emergence of Non-Realistic Acting – Meyerhold's Bio Mechanism, Surrealistic Acting, Expressionism, Epic Theatre, Acting in Absurd Plays, Concept of Acting in Theatre of Cruelty and Acting in Poor Theatre

Unit-5: Actor and Acting in Contemporary theatre

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Abhinavagupta, & M Ramakrishna Kavi. (1934). *Natyasastra*. Oriental Inst.
2. Bharata Muni. (1956). *Natyasastra.* (M. Ghosh, Trans.). Manisha Granthalaya.
3. Brecht, B., Silberman, M., Giles, S., Kuhn, T., Davis, J., Romy Fursland, Victoria Williams Hill, Imbrigotta, K., & Willett, J. (2019). *Brecht on theatre*. Bloomsbury Academic.
4. Cleaver, J. (1967). *Theatre through the ages.* New York, Hart Pub. Co.
5. Dhir, S. (n.d.). *Styles of Theatre Acting*. Gian Publishing House.
6. Harrp, J. (1992). *Acting*. Routledge.
7. K. Vallaivaaranar. (n.d.). *Tholkappium : Meippattial (Uraikalam)*. Madurai.
8. Konstantin Stanislavsky. (1945). *My life in art : by Constantin Stanislavsky.* G. Bles.
9. Konstantin Stanislavsky, & Elizabeth Reynolds Hapgood. (2017). *An actor prepares*. Read Books Ltd. (Original work published 1936)
10. P S Rama Rao. (1975). *Makers of the modern theatre*. Lalitha Publishers.
11. Rao, A., & Sastry P., R. (1967). *A Monograph on Bharata's NatyaSaastra*. Natya Mandla Publishers.
12. Roach, J. (2011). *The player's passion : studies in the science of acting*. The University Of Michigan, , Cop.
13. Stanislavskij, K. S., & Hapgood, E. R. (1991). *Building a character*. Methuen.
14. Tocole, & Helen Krich Chinoy. (1996). *Actors on acting : the theories, techniques, and practices of the world's great actors, told in their own words*. Three Rivers Press.
15. V Ė Meĭerkholʹd, & Braun, E. (1969). *Mayerhold on theatre, translated and edited, with a critical commentary by Edward Braun.* Methuen.

DRAM 423 THEATRE EXERCISES

Course Number : DRAM 423
Course title : THEATRE EXERCISES

Credits Hours : 3 Credits
No. of contact hours (per week) : 6 Hrs.
Type: hard/soft core : Hard core

General Information	: Practical
Semester & Year	: I Semester
Prerequisite	: NIL
Regular Teaching	: Yes
Practical if applicable	: Yes
Seminars	: No
Assignment	: Yes
Test	: Yes

Course Objectives and outcome of the Course:

Daily morning exercise class focuses on eastern and western method of exercise. All these methods covered in this course to give basic training, introducing various methods of physical exercise and Theatre games to nurture the body, mind and voice of performing artist.

Content and concept of the course:

Unit-1: introduction to theatre exercises- Purpose of theatre excesses-preparation of voice, body and mind

Unit-2: Physical and Psychological phases of Theater exercises - warming up, Body Conditioning Exercises, Breathing Exercises for Relaxation and Concentration

Unit-3: Exercises for Body Joints and Limbs (Neck, Head, Chest, Hands, Trunk and legs) Exercises for senses: Touch, smell, sight, hearing and taste. Eye and Face Exercises – Different Exercises for Eye and Face Muscles selected from Natyasastra, Rhythm, Balance, impulse, flow, intuition, feeling: abstract and purpose in movements

Unit-4: Full Body Coordination, Exercises with Music Trust Exercises & Acrobatics

Unit-5: Voice and speech - 4 parts of voice exercises. Individual and group movement

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Ananthanarayanan, R. (2002). *Leaving through Yoga Madiram*. Chennai.
2. Barba, E., & Savarese, N. (1992). *The $secret art of the performer*. 19.
3. Boal, A. (2002). *Games for actors and non-actors*. Routledge.
4. Cassady, M. (1993). *Acting games improvisations and exercises*. Colorado Springs, Colo. Meriwether C.
5. Clive Barker. (2010). *Theatre games: a new approach to drama training*. Methuen Drama.
6. Martin, J. (2004). *The intercultural performance handbook*. Routledge.

7. Novelly, M. C. (7710). *Theatre Games for Young Performers: Improvisations and Exercises for Developing Acting Skills.* Meriwether Publishing Ltd., P.O. Box, Colorado Springs, Co 3 ($12.95.
8. Perry, J. (1999). *Encyclopedia of acting techniques: illustrated instruction, examples and advice for improving acting techniques and stage presence - from tragedy to comedy, epic to farce.* Cassell.
9. Spolin, V. (1986). *Theater games for the classroom: a teacher's handbook*. Northwestern University Press.

DRAM 424 LIGHTING DESIGN

Course Number : DRAM 424
Course title : LIGHTING DESIGN

Credits Hours	: 3 Credits
No. of contact hours (per week)	: 6 Hours
Type of the Course (hard/soft core)	: Hard core
General Information	: Practical
Semester & Year	: II Semester
Regular Teaching	: Yes
Practical if applicable	: Yes
Assignment	: Yes
Test	: Yes
Practical Record	: Yes

Course Objectives and outcome of the Course:

An introduction to aesthetics and technical principles of lighting with attention to becoming familiar with basic instruments and lighting control board. Students learn basics of production lighting design. Basic principles of lighting design, includes script analysis, basic 3-point lighting, fill, key, differences between perceived (live, stage) light, and recorded light (video, film). Addresses various lighting design formats including production for video, film, theatre, and new media.

Content and concept of the course:

Unit-1: Introduction to Lighting Design and Lighting Instruments- Lights-Lighting-Stage Lighting, -Natural Lights- Artificial Lights- Stage Lighting and the Elements of Design-Stage Lighting and Theatrical Form-Function of Stage Lighting - Purpose of Stage Lighting and Principles of Lighting Design. Choosing the Right Instruments-Incandescent Lamps-Gaseous Discharge Lamps-Common Stage Instrument Lamps,-

Arc Light-The Plano-Convex Spotlight-The Ellipsoidal Reflector Spotlight-The Fresnel Spotlight-The PAR Fixture-Floodlights or Scoops Projection-Other Theatre Instruments-Care and Handling.

Unit-2: Colour Theory and Elements of Electronic -Color and Light-Color is Light- The Language of Color-Color Filtering-Color Interaction-Color Perception-Designing with Color-A Method of Using Color- Color Media. The History of Dimming-Elements of Electronic Control-Types of Electronic Control-State-of-the-Art Memory Systems-Designing with Electronic Control-The Operator and Remote Control-Distribution Control

Unit-3: Light as Scenery and Stage Lighting Practice-Projection Techniques and Equipment-Practical's- Special Effects-Stage Lighting Practice-The Light Plot and Production. Distribution-Angles and Direction of Lighting-Lighting the Acting Area-Lighting the Background-Hanging and Adjusting Lighting Fixtures- Focusing and Troubleshooting and Script Analysis for Lighting Purposes.

Unit-4: Design: Paperwork-The Collaborative Process-Lighting Plot-Lighting Sections-Lighting Instrument Schedule-"Magic" Sheet-Patching Schedule-Cue Sheet-Realizing the Plot-Drafting Practice for Light Plots-Storyboard Project -Computer Control and Lighting, Light Plot/Schedules Final Project Due

Unit-5: Stage Lighting and Theatre Space -The Proscenium Theatre-Arena Production-Thrust Stage Production-The Flexible Stage-Lighting for Alternative Spaces and Lighting for Dance. Development of a Lighting Designer-Role of the Lighting Designer-Lighting the Actor-Aesthetics and Creative side of the Lighting Design, -Lighting Design as a Profession-Famous Master Lighting Designer and their Works

Required Tools:

1. Electrical tester, 2. Cutting Player, 3. Cable trimmer, Synthetic Rubber Gloves, Insulation Tape, Colour sheets- Celluloid,

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Fitt, B., & Thornley, J. (1995). *Lighting by design: technical guide*. Focal.
2. Gillette, J. M. (2004). *Theatrical design and production.* McGraw-Hill.
3. Howard, J. (1963). *Stage lighting design.* Los Angeles, Los Angeles State College.
4. J Michael Gillette, Mcnamara, M., & Focal Press. (2020). *Designing with light : an introduction to stage lighting*. Routledge.

5. Palmer, R. H. (1998). *The lighting art: the aesthetics of stage lighting design*. Prentice-Hall.
6. Reid, F. (2001). *The stage lighting handbook*. A & C Black.
7. Rosenthal, J., Wertenbaker, L., & Kinsella, M. (1972). *The magic of light : the craft and career of Jean Rosenthal, pioneer in lighting for the modern stage*. Little, Brown In Association With Theatre Arts Books.
8. W Oren Parker, R Craig Wolf, & Block, D. (2013). *Scene design and stage lighting.* Wadsworth; Andover.
9. Walters, G. (2001). *Stage lighting: step-by-step: the complete guide on setting the stage with light to get dramatic results*. Betterway Books.

DRAM 425 SET DESIGN

Course Number : DRAM 425
Course title : SET DESIGN

Credits Hours	: 3 Credits
No. of contact hours (per week)	: 6 Hours
Type of the Course (hard/soft core)	: Hard core
General Information	: Practical
Semester & Year	: II Semester
Regular Teaching	: Yes
Practical if applicable	: Yes
Assignment	: Yes
Test	: Yes
Practical Record	: Yes

Course Objectives and outcome of the Course:

This course is intended to teach the basic functions, aesthetics, and methods of scenery in its context of planning, fabrication, and painting. The “planning” portions will give the student experience with designing, drafting, and model making. The “fabrication” portions will deal with techniques and materials of the scene shop. The “painting” portion will deal with scenic paint and its various techniques. The lab scheduled in conjunction with this class will provide the student with “hands-on” experience in all of the above. The student will also be required to choose one of three crews that will work on the departmental productions.

- Develop an understanding of design practices utilized in theatrical scenic design.
- Learn to analyze a script from a scenic design perspective.

- Develop research skills in scenic design.
- Develop a scenic design process.
- Develop skills in representing initial design decisions through thumb-nail sketches and floor plans.
- Develop skills in making 2-D representations of final design decisions through creating theatrical floor plans, perspective sketches and renderings.
- Develop skills in making 3-D representations of final design decisions through creating concept, white, and presentation models.

Content and concept of the course:

Unit-1: Introduction of Stage Design, Different Types of Stages and its Divisions – Open Air, Arena, Sandwich, Thrust and Proscenium

Unit-2: Set Design – Units of the Set (Ramps, Steps, Platforms, Flats), Types and Styles of Sets through History- Box, Formal, Multiple, Suggestive and Symbolic

Unit-3: Stage Properties- Set Properties, Hand Properties, Decorative, Properties, analyzing a Play for Set Design

Unit-4: Ground Plan, Elevation and Perspective& Model Making

Unit-5: Innovations and Experiments in Set Design

Required Tools:

Architect's Scale Ruler, 30-60-90 Drafting Triangle, Drafting Vellum, Drafting Pencil 2H, Tape Measure of at least 16' long, Pencils (for use during lab).

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Berrigan, T., & Padgett, R. (1969). *Noh*. Lines Press.
2. Braun, E., & Open University. Modern Drama Course Team. (1977). *The director and the stage: a companion for units 12-30*. Open University Press.
3. Crabtree, S., & Beudert, P. (1998). *Scenic art for the theatre: history, tools, and techniques*. Focal Press.
4. Domba Asomba. (2001). *Scene design: art and craft*. Caltop Publications (Nigeria) Ltd.
5. J Michael Gillette, & Dionne, R. (2020). *Theatrical design and production: an introduction to scene design and construction, lighting, sound, costume, and makeup*. Mcgraw-Hill.
6. Panchal, G. (1984). *Koothambalam and Kudiattam*. Sangeet Natak Akedemy.
7. Paul Douglas Carter, & Chiang, G. (2012). *Backstage handbook: an illustrated almanac of technical information*. Broadway Press.
8. Payne, D. R. (1985). *Theory and Craft of the Stenographic Model*. Southern Illinois University Press.

9. Pecktal, L. (1995). *Designing and drawing for the theatre*. Mcgraw-Hill.
10. Phillippi, H. (1953). *Stage Craft and Scene Design*. Houghton Mifflin Company.
11. Pinnell, W. H. (1996). *Perspective rendering for the theatre*. Southern Illinois University Press.
12. R Craig Wolf, & Block, D. (2014). *Scene design and stage lighting*. Wadsworth.
13. R Raju. (n.d.). *NadakathThozilNunukkam – KatchiAmaippu*.
14. Reid, F. (1995). *The Staging Hand Book*. A&C Black.
15. Reid, F. (2017). *Designing For The Theatre.* A & C Black.
16. Richardson, S. S. (1996). *Technical Theatre Hand Book*. WPI London.
17. Woodbridge, P. (2000). *Designer drafting for the entertainment world*. Focal.

III SEMESTER (HARD CORE)

III SEMESTER (HARD CORE)				
SL.NO.	**COURSE CODE**	**COURSE TITLE**	**CREDIT**	**COURSE MODE**
1	DRAM 511	Dramatic Literature – Modern Indian	3	T
2	DRAM 512	Make-Up Design	3	P
3	DRAM 513	Costume Design	3	P
4	DRAM 514	Direction Theories	3	T
5	DRAM 515	Play Production	3	P
6	DRAM 516	Acting Methods	3	P
		Total Credits	**18**	

DRAM 511 DRAMATIC LITERATURE - MODERN INDIAN

Course Number : DRAM 511
Course title : DRAMATIC LITERATURE- MODERN INDIAN

Credits Hours	:	3 Credits
No. of contact hours (per week)	:	3 Hours
Type of the Course	:	Hard core
General Information	:	Theory
Semester & Year	:	III Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	No
Seminars	:	Yes
Assignment	:	Yes
Test	:	Yes

Course Objectives and outcome of the Course:

This course introduces some of the major Indian plays and their authors. Out of this, students will get the richness of the Indian plays and their effectiveness towards the society.

Content and concept of the course:

Unit-1: Modern Playwrights of India

Unit-2: Post independence Trends in Indian theatre and plays, influence of Folk cultures and ethnic cultures.

Unit-3: Modernism in Indian Drama some trends, Textual Analysis – Plot, Structure and theme. Text in modern and contemporary theatre.

Unit-4: Play Analysis: Part 1

Aadhe Adhure by Mohan Rakesh
EvamIndrajit by BadalSircar
Silence the court is in Session by Vijay Tendulkar

Unit-5: Play Analysis: Part 2

Naga Mandala by Girish Karnard
Aurungazeb by Indira Parthasarathy
Narkalikaran – N. Muthuswam

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Brandon, J. R., & Banham, M. (1997). *The Cambridge guide to Asian theatre*. Cambridge University Press.
2. Parthasarathy, I. (2019). *Indira Parthasarathy Three Plays: Comforting Illusions, Rain, Shrouded Bodies*. Authorspress.

3. Rabindranath Tagore. (1993). *Two Buddhist plays : the Court dancer & Chandalika*. Writers Workshop.
4. Wilson, E., & Goldfarb, A. (2003). *Living theater : a history*. Mcgraw-Hill.

For Further Reading:

- Intirā Pārttacārati. (2002). *Man, woman and dog*. Rupa & Co.
- K.A.Gunasekaran. (n.d.). *Sathyasothanai*.
- N.muthuswamy. (n.d.). *England*.
- Parthasarathy, I. (n.d.). *Mazhai(Rain)*.
- Tagore, R. (n.d.). *Chandalika*.

DRAM 512 MAKE-UP DESIGN

Course Number : DRAM 512
Course title : MAKE-UP DESIGN

Credits Hours	: 3 Credits
No. of contact hours (per week)	: 6 hours
Type of the Course (hard/soft core)	: Hard core
General Information	: Practical
Semester & Year	: III Semester
Prerequisite	: NIL
Regular Teaching	: Yes
Practical if applicable	: Yes
Seminars	: Yes
Assignment	: Yes
Test	: Yes

Course Objectives and outcome of the Course:

Make-up is armed with tricks, tips and tools of their trade. Every imaginable brush - blush, lip and eye shadow, as well as concoctions to help your make-up last longer, can be found in their invaluable and expensive make-up kit.

Content and concept of the course:

Unit-1: The Role of Make- up in Play Performance, Functions and Principles of Make-up., Facial Anatomy/ Types of Faces/Types of Eye Brows, Nose, Lips.

Unit-2: Introduction of Make-up materials, Applications of Base/Highlighting Place/Shading Places, Straight Make-up / Character Make-up.

Unit-3: Stylized Make – up, Mask like Make-up and Mask Making Unit – 8 Changing Wrinkles, Changing the eye brows, lips, Moustaches, Beards, Use of Crepe Hair.

Unit-4: Special effects – Cuts and Wounds, Burnings, Leprosy Make – up etc., analyzing a play in the point of view of Make-up Designing.

Unit-5: Prepare a Make –up plate for all the characters in a play, All the practical works should be compiled and maintained as a record book.

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Balsam, M. S., & Sagarin, E. (1957). *Cosmetics, science and technology.* Wiley-Interscience, [200.
2. Corson, R., Glavan, J., & Beverly Gore Norcross. (2019). *Stage makeup*. Routledge, Taylor & Francis Group.
3. Davis, G., & Hall, M. (2018). *The makeup artist handbook: techniques for film, television, photography, and theatre*. Routledge, Taylor & Francis Group.
4. Debreceni, T. (2019). *Special makeup effects for stage and screen: making and applying prosthetics* (3rd ed.). Routledge.
5. J Michael Gillette, & Dionne, R. (2020). *Theatrical design and production: an introduction to scenic design and construction, lighting, sound, costume, and makeup*. Mcgraw-Hill, A Business Unit of The Mcgraw-Hill Companies, Inc.
6. Jeeva. (1998). *Arangam Athan Kurugal*.
7. Swinfield, R. (2003). *Stage makeup: step-by-step: the complete guide to basic makeup, planning and designing makeup, adding and reducing age, ethnic makeup, special effects, makeup for film and television*. Betterway Books.

DRAM 513 COSTUME DESIGN

Course Number : DRAM 513
Course title : COSTUME DESIGN

Credits Hours	: 3 Credits
No. of contact hours (per week)	: 6 hours
Type of the Course (hard/soft core)	: Hard core
General Information	: Practical
Semester & Year	: III Semester
Prerequisite	: NIL

Regular Teaching	: Yes
Practical if applicable	: Yes
Seminars	: Yes
Assignment	: Yes
Test	: Yes

Course Objectives and outcome of the Course:

To develop costume design ability through study of elements and principles of design and research techniques, as well as developing visual and verbal communication skills. To gain an understanding of costume design as an applied art and essential part of the collaborative theatre production process. This course explores planning and design of performance costumes, including skills such as drawing, painting, production and play analysis. Writing, drawing, painting, research, reading and discussion of production are included in the work of this class.

Content and concept of the course:

Unit-1: What is costume, elements costumes, role of costumes in the performance, what is design and elements, principles of design, costume design and its Functions, performance and costume, artist and costume, costumes and other technical aspects of the performance

Unit-2: Study of Textiles, textile chart, fiber and different types, what are costume material and culture, beads, treads, different hand stitching methods, machine stitching methods, tailoring material, textile material, Rexene material, study of costumes from master performances, etc.,

Unit-3: Realistic a nonrealistic costume. Stylized costumes and its interpretations, costume design for other media, study the masters design, constructing and reconstructing methods, costume suppliers, costume makers, procuring costumes for a play, ward robe and washing/ cleaning techniques, referring costume list, mail list of material suppliers, and other costume artefacts.

Unit-4: Costume Plot, theatrical costume sketches, study of Indian dance costumes, traditional, professional, folk, mythological occasional costumes, different costume properties, jewelry, turbans and headgears its importance, visit the nearby theatre group and interacting with their activities and study the costumes, properties then making a brief report, sketches and other details about makers and material.

Unit-5: Mode of Wearing's through different periods (Culture, Region and Religion), Model Making, analyzing the play in terms of a costume designer, Costume Designing for a Play, finally prepare costume design record soft/hard copy with above information for final examination and submit to Course teacher

Project:

You will choose a play from any period, research the period as well as develop a visual concept, complete all the requisite paperwork and planning materials, and develop a set of rough sketches for ten costumes.

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. BicâtT. (2006). *The handbook of stage costume*. Crowood Press.
2. Cunningham, R. (2019). *MAGIC GARMENT : principles of costume design.* Waveland Press.
3. Ingham, R., & Covey, L. (2003). *The costume technician's handbook*. Heinemann.
4. J Michael Gillette. (2012). *Theatrical design and production : an introduction to scene design and construction, lighting, sound, costume, and makeup*. Mcgraw-Hill Companies.
5. Jackson, S. (2001). *Costumes for the stage : a complete handbook for every kind of play*. New Amsterdam Books.
6. Mullin, M., & Motley. (1992). *Designing and making stage costumes*. Theatre Arts Books/Routledge.
7. Prisk, B. (1979). *Stage costume handbook*. Greenwood.
8. Russell, D. A. (1985). *Stage costume design : theory, technique and style*. Prentice Hall.
9. Tan, H. (2018). *Character Costume Figure Drawing: Step-by-Step Drawing Methods for Theatre Costume Designers /*. Routledge (Publisher.
10. Thorne, G. (2001). *Designing stage costumes : a practical guide*. Crowood.

DRAM 514 DIRECTION THEORIES

Course Number : DRAM 514
Course title : DIRECTION THEORIES

Credits Hours	: 3 Credits
No. of contact hours (per week)	: 3 hours
Type of the Course	: Hard core
General Information	: Theory
Semester & Year	: III Semester
Prerequisite	: NIL
Regular Teaching	: Yes
Practical if applicable	: No
Seminars	: Yes
Assignment	: Yes

Test : Yes

Course Objectives and outcome of the Course:

The art and technical aspect of direction is covered in this course. The evolution of direction and his role in making performance are studied in detail.

Content and concept of the course:

Unit-1: The historical development of the Director, The Modern Director as an Artist, Duties of the Director, Interpretation of Scripts.

Unit-2: Director's craft: Action Analysis of a Script, Postscript for action analysis of the plot, External and Internal Action, Progressions and Structure, Analysis of Characters. Deciding Play production style.

Unit-3: Composition - Design, - ground plan. -Blocking,

Unit-4: Composition - Lighting, - Sound, working with actors and technicians,

Unit-5: Contemporary Indian Director and Directorial Methods -Post-Modern theories and Directorial Approaches.

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Ahart, J. (2001). *The director's eye: a comprehensive textbook for directors and actors*. Meriwether Pub.
2. Braun, E. (1977). *The director and the stage*. Open University Press Milton Keynes.
3. Clurman, H. (1997). *On Directing*. Fireside Rockefeller Center.
4. Cohen, R., & Harrop, J. (1984). *Creative play direction*. Prentice-Hall.
5. Grote, D. (1985). *Script analysis: reading and understanding the playscript for production*. Wadsworth Pub. Co.
6. James Michael Thomas. (2009). *Script analysis for actors, directors, and designers*. Focal Press/Elsevier.
7. Philippi, H. (1953). *Stage Craft and Scene Design*. Houghton Mifflin Company.
8. Pollard, M., Bingham, C., & Paker, J. (1993). *On stage*. Merlion.
9. Reid, F. (2001). *The Staging Hand Book*. Routledge.
10. Richardson, S. S. (1996). *Technical Theatre Hand Book*. WPI London.
11. Tocole, & Helen Krich Chinoy. (2013). *Directors on directing: a source book of the modern theatre*. Allegro Editions.

DRAM 515 PLAY PRODUCTION

Course Number : DRAM 515
Course title : PLAY PRODUCTION

Credits Hours	: 3 Credits
No. of contact hours (per week)	: 6 Hours
Type of the Course	: Hard-core
General Information	: Practical
Semester & Year	: III Semester
Regular Teaching	: Yes
Practical if applicable	: Yes
Assignment	: Yes
Test	: Yes
Practical Record	: Yes

Course Objectives and outcome of the Course:

The production process is as logical as the rehearsal process is creative. The Brain as metaphor for the production process. The right side (processing institution and creativity holistically and randomly) may be synonymous with rehearsal process. Ideas flow back and forth between actor and director and scene partners. Conversely, the left side of the brain that is responsible for logic production team. Production manager and producer, group director and other technical designers shall sit together and has to design the production in the aspect of script, time, place, style, range of the economics, play director everything. To whom, where, when, why, what shall decide by these production members with their expected outcome. The objective of the course is to introduce the designing process of production to the students so that they can produce their productions in a constructive, and in a scientific way.

Content and concept of the course:

Unit-1: Script reading and Production Script preparation-Production Planning - Design Research-Design Paper work-Design Models.

Unit-2: Casting, Finding designers, and other crew members, and work with actors and Technicians

Unit-3: Rehearsal – Blocking, Fine Tuning / Design Work/Music and Sound / Design Execution

Unit-4: Dress Rehearsal – Grand Run Through with Costume and Makeup / Light and Set, etc.

Unit-5: Technical Rehearsal-Grand Rehearsal – Invited Audience Performance-Post Production

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Hannah, D., & Olav Harsløf. (2008). *Performance design*. Museum Tusculanum.
2. Hewitt, B. (1952). *Play production*. J.B. Lippincott Co.
3. Mcguire, B., Clarke, S., & Hogg, G. (2003). *Student handbook for drama*. Pearson Publishing.
4. Peithman, S., & Offen, N. (2000). *The stage directions guide to working back stage*. Heinemann.
5. Powers, V. E., Chapman, J., Collewis, Landau, J., & Taenzer, R. (1957). *Plays for players and a guide to play production*. Row, Peterson.

DRAM 516 ACTING METHODS

Course Number : DRAM 516
Course title : ACTING METHODS

Credits Hours	: 3 Credits
No. of contact hours (per week)	: 6 hours
Type of the Course	: Hard core
General Information	: Practical
Semester & Year	: III Semester
Prerequisite	: NIL
Regular Teaching	: Yes
Practical if applicable	: Yes
Seminars	: Yes
Assignment	: Yes
Test	: Yes

Course Objectives and outcome of the Course:

Today's theatre is lacking of real technology which particular text demanding. Many armatures theatre People they do their work by imitating or using the available resources which are not fit in that particular production. It is not their fault but, it is the time to give a proper training on these acting technologies to the upcoming theatre Practitioners. They should know the old masters' acting techniques and the feasibility and flexibility of acting technology. The objective of the course is to strengthen the students towards theatre techniques so that they can do a meaningful and energetic play production in the future.

Content and concept of the course:

Unit-1: Realistic Acting techniques: Action Vs Activities, Pose Vs Postures, Gesture, Actors' Business, Actors' craft, Stanislavski's Emotional Memories, Observing and developing a character in acting.

Unit-2: Script Analysis from the point of Actor: Character analysis, Preparation of a French Scene and Performance. Realistic Acting techniques, Real Situation based Improvisation: Method of preparing an Actor's body and Voice and two actors' performance.

Unit-3: Acting Techniques based on Non-Realistic Acting, Improvisation exercises based on Psycho-Physical actions, Improvisation: Physical movement to psychological actions.

Unit-4: Farce acting techniques / Commedia dell'arte / Clown acting techniques.

Unit-5: Practical Assignment on solo and Group performances and Record submission

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Albright, H. (1974). *Acting is a creative process.* Dickenson Publishing Company.
2. Benedetti, J. (2008). *The art of the actor: the essential history of acting, from classical times to the present day*. Methuen Drama.
3. Benedetti, R. L. (2009). *The actor at work*. Pearson Allyn And Bacon.
4. Chekhov, M. (2019). *To the actor: on the technique of acting*. Digireads.
5. James Michael Thomas. (2020). *Script analysis for actors, directors, and designers*. Routledge.
6. Martin, J. (2004). *The intercultural performance handbook*. Routledge.
7. Miller, A. (1992). *A passion for acting: exploring the creative process*. Back Stage Books.
8. Zarrilli, P. B. (2002). *Acting (re)considered: a theoretical and practical guide*. Routledge.

IV SEMESTER (HARD CORE)

IV SEMESTER (HARD CORE)				
SL.NO.	**COURSE CODE**	**COURSE TITLE**	**CREDIT**	**COURSE MODE**
1	DRAM 521	Theatre In Education	3	P
2	DRAM 522	Students' Play Production	4	P
3	DRAM 523	Master Thesis	4	T
		Total Credits	**11**	

DRAM 521 THEATRE IN EDUCATION

Course Number : DRAM 521
Course title : THEATRE IN EDUCATION

Credits Hours	: 3 Credits
No. of contact hours (per week)	: 6 hours
Type of the Course	: Hard-core
General Information	: Practical
Semester & Year	: IV Semester
Prerequisite	: Teaching aids
Regular Teaching	: Yes
Practical if applicable	: Yes
Seminars	: Yes
Assignment	: Yes
Test	: Yes

Course Objectives and outcome of the Course:

This course bridges the gap between the theatre and the education. By the way of introducing theatre as a space for teaching programmes in child centered teaching and learning process. The outcome of the course will give firm base to understand the differences between children centered teaching and learning process. The teacher centered teaching and learning process of the pre-production that leads to the formation of children's theatre in the school curriculum.

Content and concept of the course:

Unit-1: Learning, Teaching, Curricula and Theatre in Education, The Challenge for Theatre in Education, Theatre in Primary and High school in Play Way Method

Unit-2: the Practical Perspective - Theatre as Competence, Skill, and Craft, The Educational Theory Perspective: Theatre as Subjective Experience, The Cultural Studies Perspective: Theatre as Cultural Practice

Unit-3: Theatrical Elements in Primary Education, Teaching and learning process, Aesthetics and Ethics, Theatrical devices for dynamic classes, Teaching environmental, Social Science through theatre Co-ordination Exercises: - Body, Mind and Voice Exercises

Unit-4: Theatrical methods class room and parallel Education, Theatre Arts is helpful to promote self-confidence, responsibility, self-esteem, cognitive, technical, human relations and communication skills Team work: - Students, parents (management) and staff

Unit-5: Converting subject as a play- Play analysis for the Primary School children, Differences between teacher centered and child centered play production. Benefits of theatre Education in an Educational institution, play production on the basis of child focused direction (constructed by the children)

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Easley, J. A., & Gallagher, J. M. (1978). *Piaget and education*. Plenum Press.
2. Kulkarni, P. S. (1994). *Drama in Education*. Reliance Publishing House.
3. Liben, L. S. (1983). *Piaget and the foundations of knowledge*. L. Erlbaum Associates.
4. Maguire, J. (1992). *Creative storytelling: choosing, inventing, and sharing tales for children.* Yellow Moon Press.
5. Mayer, F. (1959). *Education for creative living.* New York, Whittier Books.
6. McCaslin, N. (1987). *Creative drama in the intermediate grades.* Longman.
7. Montessori, M. (1914). *Dr. Montessori's own hand-book.* F.A. Stokes C.
8. Montessori, M. (2013). *The secret of childhood*. Aakar Books.
9. Ripley, J., & Meredith, P. (1973). *Drama in education*. Dept. Of Drama, University Of Calgary.
10. Swaminathan, V. (n.d.). *AachariyamYannnumGragam*. Sahitya Academy.
11. Tajima Shinji, & Hoffman, T. M. (1992). *The legend of planet surprise: and other stories*. Banseisha.
12. Tetsuko Kuroyanagi, & Chichiro Iwasaki. (2012). *Totto chan: the little girl at the window*. Kodansha America, Inc.
13. Velu, S. (2004). *Paradise Elephant (DevalogaYannai)a Children Theatre Guide for Special Teachers*. Labour Department Govt of Tamil Nadu.
14. Velu, S. (2006). *Irapaasi*. Uyirmai Publication.

DRAM 522 STUDENTS' PLAY PRODUCTION

Course Number : DRAM 522
Course title : STUDENTS' PLAY PRODUCTION

Credits Hours	: 4 Credits
No. of contact hours (per week)	: 8 hours
Type of the Course (hard/soft core)	: Hard core
General Information	: Practical

Semester & Year	: IV Semester
Prerequisite	: NIL
Regular Teaching	: Yes
Practical if applicable	: Yes
Seminars	: No
Assignment	: Yes
Test	: No

Course Objectives and outcome of the Course:

DIRECTING A PLAY: Students of final semester direct a Major Play with minimum of One-hour duration to demonstrate their caliber. Basic knowledge for Directorial process: Analyzing for play in terms of Production interpreting the script. Fixing the style and choosing the theatre. The production based on Dramatic script. A brief knowledge of the great Directors like Brecht, Stanislavski and Mayer hold is expected.

- Each student should maintain a record book.
- Each student should produce two plays – one for internal (One act play) and one for External (Full-length Play) evaluation.
- Along with the final production, the student Director with all details recorded in it should submit the complete production script. This will be evaluated along with the production by examiners.
- All the participants like Designer and Actor should submit their production design script and Actor's script with all details recorded in it.

Content and concept of the course:

Unit-1: selection of Play and Submission of production script

Unit-2: Script reading and Casting.

Unit-3: Work on set, Properties, and Costumes

Unit-4: Rehearsals - Music and Sound / Design Execution, Dress Rehearsal – Costume and Makeup / Light and Set/Technical Rehearsal, Grand Run Through

Unit-5: Public Show for Examination –– Invited Audience / Practical Record Submission. Performance and Post-Production work

REQUIREMENTS

This course is project-based, and each student will take on a distinct role in the process. Consequently, the specific course requirements will be tailored to each student, with every effort being made to ensure that the students' workloads are

roughly comparable. All students must submit two progress reports detailing your contributions to the project, assessing the extent to which you have achieved your goals.

DRAM 523 MASTER THESIS AND INTERNSHIP REPORT

Course Number : DRAM 523
COURSE TITLE : MASTER THESIS AND INTERNSHIP REPORT

Credits Hours	: 5 Credits
No. of contact hours (per week)	: As per Project
Type of the Course (hard/soft core)	: Hard core
General Information	: Theory/Practical
Semester & Year	: IV Semester
Prerequisite	: Yes
Regular Teaching	: No
Practical if applicable	: Yes
Seminars	: Yes
Assignment	: Yes
Test	: Yes

Course Objectives and outcome of the Course:

Students will submit a statement indicating the choice of dissertation subject. They should discuss dissertation possibilities with their advisors. Each student has to submit a dissertation under the supervision of a faculty. And the Students Must go to the field work to the Reputed Theatre Companies/ Theatre Repertories/ Govt Culture Departments/ Theatre Schools/ Television Production Companies/ Film Production Companies/Media Agencies with a period of one month and from that field work they will submit the Dissertations. The Attendance Certificate from the Companies should be important.

Content and concept of the course:

Unit-1: Dissertation proposal: Personal Resume/Plan for Research

Unit-2: Project Approval/Internship / Progress report 1 / Progress report 2

Unit-3: Synopsis submission / First Chapter Submission/ Second Chapter Submission

Unit-4: Final correction of thesis

Unit-5: Master's Dissertation Due and Final Viva-voce

Note: A Dissertation should be 50 – 100 pages with Introduction, and minimum three chapters with Final conclusion. This Dissertation should be submitted to the concerned

Guide fifteen days before the viva of each year. Three copies should be submitted in the format of hard bound.

The internship report: a formal report of 20 pages with a certificate of the organization or the master, where or under whom the student has completed the internship, for 21 days minimum.

Soft Core Courses

Soft Core Courses				
SL.NO.	**COURSE CODE**	**COURSE TITLE**	**CREDIT**	**COURSE MODE**
1	DRAM 417	Fundamentals of Visual Design	3	P
2	DRAM 418	Theatre Games	3	P
3	DRAM 419	Improvisation	3	P
4	DRAM 427	Theatrical Martial Arts	3	P
5	DRAM 428	Acting for Stage	3	P
6	DRAM 429	Environmental Theatre	3	P
7	DRAM 517	Folk Songs	3	P
8	DRAM 518	Traditional Indian Theatre	3	P
9	DRAM 519	Fundamentals of Music	3	P
10	DRAM 526	Children’s Theatre		
11	DRAM 527	Street Theatre	3	P
12	DRAM 528	Event Management	3	P
13	DRAM 529	Acting For Different Media	3	P
14	DRAM 530	Drama And Education	3	P
15	DRAM 531	Creative Writing	3	T
16	DRAM 533	Theatre Therapy	3	P
17	DRAM 534	Applied Theatre	3	P
18	DRAM 535	Music In Theatre	3	P
19	DRAM 537	Dramatics for Children	3	P
20	DRAM 538	Voice And Speech	3	P
21	DRAM 539	Sound Design	3	P
22	DRAM 540	Radio Play	3	P
23	DRAM 541	Stage Management	3	P
24	DRAM 543	Mask Making	3	P
25	DRAM 544	Folk Dance (Devarattam)	3	P
26	DRAM 546	Tales And Lore	3	P
27	DRAM 547	Puppet Theatre	3	P
28	DRAM 548	Script Writing	3	P
29	DRAM 549	Theatre Journalism	3	P

DRAM 417 FUNDAMENTAL OF VISUAL DESIGN

Course Number : DRAM 417
Course title : FUNDAMENTAL OF VISUAL DESIGN
Credits Hours : 3 Credits
No. of contact hours (per week) : 6 Hours
Type of the Course : Soft core
General Information : Practical
Semester &Year : I Semester
Regular Teaching : No
Practical if applicable : Yes
Assignment : Yes
Test : Yes
Practical Record : Yes

Course Objectives and outcome of the Course:

Introductions to spatial and temporal visual design include fundamentals of graphic design and aesthetic principles. This course outlines basic visualization techniques, spatial, temporal design communication. It covers the fundamentals of art and creative direction, setting and production design in all media.

Content and concept of the course:

Unit-1: what is visual, what is design, types of visuals, what is visualization, process of visualization, design, elements and fundamentals of design its Importance, their characters, principles of design, Dimension, Light and Movement, practice all under the guidance of the course teacher

Unit-2: Space, Unity, Interest, Balance and Movement, Proportion and Rhythm Types of Proportional Balance: Centre of Interest, Drafting, Drawing and, Rendering Medium and Drawing Materials, Gray Scale Drawing, Introduction to Ground Plan, Front Elevation, Cross-Section and Perspective Drawing, Construction of Space: Interior/Exterior, practice all under the guidance of the course teacher

Unit-3: Visualization and Interpretation, working on free hand drawing, collage, poster making study and write your appreciation on any advertisement of any media, study of a logo, illustration, photos, scenery, or improvise and work with junk material to get an artistic meaning out of it. shoot with your own mobile and get some still photos and motion photos and analyses with your observation of light and shade, colour, line, mass, texture, and principles of design, practice all under the guidance of the course teacher

Unit-4: To understand and practice golden rules in different forms – photography, Different types of photography. New media, its structure and functionality. Understanding elements of theatre and analyzing the light, Scenography, costumes, make-up, special effects in relations of visual design, practice all under the guidance of the course teacher

Unit-5: Design and aesthetics and their profound impact on how users perceive information and learn, judge credibility and usability, and ultimately assign value to an online experience. With this student has to submit a soft copy/ Hard copy of his or her class room practical record.

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Crabtree, S., & Beudert, P. (2005). *Scenic art for the theatre : history, tools, and techniques*. Focal Press.
2. J Michael Gillette, & Dionne, R. (2020a). *Theatrical design and production : an introduction to scene design and construction, lighting, sound, costume, and makeup*. Mcgraw-Hill.
3. J Michael Gillette, & Dionne, R. (2020b). *Theatrical design and production : an introduction to scenic design and construction, lighting, sound, costume, and makeup*. Mcgraw-Hill.
4. Pecktal, L. (1995). *Designing and drawing for the theatre*. Mcgraw-Hill.
5. Phillippi, H. (1953). *Stage Craft and Scene Design*. Houghton Mifflin Company.
6. Pilbrow, R. (1992). *Stage lighting*. Nick Hern.
7. Pinnell, W. H. (1996). *Perspective rendering for the theatre*. Southern Illinois University Press.
8. R Craig Wolf, & Block, D. (2014). *Scene design and stage lighting*. Wadsworth.
9. R.Raju. (n.d.). *NadakathThozilNunukkam – KatchiAmaippu*.
10. Reid, F. (2016). *Discovering stage lighting*. Abingdon, Oxfordshire New York, Ny Routledge.
11. Reid, F. (2017). *Designing For The Theatre.* A & C Black.
12. Robert Edmond Jones. (2004). *The dramatic imagination reflections and speculations on the art of the theatre*. Routledge.

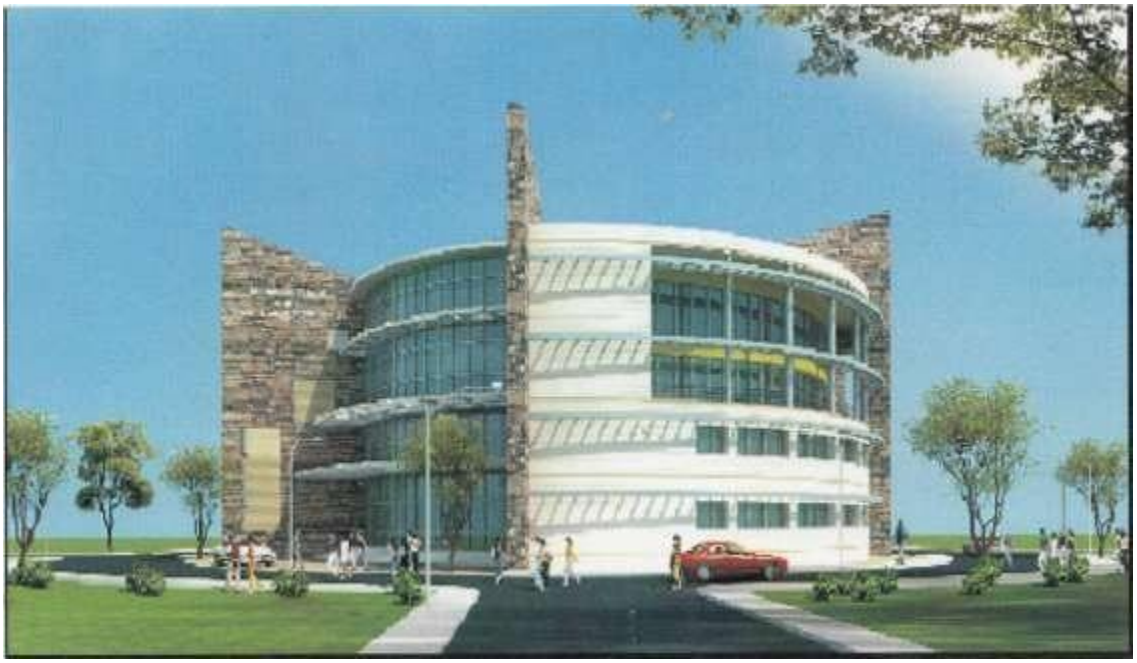
CENTRE FOR NANOSCIENCE AND TECHNOLOGY

Madanjeet School of Green Energy Technologies

PONDICHERRY UNIVERSITY

(Accredited with 'A' Grade by NAAC)

PUDUCHERRY - 605 014



M.Tech. - Nanoscience and Technology Programme

Syllabus & Regulations

2022-23 ONWARDS

Syllabus for Courses

Semester - I Credits: 18

NAST- 511: Essentials of Quantum Mechanics and Electromagnetic Theory

Outcome/Knowledge/Skill:

On completion of the course the student will be able to

- Understand basics of Nanoscience and Technology through Quantum Mechanics
- Visualization of Nanotechnology by Quantum mechanics
- Getting fundamentals of electromagnetic theory for the applications in Nanophotonics.
- Understanding the concepts of Electromagnetic theory.
- Will be able to calculate nanoparticles energy states and band gaps based on Quantum theory.
- The content of the course is rich enough so that the student can be competent to be able to grasp the concepts of Physics and Chemistry for Materials applications.

(Hard – Core Course)

L	T	P	C	
3	1	0	3	45L

Unit-I **(9 hrs)**

Introduction to Quantum Mechanics

Limitation of Mechanics at the Nanoscale - Success of Quantum Mechanics – Wave- particle Duality – Quantum mechanics of a free particle confined to 1–D potential barrier – Solution to Infinite Asymmetric Square Well Potential – Zero point energy – Particle in 3-D Potential – General treatment in Cartesian coordinates by Separation of Variables – Rectangular Box potential – The Cubic potential – Concept of Degeneracy related to symmetry – 3-D Problem in spherical Coordinates – Central Potential – General Treatment - Electrons in a periodic potential – Bloch Theorem – Schrodinger equation.

Unit –II **(9 hrs)**

Approximation methods: Essential of approximation methods - Time Independent Perturbation Theory – Non-Degenerate case – First and second order corrections - Non-generate case – Lifting degeneracy from a system.

Identical Particles: Schrodinger equation– Interchange symmetry. Systems of Identical particles (Classical and Quantum View) – Experiment on Indistinguishability– Exchange degeneracy – Symmetrization Postulate – Symmetric and antisymmetric wavefunctions – Comparison of Boson and Fermions - Constructing symmetric and antisymmetric functions (wave functions of two-, three-, and many-particle systems).

Unit - III **(9 hrs)**

Transport in nanostructures

Nanostructures connected to electron reservoirs - Current density and transmission of electron waves - The current density J - Tunneling through a potential barrier – Reflection and transmission coefficients - Tunnelling in field emission guns – Electron wavefunctions in Semiconductor Nanocrystals: Brus relation using a Particle in a Box model.

Unit – IV **(9 hrs)**

Quantum mechanics of Atoms and Molecules

Hamiltonian and Wave functions for Many-particle systems –Multi electron system – The structures of Many-electron atoms - Orbital approximation – Justification - H, He and Li atomic structure – The Pauli's principle – Total wavefunction of two-particle system including spin - Born – Oppenheimer approximation – Potential energy curve for diatomic molecule. Molecular orbital Theory – LCAO - Theory of H_2 molecule – H^+_2 - Bonding and anti-bonding orbitals – Bond Order - Term Symbols.

Unit-V **(9 hrs)**

Review of Electromagnetic Theory

Electrodynamics: Maxwell Equations – Maxwell's correction – Maxwell Equations in Vacuum and Matter - Importance of Maxwell equations. Continuity Equation – Derivation and Importance. Poynting Theorem - Energy distribution in EM waves. Electromagnetic waves in Vacuum and Matter. Reflection and Transmission at Normal and Oblique Incidences - Complex Refractive Index and Dispersion relation.

REFERENCE BOOKS

1. Quantum Mechanics: Concepts and Applications, Nouredine Zettili, Wiley, New York, (2001), ISBN 0-471 48943 3.
2. Molecular Quantum Mechanics (3rd Edition), P.W. Atkins and R. S. Friedman, Oxford University Press, (2004), ISBN: 0-19-566751-4.
3. Introduction to nanotechnology, Henrik Brus, (2004) MIC – Department of Micro and Nanotechnology, Technical University of Denmark.
4. Semiconductor Nanocrystals: A Powerful Visual Aid for Introducing the Particle in a Box, Tadd Kippeny, Laura A. Swafford, and Sandra J. Rosenthal, J. Chemical Education, Vol. 79(9), 2002, 1094-1100.
5. Introduction to Electrodynamics, David J. Griffiths, (ISBN: 978-81-203-1601-0), Prentice-Hall, India, (2009).
6. Quantum Mechanics, Vol I and Vol II, Claude Cohen-Tannaoudji, Bernard Diu, Franck Laloe, John Wiley & Sons (2005).
7. Quantum mechanics, J. L. Powell and B. Craseman, Addison-Wesley (1964).
8. Y T Tan et al. 2003 J. Appl. Phys. 94 633.
9. Classical electromagnetism J. D. Jackson, John Wiley Publications (1999) (ISBN 0- 471-30932-X).

NAST-512: Thermodynamics and Kinetics for Nanotechnology

Outcome/Knowledge/Skill:

On Completion of the course the student will be able to

- Understand fundamental Laws of Thermodynamics, and Chemical Kinetics of reactions.
- Understand the application of statistical thermodynamics concepts for complex reaction and particularly for monodispersed nanoparticle synthesis.
- Get knowledge of phase transformation and crystallization of materials, and skill for nucleation and growth pattern of a nanoparticle.

(Hard – Core Course)	**L**	**T**	**P**	**C**	
	3	**1**	**0**	**3**	**45 L**

UNIT-I **(9 hrs)**

Thermodynamic laws, Entropy, Statistical thermodynamics: micro-and macro-states. Unitary and multi-component systems, Gibbs phase rule, phase diagrams relevant to macro systems and for nanoscale materials formation, Phase transitions. General criterion for equilibrium-chemical potential and Gibbs free energy.

UNIT-II **(9 hrs)**

Statistical Thermodynamics: Concepts of probability and Maxwell Boltzmann distribution. Different ensembles and partition functions. Thermodynamic functions using appropriate partition functions. Fermi-Dirac and Bose-Einstein statistics and statistical basis of entropy. Heat capacity of solids. Debye and Einstein models. Thermodynamic functions of ideal gases, translational, vibrational and rotational contributions at different levels of approximation. Application of statistical thermodynamics concepts to ortho para hydrogen internal rotation - Calculation of equilibrium constants.

UNIT-III **(9 hrs)**

Phase Transformations: Fick's laws of diffusion, solution of Fick's second law and its applications, atomic model of diffusion, Temperature dependence of diffusion coefficient, Kirkendall effect. Thermodynamic considerations: Free energy of alloy phases and free energy- composition curves for binary systems.

UNIT-IV **(9 hrs)**

Nucleation and growth - energy considerations; heterogeneous nucleation, growth kinetics, overall transformation rates. Solidification: Nucleation and growth from liquid phase, stable interface freezing, cellular and dendrite growth, freezing of ingots, nucleation and grain size, segregation, directional solidification, growth of single crystals.

UNIT-V **(9 hrs)**

Precipitation from solid solution: Homogeneous and heterogeneous nucleation of precipitates, the aging

curve, mechanisms of age hardening, examples from Al-Cu and other alloy systems. Order-disorder Transformation: Examples of ordered structures, long and short-range order, detection of super lattices, influence of ordering on properties.

REFERENCE BOOKS

1. S. Glasstone, Thermodynamics for chemists, Affiliated East West Press, 1965.
2. B. C. McClelland, Statistical Thermodynamics, Chapman and Hall, 1973.
3. M. C. Gupta, Statistical Thermodynamics, Wiley Eastern Limited, 1993.
4. V. Raghavan, Solid State Phase Transformations, Prentice-Hall of India Pvt. Ltd. New Delhi, 1987.
5. D.A. Porter and K.E. Easterling, Transformations in metals and alloys, 2nd Edition, CRC Press, 1992.
6. D. Smith, Elementary Statistical Thermodynamics, Plenum Press, 1982.
7. J. Rajaram and J. C. Kuriacose, Thermodynamics for Students of Chemistry, Shobanlal Nagin Chand Co, 1986.
8. L. K. Nash, Elements of classical and statistical thermodynamics, Addison-Wesley, 1970.
9. G. M. Barrow, Physical Chemistry (V Edition), McGraw Hill international Series, 1988.
10. W. Atkins, Physical Chemistry, Sixth edition, Oxford University Press, 1990.

NAST-513: Elements of Materials Science and Properties of Nanomaterials

Outcome/Knowledge/Skill:

On Completion of the course the student will be able to

- Understand the basics of crystal structures and their defects.
- Describe Nanomaterials and their properties based on their dimensionality
- Describe bonding in Nanostructures.
- Describe various physical properties of solids/Nanomaterials

(Hard – Core Course)

L	T	P	C	
3	1	0	3	45 L

UNIT- I **(9 hrs)**

Crystal structures: Crystal geometry: crystal lattices, space lattices, basis and crystal structure, unit cell, lattice parameter of a unit cell - Seven crystal systems - Bravais lattices - Crystal directions and crystal planes (Miller indices) – Important parameters in crystal structures: Number of atoms per unit cell, coordination number, radius ratio, packing factor - Some special crystal structures - Calculation of lattice constant – Symmetry elements and symmetry operations - Point groups - Crystallographic nomenclature - Imperfections/defects in crystalline solids.

UNIT-II **(9 hrs)**

Bonding in Nanostructures: Atomic bonding in solids, Vander Waals interactions/Electrostatic interactions -, Hydrogen bonding - Hydrophobic interactions. Bonding in Graphene – Carbon nanotubes - Bonding in armchair, zigzag and chiral structures - n-m=3q rule, MXene – Inorganic nanotubes: Silica nanotubes, boron nitride nanotubes, Nanotubes of dichalcogenides, and Nanotubes of several metal oxides – Reactivity on Nanosurfaces: Functionalization of CNTs and Graphene.

Size effect of Nanomaterials: Size, shape, density, melting point, wet ability, specific surface area, solid state phase transformation and band gap variation - Quantum confinement, Effect of strain on band gap in epitaxial quantum dots.

UNIT-III **(9 hrs)**

Electronic Properties: Concept of energy band diagram for materials: Conductors, semiconductors and insulators - Classification of semiconductors – PN Junction, Electronic conductivity, band gap tuning/Engineering - band gap determination - Hall effect and its determination. **Optical Properties:** Optical Absorption, and transmission - Photoluminescence, Jablonski diagram, fluorescence and phosphorescence – Electroluminescence.

UNIT-IV **(9 hrs)**

Magnetic properties: Fundamentals of magnetism - Different kinds of magnetisms: dia, para, ferro, ferri and anti-ferromagnetic materials - Magnetic hysteresis – Classification of magnetic materials: hard and soft magnetic materials – Magneto-optic materials and their properties. - Superparamagnetism. **Dielctric Properties:** Effect of particles on dielectric properties, Ferro-electrics, piezo-electric, pyro-electric and muti-ferroics.

UNIT-V **(9 hrs)**

Mechanical behavior: Stress-strain behavior of metallic, ceramic and polymeric materials, Modulus of elasticity, yield strength, tensile strength, toughness, elongation, plastic deformation, visco-elasticity, micro-hardness, impact strength, creep, fatigue, ductile and brittle fracture, wear and friction of Nanomaterials; Effect of diffusion on strength and flow of materials, Methods of enhancing (or) retarding diffusion - **Thermal properties:** Heat capacity of solids, thermal conductivity and thermal expansion of solids – Thermal stresses; **Environmental degradation:** Corrosion and oxidation of materials and their prevention.

TEXT BOOKS

1. M.S.Vijaya,G.Rangarajan, Materials Science, Tata McGraw-Hill publishing company Ltd., New Dehli.
2. V.Ragavan, Materials Science and Engg., Prentice-Hall of India(p) Ltd, New Delhi.
3. The Physics and Chemistry of Solids, S.R.Elliott, John Wiley & Sons, England, 1998.
4. Theoretical Inorganic Chemistry – M.C. Day and I.Selbin, East –West Press, New Delhi, 1977.
5. Fundamental Properties of Nanostructured Materials, Ed. D. Fiorani (World Scientific, Singapore, 1994.

6. Nanostructured Materials and Nanotechnology – II, Eds. Sanjay Mathur and Mrityunjay Singh, Willey, 2008.
7. Understanding Solids: The Science of Materials, Tilley, Richard J. D. John Wiley & Sons,2004
8. Nanostructured Materials, Edited by Carl C. Koch, Noyes Publications, New York, 2002.

REFERENCE BOOKS

1. The Physics and Chemistry of Materials, Joel I.Gersten, F.W.Smith, S.R.Elliott, John Wiley & Sons, New York, 1998.
2. Properties of Materials, Robert E.Newnham,Oxford University Press, 2005.
3. Crystallography, Walter Borchardt-Ott, Springer, 1995.
4. Carbon Nanotubes Science and Applications, Edited by M.Meyappan, CRC Press, 2005.
5. Science of Fullerenes and Carbon Nanotubes, M.S.Dresselhaus, G.Dresselhaus, P.C.Eklund, Academic Press, 1996.

NAST-514: Synthesis and Characterization of Nanostructured Materials

Outcome/Knowledge/Skill:

Deals understanding at an advanced level of Physics and Chemistry for Nanotechnological applications and mainly focus on the design and development of efficient innovative nanostructured materials prepared by various methodologies and physicochemical characterization for technological applications that can facilitate widespread commercialization and it also acquired an understanding of selected areas of nanoscience and technology for various applications at the frontiers areas, beyond the undergraduate level

(Hard – Core Course)

L	T	P	C	
3	1	0	3	45 L

UNIT-I **(9 hrs)**

Soft Chemical processes

Synthesis of Nanomaterials by Soft Chemical Methods: Chemical precipitation and co- precipitation: Metal nanocrystals synthesis by polyol, and borohydrate reduction methods, Sol- Gel synthesis; Microemulsions synthesis, normal and reverse micelles formation, Hydrothermal, Solvothermal.

UNIT-II **(9 hrs)**

Chemical processes

Synthesis methods of dimensionally modulated Inorganic nanostructured materials Thermolysis routes, Microwave assisted synthesis; Sonochemical assisted synthesis, Core-Shell nanostructure, Organic – Inorganic Hybrids, Quantum dot (QDs) synthesis. Carbon Nanotubes, (SWCNT, MWCNT), Graphene nanosheets. Porous materials, Photochemical synthesis, Synthesis in supercritical fluids and Electrochemical synthesis

UNIT-III **(9 hrs)**

Physical processes

Fabrication of Nanomaterials by Physical Methods: Inert gas condensation, Arc discharge, RF- plasma, Plasma arc technique, Ion sputtering, Laser ablation, Laser pyrolysis, Ball Milling, Molecular beam epitaxy (MBE), Chemical vapour deposition (CVD) method. Template assisted synthesis, Catalyst assisted chemical vapour deposition (CCVD).

UNIT-IV **(9 hrs)**

Biological Methods of Synthesis

Use of bacteria, fungi, Actinomycetes for nanoparticle synthesis, Magnetotactic bacteria for natural synthesis of magnetic nanoparticles; Mechanism of formation; Viruses as components for the nanostructured materials; synthesis process and application, Role of plants in nanoparticle synthesis.

UNIT-V **(9 hrs)**

Nanostructured materials Characterization Techniques

X-ray diffraction (XRD), SEM, EDAX, TEM, Elemental mapping, FTIR, UV-Visible spectrophotometer, Nanomechanical Characterization using Nanoindentation, Differential Scanning Calorimeter (DSC), Differential Thermal Analyzer (DTA), Thermo gravimetric Analysis (TGA), TEM, X-ray Photoelectron Spectroscopy (XPS), ICP-AES chemical analysis, Electrochemical Characterization measurements and particle size analyzer.

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TEXT BOOKS

1. Nanochemistry: A Chemical Approach to Nanomaterials – Royal Society of Chemistry, Cambridge UK 2005.
2. Chemistry of Nanomaterials : Synthesis, properties and applications by CNR Rao et.al., Royal Society of Chemistry, Cambridge UK 2006.
3. Active Metals: Preparation, characterization, applications – A. Furstner, Ed., VCH, New York 1996.
4. Characterization of Nanophase materials – Z.L Wang (ed), Wiley-VCH, New York 2000.
5. Nanoparticles: From theory to applications – G. Schmidt, Wiley Weinheim 2004.
6. Nanostructured Silicon – based powders and composites – Andre P Legrand, Christiane Senemaud, Taylor and Francis, London New York 2003.
7. Processing & properties of structural naonmaterials - Leon L. Shaw (editor)
8. Elements of X-ray Diffraction by Cullity, B. D.,, 4th Edition, Addison Wiley, 1978.
9. Electron Beam Analysis of Materials by Loretto, M. H., Chapman and Hall, 1984.
10. Vacuum Physics and Techniques by T.A. Delcher, Chapman & Hall.

NAST-515: Nanostructure Fabrication and Metrology

Outcome/Knowledge/Skill:

Knowledge:

- Fabrication and Metrology (science of measurement) becomes important engineering aspect with respect to industry.
- It provides a source for lithography as well as non-lithogrpahy technology and test the materials with respect to dimension, chemistry etc.

Skill:

- Lithography as well as non-lithography taught at the M.Tech level results in the easy way to handle the fabrication tools.
- The students get acquainted with testing protocol – important for device technology.

(Hard – Core Course)

L	T	P	C	
3	1	0	3	45 L

UNIT-I

Principles of Photo Lithography **(10 hrs)**

Overview of lithographic process-Classification – Optical principles, Fresnel and Fraunhofer diffraction – Exposure methods –contact, proximity and projection printing – Mask Fabrication– Photoresist – positive and negative – properties of photoresist–Dill parameter –Projection system – Steppers and scanners – Cleanroom design and facilities.

UNIT-II **(8 hrs)**

Advances in Optical Lithography and Pattern transfer

Limitations of Optical Lithography – Lasers for Lithography – Deep and extreme UV lithography – Near field optical microscopy – Interference optical lithography – Maskless optical lithography– Resolution Enhancement Techniques–Vacuum techniques – Oxidation – Diffusion- Metallization - Doping techniques – ion implantation

UNIT-III **(9 hrs)**

Electron (E) - Beam Lithography: Electron Optics – Process, E beam sources, Raster and Vector scan – Proximity/Projection printing - SCALPEL – Direct writing – Interaction of electron with substrate – Electron Beam resist – E beam applications.

Xray Lithography: Principle, X-ray sources, system and components – resists, mask preparation, resolution enhancement.

Ion Beam Lithography: Focused Ion Beam – Process, Ion Source, Ion Column – Masked Ion Beam Lithography and Ion Projection Lithography.

UNIT-IV **(9 hrs)**

Nonlithographic patterning

Template based fabrication –Nanostencil, Nanoimprint and Nanosphere Lithography in device

fabrication– Soft Lithography, Microcontact Printing – Inkjet andScreen Printing – 3D printing - Stereolithography - Principle and methods of Nanowire Formation - Assembly, Integration - Additive and subtractive techniques of nano fabrication – Anodic Oxidation, Dip Pen Lithography

UNIT-V **(9 hrs)**

Metrology

Critical dimension (CD) – optical line width, defects, thickness and reflectance tools – ellipsometry – reflectometry – scatterometry – photoacoustic metrology –Electrical measurement-Dopant Concentration measurement techniques- surface defects - confocal microscopy,CD- SEM, TEM–AFM 3D surface mapping.

REFERENCE BOOKS

1. Chris Mack, Fundamental Principle of Optical Lithography, John-Wiley & Sons, Inc., Sussex, 2007, ISBN: 978-0-470-01893-4.
2. Zheng Cui, Micro-Nanofabrication Technologies and Applications, Springer-Verlag, Beijing, 2005, ISBN: 9783540289227.
3. U. Okoroanyanwu, Chemistry and Lithography, SPIE Press, Washington, 2011, ISBN: 9781118030028.
4. Michael Quirk, Julian Serda, Semiconductor Manufacturing Technology, Prentice-Hall Inc., New Jersey, 2001, ISBN: 9780130815200
5. Horst Czichos, Tetsuya Saito, Leslie Smith, SpringerHandbook of Materials Measurement Methods, Springer, New York, 2006, ISBN: 978-3-540-20785-6
6. Garry P. Wiederrecht, Handbook of Nanofabrication, First Edition, Elsevier, Amsterdam,
7. 2010, ISBN: 9780123751768.
8. Zheng Cui, Nanofabrication Principles, Capabilities and Limits, Springer, New York, 2008, ISBN:978-0-387-75576-2.
9. Ampere A Tseng, Nanofabrication Fundamentals and Applications, World Scientific, Singpore, 2008, ISBN:987-981-270-076-6.
10. Mark James Jackson, Microfabrication and Nanomanufacturing, Taylor & Francis, Boca Raton, 2005, ISBN:978-1-4200-2827-0.
11. Harry J. Levinson, Principles of Optical Lithography, SPIE Press, Third Edition, Washington, 2010, ISBN:9780819456601.
12. Ray F. Egerton, Physical Principles of Electron Microscopy – An Introduction to TEM, SEM and AFM, Springer, New York, 2005, ISBN:978-0387-25800-0.
13. John A. Rogers and Hong H. Lee, Unconventional nanopatterning technique and applications, John Wiley & Sons, Inc., New York, 2009, ISBN:978-0-470-009957-5.

NAST-510 : Synthesis and Processing Laboratory

Outcome/Knowledge/Skill:

Received training in research skills and methodology for novel chemical, physical and biological synthesis and processing approaches of nanomaterials.

(Hard – Core Course)	**L**	**T**	**P**	**C**	
	3	**1**	**0**	**3**	**45 L**

- Synthesis of $LiCoO_2$ by a simple solution combustion method
- Synthesis of calcium hydroxyapatite through aqueous precipitation technique.
- Bioglass synthesis through sol-gel method.
- Synthesis of semiconducting metal oxides by sono-chemical and microwave assisted methods.
- Preparation of Graphene by Chemical and electrochemical exfoliation method.
- Preparation of metal oxide nanorodes by hydrothermal method.
- Bio-synthesis of metal nanoparticles.
- Synthesis of multi-ferrite nanoparticles by dilute co-precipitation method.
- Preparation of Nanoporous material and Core –shell nanoparticles.
- Synthesis of gold and silver nanoparticles and its spectral analysis.
- Preparation of metal chalcogenide nanocrystals/quantum dots and its spectral studies.
- Preparation of carbon dots and its optical studies.
- Preparation of CdS, ZnS, ZnO and TiO_2 semiconducting nanoparticles and its spectral studies.
- Microwave-Assisted Hydrothermal Synthesis of Nanostructured Materials

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Semester - II **Credits: 21**

NAST – 521 Computational methods for Modeling and Simulations

Outcome/Knowledge/Skill:

On completion of the course the student will be able to

- Understand the scientific problems represented in mathematical forms such as differential equations and integral equations.
- Get introduction to Numerical methods in order to solve scientific problems.
- Get a good introduction and application how to simulate nanotechnological materials systems with the aid of computation and simulation.
- Made in simple way so that of all branches including biology can understand and do simulations.
- Good mathematical and computational skill will be developed. Will be able to computations for making crystals and carbon nanotubes.
- Will be Competent with Strong topics such as Monte Carlo simulations using Random numbers and finite difference and finite element methods are learnt to have an advanced computational technique.

(Hard – Core Course) **L T P C**

3 1 0 3 45L

UNIT – I **(9 hrs)**

Analytical methods

Ordinary differential equations – Introduction – Types – First and Second order DE - General solutions – Laplace transform – Linearity and Shifting properties - Application to common functions and differential equations – Separation of variables to ODE - Partial differential equations: Introduction - Separation of variables – First order and second order PDE – Solution to Wave equation, Laplace equation, Schrodinger equation and Diffusion equation.

UNIT – II **(9 hrs)**

Numerical Methods

Numerical Algorithms and Programming – Programming Language Fortran – Basics of Fortran – Arrays and Loops - Sub-Programs - Computer programs in Fortran for Numerical methods. **Numerical Differentiation** – Three, and Four point formulae from Taylor series – Problems - Numerical solution of a system of ordinary differential equations: Runge Kutta method - Adaptive step size control. **Numerical integration**: Newton- Cotes integration formulae – Rectangular, Trapezoidal rule, and Simpson's 1/3 rules – Simple and Composite rules - Simpson's 3/8 and 4/3 rules - Gauss quadrature method – Problems using 2- and 3-point Gauss quadrature formulas.

UNIT – III **(9 hrs)**

Numerical Linear Algebra: Matrices – Orthogonal and symmetric matrices - Solution of linear algebraic equations – Standard methods – Gauss Elimination method – Gauss-Jordan Elimination

method - Iterative methods for linear systems – Jacobi method – Gauss-Seidel method – Convergence - Eigenvalue problems - Computing Eigenvalues and Eigenvectors.

UNIT – IV **(9 hrs)**

Random numbers and Monte Carlo methods: Definition and Types of Random Numbers – Random number Generators (RNG) for True and Pseudo Random Numbers – - Properties of RNG - Uniformly distributed Pseudo random numbers - Computer clock – Linear Congruence method – Middle square method – Test for Random Numbers – Distribution, Correlation and Run Tests – Random numbers with Exponential and Normal distribution – Box-Muller algorithm - Simulation of radioactive decay - Numerical Integration using Monte Carlo simulation techniques for 1D cases.

UNIT – V **(9 hrs)**

Partial differential equations: Types - Parabolic, Hyperbolic and Elliptic equations - Finite difference method (FDM) for Parabolic, Hyperbolic and Elliptic equations – Central divided differences - Truncation errors - consistency - stability. Introduction to finite element method (FEM)– Definition - Basic elements - Structural modelling and fem analysis - Classification of the problem - Conceptual, structural and computational models - Structural analysis by the FEM - Verification and validation of FEM results.

REFERENCE BOOKS

1. Ferziger, J. H., Numerical Methods for Engineering Applications, 2nd ed., Wiley- Interscience ISBN 978-0471116219. (1998).

2. Computational Physics, J. M. Thijssen, Cambridge University Press, Cambridge, (1999).

3. Computational methods in Physics and Engineering, 2nd Edition, Samuel S.M. Wong, ISBN: 9810230176, World Scientific-Singapore (2003)

4. Structural Analysis with the Finite Element Method Linear Statics-Volume 1. Basis and Solids: Eugenio Oñate, Springer, (2009) Spain (ISBN: 978-1-4020-8732-5)

5. Scientific Computing: An Introduction with Parallel Computing, G. Golub and J.M. Ortega, Academic Press, (1993).

6. Scientific Computing: An Introductory Survey, Michael T. Heath, McGraw-Hill, New York, (2002).

7. Numerical Recipes in Fortran / F-90 / C, W.H. Press et. al., Cambridge Univ. Press (1996)

8. A First Course in Computational Physics, P.L. DeVries, John Wiley (1994).

9. Computational physics- Problem solving with computers, Rubin H. Landau, Manuel J. Paez, John Wiley & sons (1997).

10. Guide to Neural Computing Applications, L. Tarassenko, Arnold Publishers, (1998).

11. Genetic Algorithms in Search, Optimization, and Machine Learning, D. E. Goldberg, Addison Wesley, Reading, Massachusetts, (1989).

NAST-522: Polymers and Nanocomposites

Outcome/Knowledge/Skill:
On completion of the course the student will be able to

- Understand the basic concepts of polymers, their nomenclature and molecular weight determinations.
- Understand various polymerization techniques and polymerization mechanisms.
- Get familiarize with the basic concepts of conducting polymers and their applications in various advanced technologies.
- Understand various specialty polymers and their potential applications.
- Understand preparation, properties and applications of polymer and metal matrix nanocomposites.

(Hard – Core Course)

L	T	P	C	
3	1	0	3	45L

UNIT-I **(9 hrs)**

Elements of Polymer Science: Classification - Some basic definitions - Addition and condensation polymerizations and copolymerization - Mechanism of free radical, cationic and anionic polymerizations – Nomenclature – Tacticity; **Glassy solids:** Glass transition and melting temperatures and their determination by DSC - Factors affecting Tg, importance of Tg, relationship between Tm and Tg and their control; **Crystallinity in polymers**: Degree of crystallinity, factors affecting crysallinity of polymers, effect of crystallinity on the properties of polymers; **Polymerization Techniques:** Bulk, Solution, Suspension and Emulsion polymerizations; Polymerization using metal catalysts and surfactants.

UNIT-II **(9 hrs)**

Speciality polymers: Synthesis of aromatic polyethers, polyacetals, polyamides, polyurethane, polymers with metal in their backbone, P and S containing polymers, Bio-polymers, Bio-degradable polymers, Fire retardant polymers, Liquid crystalline polymers - **Molecular weight of polymers:** Number average, weight average and viscosity average molecular weights of polymers - Determination of molecular weight of polymers by GPC and Viscometry methods - Thermal analysis of polymers using DSC, TGA, DTA, and DMA.

UNIT-III **(9 hrs)**

Conducting Polymers: Discovery – Conducting mechanism – Classification of conducting polymers: Intrinsic and extrinsic conducting polymers - Chemical and electrochemical methods for the synthesis of conducting polymers – Applications of conducting polymers in corrosion protection, electrochemical energy devices and sensors.

UNIT-IV **(9 hrs)**

Nanocomposites: Introduction to Nanocomposites, Types of Nanocomposites - Methods for producing Nanocomposites – Properties of Nanocomposites.

Polymer Nanocomposites: Polymer/ Metal oxide nanocomposites - Polymer/CNTs nanocomposites - Polymer/Nanoclay based Nanocomposites and their properties and functional applications.

UNIT-V **(9 hrs)**

Other Kinds of Nanocomposites: Fractal based Glass- metal nanocomposites - Core-shell structured nanocomposites - Super hard nanocomposites and its designing and improvements in mechanical properties - Self-cleaning nanocomposites; Metal matrix nanocomposites: Metal with nanoceramic fillers such as TiO_2, SiC, ZrO_2 PTFE, CNTs and Graphene and their mechanical & corrosion resistance properties and functional applications.

TEXT BOOKS

1. Alfred Ruiden, Elements of Polymer Science and Engineering, Elsevier Science, 1998.
2. Bill Meyer, A Text Book of Polymer Chemistry, John Wiley & Sons, Singapore, 1994.
3. Gowariker and Viswanathan, Polymer Science, Wiley Eastern, 1986.
4. Nanostructured Conductive Polymers, Editor. Ali Eftekhari, Wiley, 2010.
5. Nanocomposites - Science and Technology - P. M. Ajayan, L.S. Schadler, P. V. Braun, Wiley-VCH, 2004.
6. A.J.Bard & L.R.Faulkner, Electrochemical methods-Fundamentals and Applications John Wiley & Sons, 3rd Edition, 2001.

REFERENCE BOOKS

1. George Odian, Principles of Polymerization, John Wiley & Sons, 1933
2. Conducting polymers with micro or nano meter structure, Meixiang Wan, Springer, 2008.
3. Polymer-Clay Nanocomposites, T.J. Pinnayain, G.W.Beall, Wiley, New York, 2001.
4. Composite Materials, Deborah D.L.Chung, Springer, 2002.
5. Yiu-Wing Mai and Zhong –Zhen Yu, Polymer-Nanocomposites, CRC Press, 2006.
6. E.Raub &K.Muller, Fundamentals of Metal deposition, Elseiver publishing Co, New York, 1967.

NAST-523: Fundamentals of Biology for Nanotechnology

Outcome/Knowledge/Skill:

On Completion of the course the student will be able to

- Understand basic cell structure and cell cycles.
- Understand the metabolic pathways to anabolism and catabolism of carbohydrate, protein and lipids.
- Get basic understanding of a living system and its energetics.

(Hard – Core Course) **L T P C**

3 1 0 3 45L

Unit I **(9 hrs)**

Nature, Properties and Function of Carbohydrates: Sugars-dissacharides, trioses, tetroses, pentoses, hexoses – stereoisomers - aminosugars, phosphosugars, sugar derivatives, deoxysugars - Oligossacharides-polyssacharides - homo and hetero polyssacharides, amylose, amylopectin, dextrans, limit dextran – starch - glycogen- synthesis and degradation-glycolysis, TCA cycle, glycosyl moieties, cell wall polyssacharides – cellulose, chitin. **Nature, Properties and Function of Proteins:** Amino acids, - essential and non essential - dipeptides, oligipeptides, polypeptides-monomers,dimers, oligomers - fibrous proteins and globulins - primary, secondary, tertiary, quarternary structures- disulfides, hydrogen bonds, schiff's base- amino and carboxy termini - alpha helix and beta pleats – triple helix - Ramachandran plots.

Unit II **(9 hrs)**

Nature, Properties and Function of Nucleic acids: Nitrogen bases-purines, pyrimidines, nucleosides and nucleotides – oligonucleotides - base paring – DNA, RNA-tRnNA, mRNA, rRNA, antisense RNA – linear and circular forms, single and double stranded– hypo and hyperchromicity - extra chromosomal DNA – mitochondrial, choloroplastic, plasmid and viral – microsatellites – DNA varieties – A, B, and Z – Okazaki fragment – palindrome-concatenation- polymorphism – mutation – strand breaks – genes – promoters, enhancers, structural genes - gene expression – gene silencing - transposons – telomeres.

Unit III **(9 hrs)**

Nature, Properties and Function of Lipids: Fats, Oils, Waxes - Fatty acids – types, saturated, unsaturated, essential, short and long chain – triglycerides, lipids and cholesterol - fatty acid / triglyceride / cholesterol synthesis and degradation – alpha, beta and omega oxidation of fatty acids.

Unit IV **(9 hrs)**

Biology of Cell and Cell Function: Types of cells –Glials, Astrocytes, Oligodendroglia, Fibroblasts - Cell proliferation and differentiation - Cell division – pluripotency, totipotency, progenitor cells, differentiated cells, cancer cells, - sub cellular components –locomotion-chemoattractants– pinocytosis, phagocytosis –mitosis and meosis – membrane structure-membrane transport - nuclear transport - transcription, translation, transduction, conjugation – Cell communication and Cell signaling-hormones- cytokines-natural products.

Unit V **(9 hrs)**

Bioenergetics and Protein thermodynamics: High energy compounds – ATP, GTP – synthesis and utilization – reducing equivalents – chemiosmotic process – biochemical kinetics – forward and reversible reactions – reaction free energy – enthalpy - entropy - denaturation kinetics – Arrhenius plot. **Biocatalysis & Structural biology:** Enzymes – active site, reaction rates, site specificity, sequence specificity, cofactor dependency, pH, temperature and ionic strength dependency – synthetic enzymes -enzyme classification - types of inhibition – enzyme immobilization - Industrial enzymes.

REFERENCE BOOKS

1. Harper's Biochemistry, 28th edition, Robert K Murray; Daryl K Garner; Peter A Mayes; Victor W Rodwell. Lange Medical Books/ McGraw Hill, New York, 2009.
2. Lehninger Principles of Biochemistry, 5th edition, David L Nelson; Michael M Cox. W.H.Freeman Publishers, New York, 2012.
3. Biochemistry, 3rd edition, Donald Voet and Judith Voet. John Wiley Publishers, 2010.
4. Cell & Molecular Biology, 8th edition, E.D.P.De Robertis. Lippincott publishers, 2010.
5. Molecular biology of the cell, 6th edition, Alberts. Garland Publishing, 2014.
6. Essentials of Molecular biology, David Freifelder, Jones & Bartlett Publishers, 1993
7. Genes, 9th edition, Lewin Benjamin. CBS Publishers and Distributors, 2007
8. Molecular Cell Biology, Harvey Lodish; David Baltimore; Arnold Berk. WH Freeman and Co, 2000.

NAST-524: Surface Engineering for Nanotechnology

Outcome/Knowledge/Skill:

Knowledge:

Surfaces are present in everything and how this surface are going to interact with the environment is important (eg., bio, sensor devices). NAST-624 provides an overview on the various aspects of surface interactions with liquid-solid-gas environment. It provides a selective understanding on the surface phenomenon involved in mechanical, electrical, optical, and biological world. This course provides another dimension in the surface understanding – for eg., to look into the mechanical aspects in the bio world

Skills:

- Ability to generate functional coatings (such as hydrophilic/ hydrophobic) and the measurement of physical properties
- Surface characterization tools and interpretation of the outcome

(Soft – Core Course) **L T P C**

3 1 0 3 45L

UNIT-I **(9 hrs)**

Introduction to Surfaces

Surfaces and Interfaces – Importance of Surfaces in Nano Regime – Thermodynamics of surfaces – surface energy – notation of surface structures – surface reconstruction -Surface and interfacial tension and measurement– contact angle and wetting – surfactants, and interfacial forces – Review of Surface Characterization Techniques – optical, topographic, chemical and mechanical properties (XPS, PIXE, RBS, SIMS, LEED, RHEED)

UNIT-II **(9 hrs)**

Processes at Solid Surfaces

Adsorption – Physisorption and Chemisorption – Adsorption isotherms (Langmuir and BET) – Reaction Mechanism (Langmuir-Hinshelwood and Eley-Rideal) – Sticking Probability –Types of Catalyst – Homo vs Hetero - Properties and preparation of Catalyst – TON, TOF, E factor - Surface and electronic properties of metal and metal oxide catalyst and its principle behind catalysis – Sabatier Principle – Bronstedt – Polanyi relation - Role of Surfaces, Interfaces, Morphology in Catalysis– Active sites incatalysis & determination – porous materials and supported catalyst – spillover and reverse spillover - Sensor

UNIT-III **(9 hrs)**

Role of Surfaces in Bio-nano interactions

Adhesion and its importance – Adhesion vs cohesion – Work in adhesion and cohesion
- Theories on adhesion (Bradley, Hertz, JKR) - Methods of adhesion measurement (Scotch Tape, Peel test, Scratch, Blister, Ultrasonic and acoustic microcavitation methods) – Adhesion measurement in cell (observational, probing and counting techniques) - Surface modification and adhesion - Adhesion of nanoparticles, cells and between nanoparticle & cells - Cancer cell surface interaction.

UNIT-IV **(9 hrs)**

Tribological Aspects of Surfaces

Tribological aspects of adhesion, friction and wear – Friction and Friction Types – Theories of Macro (Amontons, Coulomb) and Nanoscale friction (Tomlinson, Frenkel- Kontorova, Bowden and Tabor models)– Difference between macro and micro/nano tribology- Wear – Wear Mechanisms and types – identification of different mechanisms – Wear theory (Archard, Rabinowictz, Bassani and D'Acunto Theory)– Characterization techniques for friction and wear – Tribometer, Friction Force Microscopy, Nanoindentation and Nanoscratching – Methods to reduce wear and Friction –Fracture–Lubrication –Surface Coatings

UNIT-V **(9 hrs)**

Surfaces in Multidisciplinary Applications

Colloids– Optical and Electrical properties – Colloids in Drug Delivery – Electrical and Electronic properties of Surfaces –zeta potential - Corrosion – Coatings for corrosion protection – High temperature issues - New coating concepts in multilayer structures – thermal barrier coatings. Bioinspired materials – Tribology in Human Body, Artificial organs and Medical devices – Nanosurfaces in Energy, Environmental, Automobile and Industrial Applications

REFERENCE BOOKS

1. Gabor A. Somorjai, Yimin Li, Introduction to Surface Chemistry and Catalysis, Second Edition, John Wiley & Sons, New Jersey, 2010, ISBN: 978-0-470-50823-7.
2. HaraldIbach, Physics of Surfaces and Interfaces, Springer-Verlag, Berlin, 2006, ISBN: 978-3-540-34709-5.
3. Pankaj Vadgama, Surfaces and interfaces for biomaterials, First Edition, CRC Press, Boca Raton, 2005, ISBN: 0-8493-3446-6.
4. Peter J. Blau, Friction Scienceand Technology- From concepts to applications, Second Edition, CRC Press, Boca Raton, 2009, ISBN: 978-1-4200-5404-0.
5. I. Chorkendorff, J.W. Niemantsverdriet, Concepts of Modern Catalysis and Kinetics, First Edition, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2003, ISBN: 3-527- 30574-2.
6. Didier Astruc, Nanopaticles and catalysis, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2008, ISBN: 978-3-527-31572-7.
7. N. Birks, G. H. Meier, F. S. Pettit, Introduction to the high temperature oxidation of metals, Second edition, Cambridge University Press, 2006, 978-0-521-48042-0.
8. Bharat Bhusan, Nanotribology and Nanomechanics, Springer, Berlin, 2005, ISBN: 978- 3-540-24267-3.

NAST-525: Nanoelectronics and Bioelectronics

Outcome/Knowledge/Skill:

On successful completion of this course, the students will able to

- Understand the basic of nanoelectronics and bioelectronics
- Acquire knowledge on principle and operation of various electronics and biomedical devices, like FET, LED, MOSFET, etc.
- Acquire knowledge on utilization of various nanostructures for fabrications of nanoelectronic devices and biomedical devices

(Soft – Core Course)

L	T	P	C	
3	1	0	3	45L

UNIT-I **(9 hrs)**

LEDs and Semiconductor Lasers

Fundamentals of Semiconductor physics, Review of quantum confinement theory, optical phenomena in various quantum structures: quantum wells, quantum wires, quantum dots, superlattices. GaAs/ GaAlAs quantum well lasers, quantum wire lasers, quantum dot lasers, white light LEDs, vertical cavity surface emitting lasers, quantum cascade lasers, quantum well infrared detectors, digital logic based on quantum wells, GaN and other visible LEDs, semiconductor lasers.

UNIT-II **(9 hrs)**

Nanoscale MOSFETs

Challenges in miniaturization, quantum effects, thin oxides, random dopant fluctuations, tunneling and subthreshold currents, power density, hot electron effects, fundamental limits of MOS operations, MODFET (Modulation Doped FET), GaN based HEMT (High Electron Mobility Field Effect Transistors).

UNIT-III **(9 hrs)**

Molecular Nanoelectronics

Single molecular devices, Molecular nanowires, charge transport in organic materials, fabrication techniques for molecular electronics, organic LEDs, organic FETs, carbon nanotube and grapheme based FETs, Silicon nanowire based FETs,

UNIT-IV **(9 hrs)**

Single Electron Tunneling Phenomena and Devices

Single electron tunneling, charging energy, tunneling rates, single electron transistor, Coulomb blockade, Coulomb staircase, Bloch oscillations, negative differential resistance, resonant tunneling diode and resonant tunneling transistor.

UNIT-V **(9 hrs)**

Nanobioelectronics

Nanoelectronic biosensor, Nanowire, CNT and graphene based biosensors, DNA based biosensors, protein based biosensors, materials for biosensor applications, quantum dot based bioimaging, DNA based logic and computing elements

REFERENCE BOOKS

1. Nanoscale Transistors- Device Physics, Modeling and Simulation, M. Lundstrom and J. Guo, Springer, 2005, ISBN- 978-0-387-28003-5, 978-0-387-28002-8, 978-1-4419-3915-9.
2. Nanoelectronics- principles and devices, M. Dragoman and D. Dragoman, Artech House publishers, 2005, ISBN: 9781596933682.
3. Fundamentals of modern VLSI devices, Y. Taur and T. H. Ning, Cambridge University Press, 1998, ISBN: 0521559596, 9780521559591.
4. Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices, K. Goser, P. Glosekotter and J. Dienstuhl, Springer, 2005, ISBN 978-3-662-05421-5.
5. Handbook of Thin Film Materials, volume 5, edited by H.S Nalwa, American Scientific Publishers, 2002, ISBN: 9780125129084, 9780080533247.
6. Encyclopedia of nanoscience and nanotechnology, Edited by H.S. Nalwa, American Scientific Publishers, 2007, ISBN: 1-58883-001-2 , ISBN: 1-58883-159-0.
7. Overview of Nanoelectronic Devices, D. Goldhaber Gordon, Proceedings of IEEE, volume 85, 1997.
8. Nanoelectronics and Information Technology, W. Rainer, Wiley, 2003, ISBN: 978-3-527-40927-3
9. Nanosystems, K.E. Drexler, Wiley, 1992, ISBN:0-471-57518-6
10. Science of fullerenes and carbon nanotubes, M.S. Dresselhaus and G. Dresselhaus, Academic press, 1996, ISBN: 9780080540771.

NAST-526: Self Assembly of Nanostructures

Outcome/Knowledge/Skill:

Extend their knowledge of design of innovative nanostructured materials based on basic chemistry, physics, biology *via* self-assembly concepts applied to various applications including photonics, nanophotovoltaic and energy materials

Self-assembly of nanomaterials and their nanohybrids for technological applications

(Soft – Core Course)

L	T	P	C	
3	1	0	3	45L

UNIT-I **(9 hrs)**

Self organization of nanostructured materials, Growth Mechanism, Self assembly of Nanostructures: Chemical, physical and biological self assembly, Assembling and patterning of particles, Self organization of different Nano-morphologies (Quntum Dots, Nanorods, Nanowires and Nanotubes).

UNIT-II **(9 hrs)**

Self Assembled Monolayers (SAM), Guided Self Assembly - Nanolithography - Surface Topography - Surface Wetting - Electrostatic force; Nanomanipulators - Grippers – design - gripper arm geometry.

UNIT-III **(9 hrs)**

Bottom-up manufacturing: bottom-up approach, Self-assembly of single electron transistors, Photovoltaic related devices, Langmuir Bladgett films (LB): principle of formation of monolayer formation – from molecules to nanoparticles, compression of monolayer-fabrication of LB films-applications.

UNIT-IV **(9 hrs)**

Self-Assembly by micro contact printing- creating the stamp, substrate- creating self assembled monolayers -applications, Macroscopic expressions of Natural Nanomaterials- Hierarchical Ordering in Natural Nanoscale Materials

UNIT-V **(9 hrs)**

Bio-Inspired Approach for Complex Superstructures and Biological World, Self Assembly in biological systems: Superhydrophobicity, Self cleaning property, Multi scale ordering and function in Biological Nanoscale Materials: Proteins, Lipids, DNA and RNA and Shell as a Composite Materials.

REFERENCE BOOKS

1. Self Organized Nanoscale Materials: Nanostructure Science and Technology by Motonari Adachi and David J. Lockwood, 2006 Springer Science, Business Media, Inc. NY, USA

2. Self-Assembled Nanostructures: Jin Z. Zhang, Zhong-lin Wang, Jun Liu, Shaowei Chen, and Gang-yu Liu, 2003 Kluwer Academic/Plenum Publishers, NY, USA
3. Nanoparticles: Theory to Applications by Günter Schmid, 2010 WILEY-VCH Verlag GmbH & Co. KGaA, Boschstr. 12, 69469 Weinheim.
4. Hand Book of Nanotechnology, by Bharat Bhushan, 2007, Springer Science+Business Media, Inc, NY, USA.
5. Prospects in Nanotechnology: Toward Molecular Manufacturing, Markus Krummenacker and James Lewis (Editors), Wiley 1995.

NAST-520: Fabrication and Characterization Laboratory

Outcome/Knowledge/Skill:
On successful completion of this lab course, the students will able to

- Acquire knowledge on principle and operation of various fabrication devices.
- Acquire knowledge on fabrication of various nanostructures using various techniques like, e-beam, sputtering, electrospum, spin coating, dip-coating, and etc.

Acquire hands on training on most of fabrication techniques for fabrication of different nanomaterials.

(Hard – Core Course)

L	T	P	C	
0	2	4	3	45L

- Fabrication of thin films by thermal evaporation.
- Thin film fabrication by electron beam evaporation.
- Photocatalytic film fabrication by doctor-blade method and its photocatalytic studies on organic dyes.
- Nanocrystalline thin film by spin coating.
- Chemical bath deposition by dip coating.
- Fabrication of self standing film with QD embedded structure and optical property analysis
- Preparation polymer-semiconductor nanocrystalline films and study its electrical properties
- Fabrication of TiO_2 nanofibers on ITO glass substrate by Electro-spinning.
- Electrodeposition of polyaniline on ITO substrate.
- Electroless deposition of Ag or Au on Si substrate
- Electrical resistivity measurement by four probe method.
- Band gap determination by diffuse reflectance spectroscopy method.
- Polymer membrane electrolyte preparation and its porosity, electrolyte uptake and ionic conductivity studies.
- Electrophoretic deposition of tricalcium phosphate.
- Determination of thermal expansion of Nano-ceramic material by dilatometer.
- Film thickness measurement by ellipsometer.
- Nano indentation on a polycarbonate substrate using AFM for hardness determination.
- Mechanical evaluation of Nanomaterials.
- Clean Room: Familiarizing with essential terms, tools and practices.

- Synthesis of CNTs by CVD method.
- Dip-pen lithography using AFM with molecularinks.
- Nano-patterning by AFM lithography.
- Nanosphere lithography using silica Nanospheres
- Surface topography of a sputtered Au using AFM /STM.
- Surface topography of a sputtered Au using AFM / STM.
- Electrical resistivity measurement by Four probe method.
- Polymer membrane electrolyte preparation and its porosity, electrolyte uptake and ionic conductivity measurements.
- Determination of thermal expansion of Nano-ceramic material by dilatometer.
- Film thickness measurement by ellipsometer.
- Device fabrication like solar photovoltaics and energy storage
- LED conversion materials

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Semester - III **Credits: 21**

NAST-631: MEMS/NEMS and Microsystems

Outcome/Knowledge/Skill:

Knowledge:

Tailor made microelectro mechanical device fabrication has generated huge opportunity and challenges for the students. Though NAST-731 gets exposed to design, selection of materials, and fabrication of devices / testing in addition to issues in properties at lower dimension.

Skills:

Students get to understand the MEMS technology – fabrication as well as dimensional issues. The generic approach impart the skills of the student to face the real industrial scenario across different domains of application

(Hard – Core Course)

L	T	P	C	
3	1	0	3	45L

UNIT- I **(9 hrs)**

Mechanics and Materials

Overview of MEMS and Microsystems – Thin film growth and models –Mechanical, Electrical, Thermal properties for Thin Films/MEMS –Measurement techniques – Materials for MEMS-Semiconductors, Metals and Metal alloys, Ceramics, Polymers – Silicon and other substrate materials.

UNIT- II **(9 hrs)**

Processing of MEMS/NEMS and Microsystems

Silicon processing, Structure & properties – Single crystal growth - Overview of Lithographic process – Additive processes for Semiconductors, Ceramics, Metals and polymers - MEMS Fabrication – Doping process - Bulk micromachining - Wet & Dry Etching- Isotropic and anisotropic etching and mechanism - Etch stop techniques – DRIE and other processes- Surface Micromachining – LIGA and laser assisted processing – Nanomechanical system fabrication - Fundamentals of Design and Simulation.

UNIT- III **(9 hrs)**

Interconnects and Bonding

Interconnects – requirements of interconnects –Metallization Techniques — Damascene process-silicide and refractory metals - Multilevel and nanostructured interconnects – Bonding Techniques.

Packaging and Failure: Packaging Fundamentals – Packaging Techniques– Electrical and thermal requirements - Packaging Reliability and failure modes and analysis – MEMS process integration- Tribological issues

UNIT- IV **(9 hrs)**

Engineering Mechanics

Microsystem design – Static bending of thin films –Mechanical vibration– thermomechanics– fracture mechanics – Thermofluidics

UNIT- V **(9 hrs)**

Design and Applications

Scaling laws in miniaturization – Design considerations – Process and Mechanical design – Finite element method (FEM), Computer aided design CAD – Mircosensors and Microactuators– Optical, chemical, thermal, gas, pressure, bio and mechanical sensors – Nanosensors– Applications in automobile, aerospace, health care, industrial, consumer and telecommunications

REFERENCE BOOKS

1. Tai-Ran Hsu, MEMS and Microsystems – Design, Manufacture, and Nanoscale Engineering, Second Edition, John Wiley & Sons, Inc., New Jersey, 2008, ISBN: 978-0- 470-08301-7.
2. Reza Ghodssi, Pinyen Lin, MEMS Materials and Processes Handbook, Springer, New York, 2011, ISBN: 978-0-387-47316-1.
3. Nadim Maluf and Kirt Williams, An introduction to Micro electro mechanical systems Engineering, Second Edition – Artech House, Inc., Boston, 2004, ISBN: 1-58053-590-9.
4. Sami Franssila, Introduction to Microfabrication, Second Edition, John Wiley & Sons, Sussex, 2010, ISBN: 978-0-470-74983-8.
5. Marc Madou, Fundamentals of Microfabrication, Second Edition, CRC Press, Boca Raton, 2002, ISBN: 0-8493-0826-7.
6. Francisco J. Arregui, Sensors based on nanostructured materials, First Edition, Springer-Verlag, New York, 2009, ISBN: 978-0-387-77752-8.
7. Bharath Bhushan, Springer Hand Book of Nano Technology, Third Edition, Springer- Verlag, New York, 2010, ISBN: 978-3-642-02524-2.
8. Sergey Edward Lysherski, MEMS and NEMS Systems, devices, and structures, First Edition, CRC Press, Boca Raton, 2002, ISBN: 9780849312625.
9. H. Baltes, O. Brand, G. K. Fedder, C. Hierold, J. G. Korvink, O. Tabata, Enabling Technology for MEMS and Nanodevices, Wiley-VCH, Weinheim, 2013, ISBN: 978-3- 527-33498-8..
10. Danny Banks, Microengineering, MEMS, and Interfacing - A Practical Guide, Taylor & Francis, Boca Raton, 2006, ISBN: 978-0-8247-2305-7.
11. C.P. Wong, Kyoung-Sik (Jack) Moon, Yi Li, Nano-Bio- Electronic, Photonic and MEMS Packaging, Springer, New York, 2010, ISBN: 978-1-4419-0039-5.
12. Sandra Carrara, Nano-Bio-Sensing, Springer, New York, 2011, ISBN: 978-1-4419-6169-3.

NAST-632: Nanostructured Materials for Clean Energy Systems

Outcome/Knowledge/Skill:

Fundamental concepts and understanding of the structure-composition-performance relationships of materials for clean energy conversion and storage technological application. Fabrication and evaluation of prototype clean energy conversion & storage devices (Hydrogen generation & storage, DSSC and Perovskite based solar cells, lithium batteries, redox-flow batteries, supercapacitors, and fuel cells) for made-in-India program for our country sustainability and developing human resource in the clean energy areas.

(Hard – Core Course)	L	T	P	C	
	3	1	0	3	45L

UNIT-I **(9 hrs)**

Fundamental Concepts in Energy Systems

Electrochemical Cell, Faraday's laws, Electrode Potentials, Thermodynamics of electrochemical cells, Polarization losses in electrochemical cells, Electrode process and kinetics, Electrical double layer, Photoelectrochemical cell, thermoelectric effect.

UNIT-II **(9 hrs)**

Nanomaterials for Energy Conversion Systems

Issues and Challenges of functional Nanostructured Materials for electrochemical Energy, Conversion Systems, Hydrogen generation & Storage, Fuel Cells, Principles and nanomaterials design for; Proton exchange membrane fuel cells (PEMFC); Direct methanol fuel cells (DMFC); Solid-oxide fuel cells (SOFC), Current status and future trends.

UNIT-III **(9 hrs)**

Nanomaterials for Photovoltaic Solar Energy Conversion Systems

Principles of photovoltaic energy conversion (PV), Types of photovoltics Cells, Physics of photovoltaic cells, Organic photovoltaic cell cells, thin film Dye Sensitized Solar Cells, Quntum dot (QD) Sensitized Solar Cells (QD-SSC), Perovskite solar cells, Organic-Inorganic Hybrid Bulk Hetero Junction (BHJ-SC) Solar cells, Solar-water splitting, Current status and future trends.

UNIT-IV **(9 hrs)**

Nanomaterials for Energy Storage (Batteries) Systems

Issues and Challenges of functional Nanostructured Materials for electrochemical Energy Storage Systems, Primary and Secondary Batteries (Lithium ion Batteries), Cathode and anode materials, redox-flow batteries for HEV/EV transportation and stationary applications, Nanostructured Carbon based materials, Nano-Oxides, Novel hybrid electrode materials, Current status and future trends.

UNIT-V **(9 hrs)**

Nanomaterials for Energy Storage (Capacitor) Systems

Capacitor, Electrochemical supercapacitors, electrical double layer model, Principles and materials design, Nanostructured Carbon based materials, porous materials for Redox capacitor Nano- Oxides, conducting polymers based materials, Current status and future trends.

REFERENCE BOOK

1. Electrochemical methods: Fundamentals and Applications, Allen J.Bard and Larry R. Faulkner, 2nd Edition John Wiley & Sons. Inc (2004)
2. D. Linden Ed., Handbook of Batteries, 2nd edition, McGraw-Hill, New York (1995)
3. G.A. Nazri and G. Pistoia, Lithium Batteries: Science and Technology, Kulwer Acdemic Publishers, Dordrecht, Netherlands (2004).
4. J. Larmine and A. Dicks, Fuel Cell System Explained, John Wiley, New York (2000).
5. Science and Technology of Lithium Batteries-Materials Aspects: An Overview, A. Manthiram, Kulwer Academic Publisher (2000).
6. M. S. Whittingham, A. J. Jacobson, Intercalation Chemistry, Academic Press, New York (1982).
7. M. Wakihara, O. Yamamoto, (Eds.) Lithium Ion Batteries: Fundamentals and Performance, Wiley –VCH , Weinheim (1998).
8. Nanocomposites Science and Technology - P. M. Ajayan, L.S. Schadler, P. V. Braun.
9. Photoelectrochemical hydrogen generation, theory, materials advances, and challenges, by Pooja Devi, Springer Publications 2022, ISBN: 978-981-16-7285-9
10. Redox flow batteries, Fundamentals and applications by Zhang Huamin, CRC Press publications, ISBN: 9781498753944

NAST-633: Nanophotonics and Biophotonics

Outcome/Knowledge/Skill:

- On completion of the course the student will be able to understand the basics of Nanophotonics and Biophotonics based on Electromagnetic theory.
- Concepts of Photonics band gap will be understood.
- Learn the techniques on fabrication of 1, 2 and 3 D photonics crystals.
- Learn the applications of Bioderived and Bioinspired materials for photonic applications.
- Concepts of quantum dots and their application in nanotechnology for bioimaging is studied.
- Will be Competent to make photonic materials for advanced technologies such as optoelectronics, quantum computation, optical transmission etc.

(Hard – Core Course)

L	T	P	C	
3	1	0	3	45L

Unit I **(10 hrs)**

Introduction to photonics

Light and Matter on a nanometer scale – Nanophotonics classification – electron and light confinement – quantum optics – Nanoplasmonics - Electromagnetic properties of nanostructures – Wavelength - Dispersion laws for photons and electrons – Density of states for 1D – Extension to 2D and 3D cases – Maxwell and Helmholtz equations – Photonic band-structure and photonic band gap - Propagation of light in periodic media – Bloch waves and Band structure in periodic media – 1D case – Origin and size of

bandgap based on dielectric contrast – Evanescent Waves.

Unit II **(10 hrs)**

Photonic Crystals – Definition of 1-, 2- and 3-D photonic crystals – Bragg Mirror – Yablonovite structure - Fabrication – 1-D Phototonic crystal by sputtering method – 2-D photonic crystal by Biomineralization – 2-D photonic crystals by Microfabrication– 3-D photonic crystals by Self-assembly – Colloidal crystals by Sedimentation – Convective Self-assembly of Opaline thin films - Photonic Crystals with Tunable Properties.

Unit III **(9 hrs)**

Photobiology

Interaction of light with cells: Light absorption in cells – Proteins, DNA, RNA, NADH and Water - Light induced cellular processes – Autofluorescence and Fluorophores –Green Fluorescent Protein – Photochemical Processes - **Interaction of light with tissues:** Nature of Optical interactions – Raman scattering – Optical Loss by scattering – Optical Transparency of a tissue - Measurement of optical properties of a tissue – The Double Integrating Sphere Method - Light-induced Processes in Tissues – Autofluorescence - Photochemical processes - thermal effects – photoablation - plasma induced ablation and photodisruption.

Unit IV **(8 hrs)**

Nanotechnology for biophotonics: The interface of bioscience, nanotechnology and photonics - Semiconductor quantum dots for bioimaging – Quantum confinement – Size dependent band gap – Advantages – Major issues and solution – Metallic nanoparticles for Biosensing - Surface plasmon resonance – Localized SPR – SPR based sensor using Au nanoparticles – Up-converting nanophores - Nanoparticles for Upconversion – Pebble nanosensors for Invitro Bioanalysis - Nanoclinics for optical diagnostics and Targeted therapy – Hyperthermic effect in Nanoclinic.

Unit – V **(8 hrs)**

Biomaterials for Photonics: Four types of Biomaterials for photonics – Bioderived materials - Baceriorhodopsin – Structure – Application to Holographic memory – Storage mechanism - Angular multiplexing & Optical correlation - Green Fluorescent Protein – Structure – characteristics – Variants – Environmental stability - A photonic application of GFP – Molecular photodiode with MIM structure – Naturally occurring DNA - Bio-objects and biocolloids – Bioinspired materials – light-harvesting dendrimer – Biotemplates - DNA and Viruses as templates.

REFERENCE BOOKS

1. Introduction to Nanophotonics, Sergey V. Gaponenko, Cambridge University Press, New York, ISBN-13 978-0-521-76375-2 (2010)
2. Photonic crystals: Physics and Technology, (Eds.) C. Sibilia, T. M. Benson, M. Marciniak, T. Szoplik, (ISBN: 978-88-470-0843-4) (2008)
3. Photonic Crystals (2nd edition), John D. Joannopoulos, Steven G. Johnson, Joshua N. Winn, Robert D. Meade, Princeton University Press, ISBN: 978-0-691-12456-8 (2008)
4. Introduction to Biophotonics, Paras N. Prasad, (John Wiley and Sons, New Jersey), ISBN: 0-471-28770-9 (2003)
5. Photonic Crystals:Towards Nanoscale Photonic Devices, J.-M. Lourtioz, H. Benisty, V. Berger, J.-M. Gerard, D. Maystre, A. Tchelnokov, ISBN-13 978-3-540-24431-8, Springer-Verlag Berlin Heidelberg (2005)
6. Principles of Nanophotonics, Motoichi Ohtsu, et al. ISBN : 13: 978- 1- 58488- 972- 4, by Taylor & Francis Group, LLC (2008)

7. Advances In Biophotonics, (Eds.) Brian C. WilsonValery V. Tuchin and Stoyan Tanev, IOS Press, ISBN 1-58603-540-1, (2005)
8. Biophotonics, Optical Science and Engineering for the 21st Century, (Ed.) Xun Shen and Roeland Van Wijk, ISBN-10: 0-387-24995-8; ISBN-13: 978-0387-24995-7; eISBN: 0- 387-24996-6
9. Nano Biophotonics: Science and Technology, (Eds) Hiroshi Masuhara, Satoshi Kawata and Fumio Tokunaga, ISBN-13: 978-0-444-52878-0; ISBN-10: 0-444- 52878-4, Elsevier (2007)

NAST-634: Nanomagnetic Materials and Devices

Outcome/Knowledge/Skill:

On successful completion of this course, the students will able to

- Understand the basics of magnetism and magnetic properties
- Acquire knowledge on principle and operation of various magnetic devices.
- Acquire knowledge on utilization of various nanostructures for fabrications of advanced magnetic devices, like GMR, TMR, BMR devices

(Soft – Core Course)

L	T	P	C	
3	1	0	3	45L

UNIT-I **(9 hrs)**

Magnetism of the solid state

Basics of magnetic materials, magnetic flux, magnetization, magnetic induction, susceptibility and permeability, diamagnetism and diamagnetic susceptibility, Paramagnetism, Curie law and Curie-Weiss law, Pauli paramagnetism, Ferromagnetism, hysteresis, magnons, domain theory, ferrimagnetism, antiferromagnetism

UNIT-II **(9 hrs)**

Giant magnetoresistance

Introduction to spintronics, magnetoresistance in normal metals, MR ratios, Giant magnetoresistance in ferromagnetic multi layers and superlattices, co-operative phenomena and magnetization reversal, applications in spin valve and read heads, comparison of GMR and AMR, oscillation of coupling energy, non-coupling type GMR, CPP and CIP GMR, GMR in nanograins, mechanism of GMR.

UNIT-III **(9 hrs)**

Tunnel magnetoresistance

Introduction to tunnel magneto resistance, ferromagnetic tunnel junctions, experiments for TMR, phenomenological theory of TMR, MR ratio and spin polarization, factors influencing TMR, MR ratio for Fe/MgO/ Fe system, oscillations in TMR, tunnel junctions with manganites, Heusler alloys, nanoscale granules, Coulomb blockade in tunnel junctions.

UNIT-IV **(9 hrs)**

Ballistic magnetoresistance and Magnetic nanostructures

Ballistic magneto resistance, conductance quantization in quantum confined semiconductors,

metals. Anisotropic magneto resistance and applications, magnetism of nanoparticles, nanoclusters, nanowires, hard and soft magnetic materials and their applications, media for extremely high density recording, magnetic sensors, ferro fluids, spinglass- magnetic properties and electronic structure

UNIT-V **(9 hrs)**

Nanobiomagnetism

Magnetic targeting, magnetic separation and detection, magnetic tweezers, drug and gene delivery, chemo therapy, MRI, magnetic contrast agents, hyperthermia, application of various nanomagnetic materials in biotechnology, superparamagnetism, core-shell structures and their applications, iron oxide and novel Nanomaterials.

REFERENCE BOOKS

1. Physics of Magnetism and Magnetic Materials, K.H.J Buschow, F.R. de Boer, Springer, 2003, ISBN: 9780970467041, 0970467044.
2. Advanced Magnetic Nanostructures, Ed. D. Sellmyer, R. Skomski, Springer, 2009, ISBN: 9780387233093, 0387233091.
3. Nanostructured Magnetic Materials and their Applications, Ed. D. Shi, B. Aktas, L. Pust, F. Mikailov, Springer, 2002, ISBN: 9783540368724
4. Introduction to Magnetic Materials, B. D. Cullity, Wiley, 1972, ISBN: 9780471477419.
5. Magnetism in the Solid State, Peter Mohn, Springer series in solid-state sciences, 2006, ISBN: 3540293841, 9783540293842.
6. Handbook of Thin Film Materials, Volume 5, Edited by H.S Nalwa, American Scientific Publishers, 2002, ISBN: 9780125129084, 9780080533247.
7. Encyclopedia of Nanoscience and Nanotechnology, Edited by H.S. Nalwa, American Scientific Publishers, 2007, ISBN: 1588830012, 1588831590
8. Magnetism – Fundamentals, Edited by E. du Tremolet de Lacheisserie, D. Gognoux, M. Schlenker, Springer, 2003, ISBN: 9780387229676.
9. Advances in Nanoscale Magnetism, Ed. B. Aktas, F. Mikailov, Springer, 2009, ISBN: 9783540698821
10. Spintronics: Fundamentals and Applications, I. Zutic, J. Fabian and S. Das Sarma, Rev. Mod. Phys, 76, 323 (2004).

NAST-635: Advanced Nanobiotechnology

Outcome/Knowledge/Skill:

On Completion of the course the student will be able to

- Understand the research oriented concepts of tissue engineering and drug delivery.
- Understand the toxicity of Nanomaterials, and evaluation of biocompatibility of nanomaterials.

(Soft – Core Course)

L	T	P	C	
3	1	0	3	45L

Unit –I **(9 hrs)**

Synthetic Materials in Medicine, properties of Materials: Bulk Properties of Materials, Surface Properties of Materials. Classes of Materials Used in Medicine: Structure and Properties of Metals, Ceramics, Glasses, and Glass-Ceramics, Polymers, Hydrogels, Family of Carbon Nanomaterials, Bioresorbable and Bioerodible Materials, Composites, Thin Films, Grafts and Coatings, Biologically Functional Materials.

Unit –II **(9 hrs)**

Biological Interactions with Materials

Introduction, Biocompatibility, Toxicity, Cytotoxicity, Hypersensitivity, Carcinogenicity, Interaction of Materials with Soft Tissues, Inflammation, Granulation Tissue Formation, Foreign Body Reaction, Fibrosis, Modification of Blood-Biomaterial Interactions, Interaction with Blood by Heparin, Interactions with Proteins, Cell Adhesion, Interactions with Hard Tissues, The Vroman Effect, Adhesion of Osteoblasts, Osseointegration, Fibrous Capsule Formation, Safety Testing of Biomaterials.

Unit –III **(9 hrs)**

Nanotoxicology

Introduction, Toxicity of nanoparticles, Types of Nanoparticles causing Toxicity, Target organ toxicity, Exposure, Uptake, and Barriers, Experimental Models in Nanotoxicology- In vitro Models, In Vivo Models, Predicting Penetration and Fate of Nanoparticles in the Body, Toxicity Mechanisms - Mechanisms for Radical Species Production, General Genotoxicity Mechanisms, Detection and Characterization of Genotoxicity.

Unit –IV **(9 hrs)**

Tissue engineering

Introduction, Stem cells, Morphogenesis, Generation of tissue in the embryo, Tissue homeostasis, Cellular signaling, Extracellular matrix as a biologic scaffold for tissue engineering, Natural polymers in tissue engineering applications, Degradable polymers for tissue engineering, Degradation of bioceramics.Cell source, Cell culture: harvest, selection, expansion, and differentiation, Cell nutrition, Cryobiology, Scaffold design and fabrication, Controlled release strategies in tissue engineering

Unit –V **(9 hrs)**

Drug Delivery Systems

Fundamentals of Drug Nanoparticles: Production, Size, Surface area, Suspension and Settling, Magnetic and Optical Properties, Biological Transport. Manufacturing of Nanoparticles: Ball-Milling, High-Pressure Homogenization, Spray-Drying Production in Nonaqueous Liquids, Hot-Melted Matrices, Pelletization Techniques, Direct Compress. Delivery of Nanoparticles: Brain Delivery, Ocular Drug Delivery, Gene Delivery Systems, Carriers in Cancer Therapy, Cardiovascular System, Vascular Delivery to the Lungs, Targeting Lymphatics.

REFERENCE BOOKS

1. BlOMATERIALS SCIENCE, An Introduction to Materials in Medicine, Edited by Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, Academic Press, A division of Harcourt Brace & Company, 525 B Street, Suite 1900, San Diego, California 92101-4495, USA.
2. The Chemistry of Medical and Dental Materials, John W. Nicholson, RSC MATERIALS MONOGRAPHS, Published by The Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge CB4 OWF, UK. ISBN 0-85404-572-4.
3. Tissue Engineering, Clemens van Blitterswijk, Peter Thomsen, Anders Lindahl, Jeffrey Hubbell, David Williams, Ranieri Cancedda, Joost de Bruijn, Jérôme Sohier, Academic Press, Elsevier, 84 Theobald's Road, London WC1X 8RR, UK, 30 Corporate Drive, Suite 400, Burlington, MA 01803, USA, 525 B Street, Suite 1900, San Diego, CA 92101-4495, USA, 2008 ISBN: 978-0-12-370869-4.
4. Nanoscale Technology in Biological Systems, Edited by Ralph S. Greco, Fritz B. Prinz, R. Lane Smith, CRC PRESS, Boca Raton London New York Washington, D.C. Copyright © 2005 by Taylor & Francis.
5. Nanoparticulates Drug Carriers, Edited by VLADIMIR P TORCHILIN, 2006, Imperial College Press, 57 Shelton Street, Covent Garden, London WC2H 9HE, ISBN 1- 86094-630- 5.
6. Nanoparticle Technology for Drug Delivery. Edited by Ram B. Gupta, Uday B. Kompella, 2006, Taylor & Francis Group, 270 Madison Avenue, New York, NY 10016.
7. Biological Nanostructures and Applications of Nanostructures in Biology. Electrical, Mechanical, and Optical Properties. Edited by Michael A. Stroscio and Mitra Dutta, 2004, KLUWER ACADEMIC PUBLISHERS, NEW YORK, BOSTON, DORDRECHT, LONDON, MOSCOW, eBook ISBN: 0-306-48628-8, Print ISBN: 0-306-48627-X
8. BIOMEDICAL NANOSTRUCTURES. Edited by Kenneth E. Gonsalves, Craig R. Halberstadt, Cato T. Laurencin, Lakshmi S. Nair, WILEY-INTERSCIENCE A JOHN WILEY & SONS, INC., PUBLICATION, 2008.
9. Dendrimer based Nanomedicine, Edited by Istvan J. Majoros, James R. Baker, 2008, Pan Stanford Publishing Pte. Ltd.
10. Nanoparticulate Drug Delivery Systems, Edited by Deepak Thassu, Michel Deleers, Yashwant Pathak, 2007, Informa Healthcare USA, Inc., 270 Madison Avenue, New York, NY 10016, ISBN-13: 978-0-8493-9073-9.
11. Nanofabrication towards Biomedical Applications, Techniques, Tools, Applications, and Impact. C. S. S. R. Kumar, J. Hormes, C. Leuschner, 2005, WILEY -VCH Verlag GmbH & Co. KGaA, Weinheim, ISBN-13 978-3-527-31115-6, ISBN-10 3-527-31115- 7.

NAST -636: Industrial Nanotechnology

Outcome/Knowledge/Skill:

On completion of this course, the student will be able to

- Educate students about the interactions at molecular scale.
- Understand the influence of Nanotechnology based applications on each industry.
- Understand the future technologies advantages and increasing role of Nanotechnology in each industry.

(Soft – Core Course)

L	T	P	C	
3	1	0	3	45L

UNIT- I **(9 hrs)**

Nanotechnology in Agriculture and Food Industries

Agricultureindustry: - Precision farming, Smart delivery system – Insecticides using Nanotechnology – Nanofertilizers -Nanofertigation - Nano-seed Science.

Food industry: Nanopackaging for enhanced shelf life - Smart/Intelligent packaging - Food processing and food safety and bio-security –Electrochemical sensors for food analysis and contaminant detection.

UNIT- II **(9 hrs)**

Nanotechnology in Textiles and Cosmetics Industries

Textiles Industry: Production of Nano-woven fibers from electrospinning – Controlling parameters and morphologies of nanofibers – Nanocomposite fibers; **Bionics**: Swim-suits with shark-skin effect, Soil repellence, Lotus effect;**Nano finishing in textiles:** UV resistant, anti-bacterial, hydrophilic, self-cleaning, flame retardant finishes; **Modern textiles**: Lightweight bulletproof vests and shirts, Colour changing property, Waterproof and Germ proof clothes.

Cosmetics Industry: Formulation of Gels, Shampoos, Hair-conditioners (Micellar self-assembly and its manipulation) – Sun-screen dispersions for UV protection using titanium oxide – Anti-aging cream - Colour cosmetics.

UNIT-III **(9 hrs)**

Nanotechnology in Chemical and Electrochemical Industries

Nanocatalysts – Smart Materials – Nanostructures for molecular recognition (0D, 1D and 2D) – Molecular encapsulation and its applications – Nanoporous Zeolites – Nano-reactors – Solid lubricants – Nanotechnology in Electrometallurgy, Electroplating industry and Corrosion protective organic coatings – Electrolytic production of metal nanopowders, Electrochemical exfoliation for the production of Graphene and other metal chalcogenides – Electrochemical preparation of Nanostructured conducting polymers.

UNIT- IV **(9 hrs)**

Nanotechnology in Defence

Military applications of Nanotechnology –Nano-Battle suit – Nano-drones – Nano- Satellites – Nano-Propellants and Explosives – Camouflage distributed sensors - Amour protection - Implanted Nano-systems - Mini-/Micro robots - Small satellites and Space launchers –Nano- Nuclear, Chemical and Biological weapons - Chemical/Biological protection.

UNIT- V **(9 hrs)**

Nanotechnology in Environmental and Health Effects

Overview of physical, chemical and biological processes concerning the environment- Nanomaterial based adsorbents and photocatalysts for water and waste water treatment – Nanomaterials for adsorption of heavy metals – Nanoparticles for degradation of organic and organic compounds – Treatment of Arsenic using Nano TiO_2 and other nanoparticles – Nanomembranes in drinking water purification and desalination – Environmental impacts of Nanomaterials on human and animal health – Safety issues and regulatory practices in handling Nanomaterials – Environmental hazard in processing of Nanomaterials – Emerging issues of nano/microplastics - Green synthesis/zero-waste processes.

TEXTBOOK

1. P. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead publication, London, 2006.
2. J. Altmann, Routledge, Military Nanotechnology: Potential Applications and Preventive Arms Control, Taylor and Francis Group, 2006.
3. Jennifer Kuzma and Peter VerHage, Nanotechnology in agriculture and food production, Woodrow Wilson International Center, (2006).
4. Lynn J. Frewer, WillehmNorde, R. H. Fischer and W. H. Kampers, Nanotechnology in the Agri-food sector, Wiley-VCH Verlag, (2011).
5. P. J. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead Publishing Limited, Cambridge, (2007).
6. Q. Chaudry, L.Castle and R. Watkins Nanotechnologies in Food, RSC Publications, 2010.
7. W.N.Chang, Nanofibers Fabrication, Performance and Applications, Nova Science Publishers Inc., (2009).
8. M.R. Rifi and F.H.Covitz, Industrial Electrochemistry, Marcel Dekker Inc, New York, 1974.
9. K.I.Popov, S.S.Djokic and B.N.Grgur, Fundamentals of Electrometallurgy, Kluwer Academic Publishing 2002.
10. A.J.Bard & L.R.Faulkner, Electrochemical methods-Fundamentals and Applications John Wiley & Sons, 3rd Edition, 2001.

REFERENCE BOOK

1. Y-W. Mai, Polymer Nano composites, Woodhead publishing, (2006).
2. Udo H. Brinker, Jean-Luc Mieusset (Eds.), Molecular Encapsulation: Organic Reactions in Constrained Systems, Wiley Publishers (2010).
3. Nanocomposites Science and Technology - P. M. Ajayan, L.S. Schadler, P. V. Braun.
4. E.Raub & K.Muller, Fundamentals of Metal deposition, Elseiver publishing Co, New York,1967.

NAST-630: Modeling and Simulation Laboratory

Outcome/Knowledge/Skill:

On successful completion of this computer lab course, the students will able to

- Acquire knowledge on various scientific modelling and simulation techniques.
- Understand various syntax and command code for wide used modelling and simulation softwares.
- Acquire knowledge to theoretically simulate the physical and chemical properties of various nanomaterials based on available data.

(Hard – Core Course) **L T P C**

0 2 4 3 45L

- Fortran programming for basic matrix handling.
- Fortran programming for Numerical methods such as Runge-Kutta method, Gauss-elimination, Gauss-Seidel methods.
- Simulation of wave function and energy levels of the particle in a 1-D potential using Fortran program.
- Simulation of Radioactive decay using uniformly distributed Random numbers.
- Deconvolution of the experimental spectra using FitYK freeware.
- Image analysis by SciLab (Freeware)
- Construction of fullerene & its energy calculations by ARGUS Lab.
- Construction of carbon nanotubes by ARGUS Lab.
- Simulation with MATLAB: Programme assembly, execution, data processing and graphic analysis.
- Image processing with MATLAB
- MATLAB programme to plot the first four Eigen functions of a one dimensional rectangular potential well with infinite potential barrier.
- Nanomaterials optical bandgap simulation using MATLAB.
- Monte Carlo Simulation-Determination of mean, medium and standard deviation.
- Atom manipulation and Patterning.
- Study of single electron transistor using MOSES 1.2 simulator.
- Simulation of I-V characteristic for a single junction circuit with a single quantum dot using MOSES 1.2 simulator.
- To determine the surface roughness of raw and processed AFM images of glass, silicon and films made by different methods using offline SPIP software.
- Simulation with VASP and GIBBS
- Numerical simulation of SOFC for impedance analysis

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Semester - IV Credits: 12

NAST-641: Research Project (Report and Viva-Voce)

Outcome/Knowledge/Skill:

- Supports advance research capabilities undertaking a major, individual, related project
- Develop communication skills, both written and oral, to specialized in Nanoscience and Technology for society.

(Hard – Core Course)

L	T	P	C	
0	0	0	3	45L

Students are required to carry out a research project for **one full semester** related to Nanoscience and Nanotechnology and submit a project report. Each student is assigned with a supervisor among the faculty members of the CNST of Pondicherry University. Arrangement could also be made to pursue research studies at institutions other than the CNST of PU. In such circumstance, the student is assigned with two supervisors: an internal supervisor/advisor from the CNST of PU and an external supervisor from the institutions where the research project is carried out.

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PONDICHERRY UNIVERSITY
(A CENTRAL UNIVERSITY)

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

B.Sc. Computer Science (Honors)

B.Sc. Computer Science (Honors with Research)

REGULATIONS, CURRICULUM & SYLLABUS

(Under the National Education Policy 2020)

Effective from the Academic Year 2023 - 2024

Revised in June 2024

Year	I	Course Code: CSCS101 Course Title: Digital Logic Fundamentals	Credits	4
Sem.	I		Hours	75
			Category	C
Course Prerequisites, if any	NIL			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	● Understand the principles of digital systems and binary number operations ● Apply Karnaugh mapping to simplify Boolean expressions and optimize digital circuits ● Analyze and design basic combinational circuits. ● Synthesize and evaluate synchronous sequential circuits using storage elements and HDL ● Design and implement various types of registers and counters using HDL			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction** Digital Systems – Binary Numbers – Conversions – Types – Codes – Storage and Registers – Binary Logic – Boolean Algebra – Theorems and Properties – Functions – Canonical and Standard Forms – Other Logic Operations – Digital Logic Gates – Integrated Circuits		9	
Unit II	**Gate-Level Minimization** Map Method – Four-Variable K-Map – Product-of-Sums Simplification – Don't-Care Conditions – NAND and NOR Implementation – Other Two-Level Implementations – Exclusive-OR Function – Hardware Description Language		9	
Unit III	**Combinational Logic** Analysis Procedure – Design Procedure – Binary Adder–Subtractor – Decimal Adder – Binary Multiplier – Magnitude Comparator – Decoders – Encoders – Multiplexers – HDL Models of Combinational Circuits		9	
Unit IV	**Synchronous Sequential Logic** Storage Elements – Latches – Flip-Flops – Analysis of Clocked Sequential Circuits – Synthesizable HDL Models of Sequential Circuits – State Reduction and Assignment – Design Procedure		9	
Unit V	**Registers and Counters** Registers – Shift Registers – Ripple Counters – Synchronous Counters – Other Counters – HDL for Registers and Counters		9	
Practical Component				
Exercises	1. Binary to Decimal and vice-versa 2. Decimal to Hexadecimal and Vice-Versa 3. Digital Logic Gates 4. Simplification of Boolean Functions 5. Combinational Logic Circuits i. Code Converters		30	

	ii. Arithmetic (Adders, Subtractors, Multipliers, Comparators) iii. Data Handling (Multiplexers, Demultiplexers, Encoders & Decoders) 6. Combinational Logic Circuit Design 7. Binary Adder-Subtractor Simulation 8. Decimal Adder Simulation 9. Binary Multiplier Simulation 10. Sequential Circuit Storage Elements: Flip-Flop Simulation	
Recommended Learning Resources		
Print Resources	1. M. Morris Mano, Michael D. Ciletti, "Digital design With an Introduction to the Verilog HDL", Pearson, Sixth Edition, 2018. 2. M. Rafiquzzaman, "Fundamentals of Digital Logic and Microcomputer Design", John Wiley & Sons, Inc., Fifth Edition, 2009.	
Syllabus Design: Dr. M. Sathya, Assistant Professor, PUDoCS		

Year	I	Course Code: CSCS102	Credits	4
Sem.	I	Course Title: Microprocessor & Assembly Language Programming	Hours	75
			Category	C
Course Prerequisites, if any	• Number Systems (binary, octal, hexadecimal) and their conversions • Boolean Algebra, logic gates, flip-flops and registers • Concepts in Combinational and Sequential logic			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Learn the architecture & organization of 8085 Microprocessor • Understand and classify the instruction set of the 8085Microprocessor • Apply the memory & I/O Interfacing with 8085 Microprocessor • Analyze the architecture and operation of Programmable Interface • Create applications to interface various peripheral IC's with Intel 8085 microprocessor			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction to Microprocessors & 8085 Assembly Language Programming** Microprocessors – Instruction set and computer languages – 8085 programming model – Instruction classification – Instruction – Data format and storage – Execute a simple program – 8085 Instruction Set	9
Unit II	**8085 Microprocessor architecture** Microprocessor Architecture and its operations – Memory – I/O Devices, 8085 MPU – 8085 based microcomputer – memory interfacing – 8155 memory segment Interfacing – Interfacing I/O devices: Basics – Interfacing input and output devices – memory mapped I/O	9
Unit III	**Programming 8085** Instruction Set of 8085 – Data Transfer – arithmetic – Logic – Branch – Writing ALP and Debugging programs – Looping – Counting and Indexing – 16-bit Arithmetic instructions – Logic operations – Counters and Time Delay	9
Unit IV	**Interfacing I/O Devices** Stack and subroutines – Restart – Conditional call and Return instruction – Advanced subroutine concepts – Code conversion – BCD Arithmetic and 16-bit operations – BCD-Binary conversion – Binary to BCD conversion – BCD to seven segment LED code conversion – Binary to ASCII and ASCII to binary conversion – BCD addition and subtraction	9
Unit V	**Interfacing Peripheral (I/O) and Applications** Interrupts: 8085 Interrupt – RST instructions – Software and Hardware interrupt – multiple Interrupts and Priorities – 8085 Vectored Interrupts – Restart as Software Instructions – 8155 – Multipurpose programmable Device – 8279 Programmable Keyboard/Display Interface – 8255 Programmable peripheral Interface	9

Practical Component		
Exercises	1. Assembly Language Programming for Arithmetic Operations like Addition, Subtraction, Multiplication and Division on 8, 16-bit data 2. Assembly Language Programming for different logical operations 3. Assembly Language Programming for code conversions 4. Assembly Language Programming for sorting 5. Assembly Language Programming for Searching 6. Assembly Language Programming for memory block transfer 7. Assembly Language Programming using subroutines 8. Assembly Language Programming using counters and time delay	30
Recommended Learning Resources		
Print Resources	1. Ramesh S. Gaonkar, "Microprocessor – Architecture, Programming and Applications with the 8085", Penram International Publisher, Sixth Edition, 2013. 2. Douglas V. Hall, "Microprocessors and Interfacing", Tata McGraw Hill publications, Third Edition, 2017.	
Syllabus Design: Dr. M. Sathya, Assistant Professor, PUDoCS		

Year	I	Course Code: CSCS103	Credits	3
Sem.	I	Course Title: Python Programming	Hours	60
			Category	B

Course Prerequisites, if any	Basic Knowledge in Programming Concepts	
Internal Assessment Marks: 50	End Semester Marks: 50	Duration of ESA (Practical): 03 hrs.
Course Outcomes	• Understand the basics of writing Python code • Implement programs using lists, tuples and dictionaries • Understand the use of control structures • Ability to write programs using packages • Understand the file manipulation	

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction, Data types** Introduction to Python – Advantages of using Python – Executing Python Programs – Python's Core data types – Numeric Types – String Fundamentals	6
Unit II	**Lists, Tuples, Dictionaries** Lists: list operations, list slices – list methods – list loop – mutability – aliasing – cloning lists – list parameters; Tuples: tuple assignment – tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension	6
Unit III	**Control Flow, Functions, Modules** Python Statements: Assignments – Expressions – If condition – While and For Loops. Functions: Definition, Calls – Scopes – Arguments – Recursive Functions– Functional Programming tools Classes and Object-Oriented programming with Python – modules and Packages: Purpose, using packages – Exception Handling with Python	6
Unit IV	**Packages** Packages: NumPy, Pandas, Scikit learn – Machine learning with Python – Cleaning up, Wrangling, Analysis, Visualization - Matplotlib package – Plotting Graphs	6
Unit V	**File Handling** Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions	6
	Practical Component	
Exercises	1. Exchange the values of two variables 2. Finding minimum among n variables 3. Perform Simple sorting 4. Generate Students marks statement 5. Find square root, GCD, exponentiation 6. Sum the array of numbers 7. Perform linear search, binary search 8. Perform Matrix operations using NumPy 9. Perform Data frame operations using Pandas	30

	10. Use Matplotlib on dataset and visualise 11. Perform Word count, copy file operations	
Recommended Learning Resources		
Print Resources	1. Mark Lutz, “Learning Python”, Fifth Edition, O’Reilly, 2013. 2. Daniel Liang, “Introduction to programming using Python”, Pearson, First Edition, 2021. 3. Wes Mc Kinney, “Python for Data Analysis”, O’Reilly Media, 2012. 4. Tim Hall and J-P Stacey, “Python 3 for Absolute Beginners”, Apress, First Edition, 2009. 5. Magnus Lie Hetland, “Beginning Python: From Novice to Professional”, Apress, Second Edition, 2005.	
Syllabus Design: Dr. V. Uma, Associate Professor, PUDoCS		

Year	I	Course Code: CSCS104 Course Title: R Programming	Credits	3
Sem.	I		Hours	60
			Category	B
Course Prerequisites, if any	NIL			
Internal Assessment Marks: 50	End Semester Marks: 50	Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Learn the basics in R programming • Understand to accessing variables and managing subsets of data • Design simple applications using the functions of R programming • Analyze the performance of the plotting tools in R programming • Create a project using the Lattice Package in R programming			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Downloading and Installing R – Script code – Graphing Facilities in R – Packages – General Issues in R – Getting Data into R – Importing Data	6
Unit II	**Accessing Variables and Managing Subsets of Data** Accessing variables from a Data Frame – Accessing Subsets of Data – Combining Two Datasets with a Common Identifier – Exporting Data – Recoding Categorical Variables	6
Unit III	**Simple Functions** The *tapply* Function – The *sapp*ly and *lapply* Functions – The *summary* Function – The *table* Function	6
Unit IV	**Plotting Tools** The *plot* Function – Symbols, Colours, and Sizes – Adding a Smoothing Line – Loops and Functions **Graphing Tools** Pie Chart – Bar Chart and Strip Chart – Boxplot – Cleveland Dotplots – Pairplot – Coplot – Combining Types of Plots	6
Unit V	**Lattice Package** High-level Lattice Functions – Multipanel Scatterplots – Multipanel Boxplots – Multipanel Cleveland Dotplots – Multipanel Histograms – Panel Functions – 3-D Scatterplots and Surface and Contour Plots	6
	Practical Component	
Exercises	1. Install R and RStudio, create and execute your first R script, generate basic plots using both base R and ggplot2, install and utilize R packages, and import and explore a dataset 2. Access specific variables from a data frame and manage subsets of data 3. Combine two datasets with a common identifier and export your final data set 4. Read data, explore structure using head(), summary(), and str() 5. Handle missing values, remove duplicates with duplicated() 6. Create plots (scatter, line, bar) using ggplot2 7. Create plots (pie, bar and strip chart, boxplot, Cleveland dotplots, pairplot, coplot) and a composite plot that combines multiple plot types, using R's graphing capabilities 8. Create advanced visualizations (multipanel scatterplots, boxplots, Cleveland dotplots, histograms, panel functions) using lattice functions in R	30

	9. Create 3-D scatterplots and surface and contour plots to explore complex data relationships	
Recommended Learning Resources		
References	1. Alain F. Zuur, “A Beginner’s Guide to R”, Springer-Verlag New York Inc., 2019. 2. Robert Knell, “Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R”, Amazon Digital South Asia Services Inc, Revised Edition, 2014.	
Syllabus Design: Dr. M. Sathya, Assistant Professor, PUDoCS		

SEMESTER II

Year	I	Course Code: CSCS105	Credits	4
Sem.	II	Course Title: Problem Solving & Programming Fundamentals	Hours	75
			Category	C
Course Prerequisites, if any	NIL			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	● Analyze problems and develop top-down designs ● Write, compile, and debug basic programs ● Implement logic with conditionals and loops ● Manipulate arrays of various dimensions ● Design and implement functions with recursion			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction to Computer Problem-Solving** Problem-solving Aspect – Top-down Design – Implementation of Algorithms – Program Verification – Efficiency of Algorithms – Analysis of Algorithms		9	
Unit II	**Basic programming constructs** Basic Data types (Numerical, String) – Variables – Expressions – I/O statements – Compile and Run – Debugging		9	
Unit III	**Decision Making – Branching & Looping** Decision making – Relational Operators – Conditional statement, Looping Statements – Nested loops – Infinite loops – Switch Statements		9	
Unit IV	**Array Techniques** Array Manipulation – Different operations – One dimensional Array – Two-dimensional Array – Multi-dimensional Array – Character – Arrays and Strings		9	
Unit V	**Modular solutions** Introduction to Functions – Importance of Design of Functions – Arguments – Parameters – Return Values – Local and Global Scope – Recursion		9	
Practical Component				
Exercises	1. Program to array counting, array order reversal & find the maximum number in a set 2. Program for removal of duplicates from an ordered array & to partition an array 3. Program to find the k^{th} smallest element 4. Program to exchange the values of two variables without using a third variable 5. Program that takes a list of numbers as input and counts the total number of elements in the list 6. Program to compute the factorial of a given integer 7. Program to compute the sine of an angle (in degrees) using a series expansion 8. Program to generate the Fibonacci sequence up to a specified limit 9. Program that takes an integer as input and reverses		30	

	its digits 10. Program that converts a number from one base to another (e.g., binary to decimal, decimal to binary)	
Recommended Learning Resources		
Print Resources	1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India, Thirteen Edition, 2013. 2. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", Third Edition, O'Reilly Publishers, 2020.	
Syllabus Design: Dr. M. Sathya, Assistant Professor, PUDoCS		

Year	I	Course Code: CSCS106 Course Title: Microcontrollers Programming	Credits	4
Sem.	II		Hours	75
			Category	C
Course Prerequisites, if any	• Digital Logic Fundamentals • Microprocessors • Assembly Language Programming			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Learn the fundamentals of Microcontrollers • Understand the internal design of 8051 microcontroller along with the features and their programming • Analyze the on-chip peripherals of microcontrollers • Design different interfacing applications using microcontrollers and peripherals • Build systems using microcontrollers for real time applications			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Microprocessors and Microcontrollers** Microprocessors vs Microcontrollers – 8051 Architecture – Input/Output Pins – Ports – External Memory – Counter and Timers – Serial Data I/O – Interrupts		9	
Unit II	**Programming 8051** Addressing Modes – External Data Moves – Code Memory Read-Only Data Moves – PUSH and POP Opcodes – Data Exchanges – Logical Operations – Arithmetic Operations – Jump and Call Opcodes		9	
Unit III	**8051 Microcontroller Design** Microcontroller Specification – Design – Testing – Timing Subroutines – Lookup Tables for 8051 – Serial Data Transmission		9	
Unit IV	**Applications** Keyboards – Displays – Pulse Measurement – D/A and A/D Conversions – Multiple Interrupts		9	
Unit V	**Serial Data Communication** Network Configurations – 8051 Data Communication Modes		9	
Practical Component				
Exercises	1. Blinking LED 2. Digital Counter with Seven-Segment Display 3. Analog-to-Digital Conversion (ADC) 4. UART Communication 5. Timer Interrupt - Using a timer interrupt to perform a task at regular intervals 6. External Interrupt 7. Temperature Sensor (DS18B20) Interface 8. Matrix Keypad Interface 9. LCD Display Interface 10. Traffic Light Controller		30	

Recommended Learning Resources	
Print Resources	1. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming, and Applications", Delmar Cengage Learning, Third Edition, 2004. 2. Martin Bates, "PIC Microcontrollers - An Introduction to Microelectronics", Third Edition, Newnes, Elsevier, 2011. 3. Hubert Henry Ward, "C Programming for the PIC Microcontroller-Demystify Coding with Embedded Programming", Apress, UK, 2020. https://doi.org/10.1007/978-1-4842-5525-4
Syllabus Design: Dr. M. Sathya, Assistant Professor, PUDoCS	

Year	I	Course Code: CSCS107 Course Title: Programming for Mobile Devices	Credits	3
Sem.	II		Hours	60
			Category	B
Course Prerequisites, if any	Basic computer programming skill			
Internal Assessment Marks: 50	End Semester Marks: 50	Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand the basics of Android Ecosystem • Learn to use the Android Ecosystem • Understand the programming constructs in Kotlin • Understand the process of building interactive apps, Games, Social Media apps • Understand the process of building apps for TVs, Wearable and Android Auto			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction** About the Android Ecosystem – Installing Software tools – Creating an Android App – Examining a basic Android app – Improving the App.		6	
Unit II	**Android Background Material** Using Android Studio – Kotlin for Java programmers – Kotlin for Everyone – Object Orientation in Kotlin – Functional Programming in Kotlin – An Introduction to XML.		6	
Unit III	**The Building Blocks** Overview of Jetpack – Building foundations for the App – Architecture of the App – Defining App's behaviour – Interactivity.		6	
Unit IV	**Adding Cool Features** Building a Game in Android – Case study of building a Social Media App – Building Native applications		6	
Unit V	**Apps for Tablets, Watches, TVs and Cars** Apps for Tablets – Developing for Android Wear – Developing Android TV apps – Case study of App building with Android Auto		6	
Practical Component				
Exercises	1. Configure Android Studio and set the development environment 2. Build a basic Android app for numerical calculations 3. Build an Android app to use various sensors of the device 4. Case study: Build a calendar for Tablets 5. Case Study: Build a diet planner app		30	
Recommended Learning Resources				
Print Resources	1. Barry Burd, John Paul Mueller, "Android Application Development: All–in–one for Dummies", Third Edition, Wiley India, 2021. 2. Dawn Griffiths, David Griffiths, "Head First Android Development: A Learner's Guide to Building Android Apps with Kotlin", Third Edition, O'Reilly, 2021.			
Syllabus Design: Dr. K. S. Kuppusamy, Associate Professor, PUDoCS				

Year	I	Course Code: CSCS108 Course Title: Visual Programming with C#	Credits	3
Sem.	II		Hours	60
			Category	B
Course Prerequisites, if any	Basic knowledge of computer Programming.			
Internal Assessment Marks: 50	End Semester Marks: 50	Duration of ESA (Practical): 03 hrs		
Course Outcomes	• Understand the key components of the .NET Framework related to C# development • Learn the basic syntax and structure of C# programs • Design C# applications by integrating various object-oriented programming techniques in the .NET framework • Analyze the significance of graphical user interface (GUI) components and the Event Handling Model using C# programming • Learn and apply the fundamental skills to efficiently develop, test, and deploy ASP.Net Core applications			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction to .Net Framework** An Overview - Framework Components - The Common Language Runtime (CLR) - .NET Base Class Library - Common Language Specification (CLS) - Common Type System (CTS) - Metadata and Assemblies - .NET Namespaces - MSIL - JIT Compilers	6
Unit II	**Overview of C#** Program structure- Literals- Variables- Constants -Data Types- Operators-Statements and Expressions- Branching- Looping and loop control statements- Arrays- Strings manipulation- Boxing and Unboxing- Pre-processors- Namespaces	6
Unit III	**Object Oriented Programming concepts in C#** Class- Objects- Encapsulation- Constructors and its types- Inheritance-Polymorphism-Interface-Abstract class- Operator overloading- Properties- Indexers- Delegates- Collections	6
Unit IV	**Windows Forms** Introduction to Windows Forms and various controls-SDI and MDI applications- Menu Creation, Common Dialog Boxes- Events and event handling	6
Unit V	**Getting started with ASP.Net** Choosing a code editor, Creating an ASP.NET Core project, Running the ASP.NET Core application, ASP.NET Core application - Creating the project, Testing ASP.Net Core Applications - Creating a unit test project, Writing and running unit tests	6
	Practical Component	
Exercises	1. Installation of Visual Studio and creation of Simple Console Application 2. Create a simple C# program for the following concepts: a. To Check whether a given number is an Armstrong or not b. To Check whether the alphabet is a vowel or not using switch..case c. To Check whether the given string is palindrome or not using arrays	30

	3. Create a program to demonstrate boxing and unboxing operations 4. Implement the basic OOP concepts 5. Implement Interfaces and Operator Overloading 6. Create a GUI using standard controls, SDI & MDI forms 7. Design an application with menu options and a Common Dialog box 8. create a simple web application using ASP.Net 9. Develop any ONE case study listed below: a. Inventory Control b. Retail Shop Management c. Employee Information System d. Personal Assistant Program e. Students' Information System	
Recommended Learning Resources		
Print Resources	1. Herbert Schildt, "C# 4.0: The Complete Reference", First Edition**,** McGraw Hill Education, 2017. 2. Albahari. J, "C# 10 in a Nutshell: The Definitive Reference", First Edition, O'Reilly, 2022. 3. Adam Freeman. A, " Pro ASP.NET Core 7", Tenth Edition. Manning Publication, 2023.	
Syllabus Design: Prof. S. Ravi and Dr. S. L. Jayalakshmi, Assistant Professor, PUDoCS		

Year	I	Course Code: CSVA101 Course Title: Digital Technologies	Credits	2
Sem.	II		Hours	45
			Category	A
Course Prerequisites, if any	NIL			
Internal Assessment Marks: 40	End Semester Marks: 60		Duration of ESA (Theory) : 03 hrs.	
Course Outcomes	• Get introduced to the digital systems and its building blocks • Understand how the Digital Communication happens and to Learn the advantages and disadvantages including Cybersecurity • Learn the day-to-day digital activities and the initiatives on Digital India • Acquire knowledge on current Technologies and Trends in Digital Space • Explore the applications on the state of the art in Digital Technologies			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Digital Systems – Information & Communication Technology – ICT Tools. Computer Architecture – Software – Hardware – Operating System – Algorithms – Flowcharts	7
Unit II	**Communication Systems** Transmission Media – Computer Networks – Internet – Web Browsers – Search Engines – Messaging – Email – Social Media – Online Ethics **Cybersecurity** Threats – Significance – Challenges – Precautions – Safety Measures – Cyber Crime Awareness	7
Unit III	**Digital India & e-Governance** Initiatives - Unified Payment Interface – Aadhar online services – Credit / Debit Cards – e-Wallets – Mobile and Internet Banking – NEFT / RTGS / IMPS – Online Payments & PoS – Digital Accessibility	7
Unit IV	**Emerging Technologies & Applications** (Basic introduction only**)** Overview of Artificial Intelligence – Cloud Computing – Big Data – Internet of Things – Virtual Reality – 5G – 3D Printing	7
Unit V	**Case Studies** Any one case study on the emerging technologies and report submission by the candidates	7
	Practical Component	
Exercises	1. Operating System Installation and configuration 2. Application Software Installation and configuration 3. Hardware understanding and minor troubleshooting 4. Networking, cabling, configuration	10
	Recommended Learning Resources	
Print Resources	1. Pramod Kumar, Anuradha Tomar, R. Sharmila, "Emerging Technologies in Computing - Theory, Practice, and Advances", Chapman and Hall / CRC, First Edition, 2021, https://doi.org/10.1201/9781003121466. 2. V. Rajaraman, "Introduction to Information Technology", PHI, Third Edition, 2018. 3. E. Balagurusamy, "Fundamentals of Computers", Tata Mc GrawHill, Second Edition, 2011.	

	4. Behrouz A. Forouzan, “Data Communications and Networking”, McGraw Hill, Fourth Edition, 2007. 5. Rajkumar Buvya, James Broberg, and Andrzej Gosciniski, “Cloud Computing-Principals and Paradigms”, Wiley, 2011. 6. Stuart Russel and Peter Norvig, “Artificial Intelligence - A Modern Approach”, Pearson Education, Third Edition, 2010. 7. Samuel Greengard, “Internet of Things”, The MIT Press, 2015, https://doi.org/10.7551/mitpress/10277.001.0001. 8. C.S.V. Murthy, “E- Commerce – Concept, Models &Strategies”, Himalaya Publishing House, 2015. 9. Hurwith, Nugent Halper, Kaufman, “Big Data for Dummies”, Wiley & Sons, First Edition, 2013.
Syllabus Design: Dr. S. K. V. Jayakumar, Professor, PUDoCS	

SEMESTER III

Year	II	Course Code: CSCS201 Course Title: Object Oriented Programming	Credits	4
Sem.	III		Hours	75
			Category	C
Course Prerequisites, if any	Basic Programming knowledge			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand the principles of OOP and the concept of class and objects • Apply the concept of Object initialization and overloading • Understand the concept of inheritance and reusability • Understand file operations and exception handling • Apply OOP to design and implement solutions to real-world problems			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Principles of Object-Oriented Programming (OOP)** Object Oriented Programming Paradigm-Basic Concepts of OOP-Benefits of OOP - Application of OOP - Simple C++ program - Compiling and Linking	9
Unit II	**Classes and Objects** Specifying class - Member functions - Nesting of Member functions - Access specifier - Static Data members and functions - Arrays within a Class - Arrays of Objects - Objects as Arguments - Returning Objects - Friend Function	9
Unit III	**Object Initialization and Overloading** Types of Constructors - Dynamic Initialization of Objects - Destructors Operator overloading - function Overloading - Manipulation of Strings	9
Unit IV	**Inheritance** Derived Classes - Types of inheritance - Virtual Base Classes - Abstract Classes - Pointers to Derived Classes - Virtual base class - Method Overriding - Pure Virtual Functions	9
Unit V	**File operations and Exception handling** Classes for File Operations - File Modes - opening and closing a File - Basics of Exception Handling - Try-Catch block - Case Studies on Real Time Applications	9
	Practical Component	
Exercises	**1.** Write a Program to Read and Print Number Input from the User 2. Write a simple program using a class and objects 3. Write a program to demonstrate the usage of a constructor and destructor in a class 4. Write a program to overload + operator to add two complex numbers 5. Write a program to demonstrate the usage of function overloading 6. Write a program to display employee information using multiple inheritance 7. Write a program to demonstrate multilevel inheritance	30

	8. Write a program to copy a file from one location to another location	
Recommended Learning Resources		
Print Resources	1. E Balagurusamy, “Object oriented Programming with C++”, Seventh edition, Tata McGraw Hill, 2020.	
Syllabus Design: Dr. T. Vengattaraman, Associate Professor, PUDoCS		

Year	II	Course Code: CSCS202 Course Title: Data Structures	Credits	4
Sem.	III		Hours	75
			Category	C
Course Prerequisites, if any	Introductory knowledge about Computing			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	● Learn basic terminologies of linear and nonlinear data structures and algorithms ● Understand the concept of polynomial addition and sparse matrices using arrays ● Apply linked lists to solve problems related to stacks, queues, and sparse matrices ● Understand the operations and traversals of binary trees ● Apply graph algorithms to solve problems like topological sorting and finding minimum cost spanning trees			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction** Basic terminologies – Linear and Nonlinear data structures – Algorithm - Definition – Pseudo code – Analysis – Design Techniques		7	
Unit II	**Arrays, Stacks and Queues** Representation – Polynomial Addition – Sparse Matrices – Multidimensional Arrays - Stacks and Queues - Stack ADT – Operations – Evaluation of Expressions – Queue ADT – Operations – Application – Multiple Stacks and Queues		11	
Unit III	**Lists** Singly Linked Lists – Linked Stacks and Queues – Operations – Circularly Linked Lists – Equivalence Relations – Sparse Matrices – Doubly Linked Lists		9	
Unit IV	**Trees** Basic Terminologies – Binary trees – Representation, Operations, Traversals, Types – Applications of Trees		9	
Unit V	**Graphs** Basic Terminologies – Representation, Operations, Traversals – Applications - Shortest path problem, Topological sorting, Minimum Cost Spanning trees		9	
Practical Component				
Exercises	1. Searching Algorithms (with the number of key comparisons) - Sequential, Binary and Fibonacci search algorithms 2. Evaluation of arithmetic expression 3. Stack, Queue, Circular queue, priority queue 4. Singly Linked List, Doubly Linked List, Circular Linked List 5. Tree Traversal techniques 6. Graph Traversal techniques 7. Dijkstra's Algorithm to obtain the shortest paths		30	

Recommended Learning Resources	
Print Resources	1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Fundamentals of Data Structures in C", India University Press, Second Edition, 2008 2. Debasis Samanta, "Classic Data Structures", Prentice-Hall of India, Pvt. Ltd., India, Seventeenth Printing, Second Edition, 2009 3. Dinesh P Mehta & Sartaj Sahni, Handbook of Data Structures and Applications, Second Edition, Chapman and Hall, 2020
Syllabus Design: Dr. M. Sathya, Assistant Professor, PUDoCS	

Year	II	Course Code: CSCS203 Course Title: System Software	Credits	4
Sem.	III		Hours	75
			Category	C
Course Prerequisites, if any	• Knowledge of digital logic design • Introductory knowledge in problem Solving			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand basic computer architecture via Simplified Instructional Computer (SIC) • Analyze differences in assemblers and machine features • Apply dynamic linking and bootstrap loaders in program preparation • Design macros demonstrating machine features • Apply machine-independent compiler features in design			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** System Software and Machine Architecture – Simplified Instructional Computer (SIC) – Traditional (CISC) Machines – RISC Machines	9
Unit II	**Assemblers** Basic Assembler Functions – Machine Dependent and Machine Independent Assembler Features – One-Pass Assemblers – Multi Pass Assemblers – MASM assembler – SPARC assembler	9
Unit III	**Loaders and Linkers** Basic Loader Functions – Machine Dependent and Machine Independent Loader Features – Linkage Editors – Dynamic Linking - Bootstrap Loaders	9
Unit IV	**Macro Processors** Basic Macro Processor Functions – Machine Dependent and Machine Independent Macro Processor Features – Macro Processor Design Options	9
Unit V	**Compilers** Basic Compiler Functions – Machine-Dependent Compiler Features – Machine Independent Compiler Features – Compiler Design Options – YACC	9
	Practical Component	
Exercises	1. Simulate a simple arithmetic operation (e.g., addition, subtraction) in both a CISC-like and RISC-like manner. The CISC simulation should perform the operation in a single step, while the RISC simulation should break it down into simpler steps 2. Design a program that translates a small set of assembly-like instructions (define your simple instruction set) into a simulated machine code. Your program should handle basic operations like load, store, add, and subtract 3. Design a program that simulates the basic functions of a linker and loader for a simplified computational system 4. Implement a simple macro processor that allows for the definition and expansion of macros within a text file. The macros should perform simple text replacement or predefined operations (like incrementing a number) 5. Design and implement a simple arithmetic expression evaluator using YACC. The evaluator should be capable of	30

	handling basic arithmetic operations (+, -, *, /) and correctly respects the standard mathematical precedence of operations and handles parentheses to alter the precedence order	
Recommended Learning Resources		
Print Resources	1. Leland L. Beck, D. Manjula "System Software – An Introduction to Systems Programming", Third Edition, Pearson India, 2007. 2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques, and Tools", Second Edition, Pearson Addison Wesley, 2023.	
Syllabus Design: Dr. M. Sathya, Assistant Professor, PUDoCS		

<table>
<tr><td>Year</td><td>II</td><td colspan="2" rowspan="2">Course Code: CSCS204
Course Title: 3D Modelling & Animation</td><td>Credits</td><td>3</td></tr>
<tr><td>Sem.</td><td>III</td><td>Hours</td><td>60</td></tr>
<tr><td colspan="4"></td><td>Category</td><td>B</td></tr>
<tr><td>Course Prerequisites, if any</td><td colspan="5">Basic Computer Knowledge</td></tr>
<tr><td>Internal Assessment Marks: 50</td><td colspan="2">End Semester Marks: 50</td><td colspan="3">Duration of ESA (Practical): 03 hrs.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">• Understand the basics of 3D modeling and animation concepts.
• Learn the various stages of the production pipeline.
• Acquire skills to handle digital images, videos, and process them
• Become proficient in the usage of 3D modeling and adding visual effects, lighting, and rendering
• Develop a model for a given specification
• Develop an animated game, story, virtual tour of a building, etc.</td></tr>
<tr><td>Unit No.</td><td colspan="4">Course Content</td><td>Hours</td></tr>
<tr><td colspan="6">Theory Component</td></tr>
<tr><td>Unit I</td><td colspan="4">Introduction
Defining 3D Animation, Exploring the 3D Animation Industry – History of 3D Animation: Early Computers – The Dawn of Computer Animation – The Building Blocks of 3D Animation – The Foundations of Modern Computing – 3D Animation Achieves Commercial Success – The Refining of 3D Animation.</td><td>9</td></tr>
<tr><td>Unit II</td><td colspan="4">Production Pipeline
Understanding the Production Pipeline’s Components- Working in 3D Animation Preproduction – Working in 3D Animation Production – Working in 3D Animation Postproduction – Using Production Tools</td><td>9</td></tr>
<tr><td>Unit III</td><td colspan="4">Understanding Digital Imaging and Video
Understanding Digital Imaging – Understanding Digital Video - Exploring Animation, Story, and Pre-visualization: Using Principles of Fine Art and Traditional Animation- Building a Good Story – Using Pre-visualization Techniques</td><td>9</td></tr>
<tr><td>Unit IV</td><td colspan="4">Understanding Modeling and Texturing
Modeling: Polygons, NURBS, Subdivision Surfaces – Texturing: UVs, Texture Maps, Texturing Workflows – Rigging and Animation</td><td>9</td></tr>
<tr><td>Unit V</td><td colspan="4">Understanding Visual Effects, Lighting, and Rendering
Creating Visual Effects – Lighting – Rendering – Hardware and Software Tools of the Trade: Choosing a computer – Using Monitors / Displays – Working with Graphics Tablets – Using 3D Scanners – Setting Up Render Farms – Finding Data Storage Solutions – Choosing Software</td><td>9</td></tr>
<tr><td colspan="6">Practical Component</td></tr>
<tr><td>Exercises</td><td colspan="4">1. Implementing basic rendering techniques and effects
2. Developing storyboards, scripts / screenplay, 3D Production layout for a sample scene Ex: Friends meeting at a bus stop
3. Creating 3D models of characters, props, and environments for the above scene
4. Adding visual effects to the above scene
5. Adding texturing and minimal animation to the above scene
6. Setting up lighting and rendering scenes to achieve desired visual results for early morning moon and night time happening of the above scene</td><td>30</td></tr>
</table>

	7. Animating the above scene when the friends board the bus and the bus moves 8. Developing an animated game 9. Developing an animated story 10. Developing an animated virtual building tool	
Recommended Learning Resources		
Print Resources	1. Andy Beane, "3D Animation Essentials", First Edition, Wiley & Sons, 2012. 2. Magesh Chandramouli, "3D Modeling & Animation: A Primer", CRC Press, 2021. 3. Tony Mullen, "Introducing Character Animation with Blender", Second Edition, Wiley Publishers, 2011.	
Syllabus Design: Dr. T. Chithralekha, Professor, PUDoCS *Dr. S.L .Jayalakshmi, Assistant Professor, PUDoCS*		

Year	II	Course Code: CSCS205 Course Title: Game Programming	Credits	3
Sem.	III		Hours	60
			Category	B
Course Prerequisites, if any	Basic Programming Knowledge Computer Graphics			
Formative Assessment Marks: 50	Summative Assessment Marks: 50	Duration of ESA (Practical): 03 hrs		
Course Outcomes	• Develop creativity and problem-solving skills • Enable students to develop games individually or in teams • Understanding the underlying technologies in game development			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Game Designing** Magic Words – Importance of Skills a Game Designer Need – Important Skill – The Five Kinds of Listening – The Secret of the Gifted	9
Unit II	**3D Programming Concepts** Coordinate Systems – 3D Models – Shapes – Displaying 3D Models – Transformation – Rendering – Scene Graphs – 3D Audio – 3D Programming – Programmed Translation – Programmed Rotation – Programmed Scaling – Programmed Animation – 3D Audio – Basic Programming Concepts.	9
Unit III	**Game Programming** Torque Script – Strings – Objects – Data – Blocks – Game Structure – Server versus Client Design Issues – Common Functionality – Preparation – Root Main – Control Main – Initialization – Client – Server – Player – Running Emaga4	9
Unit IV	**Game Play** The Changes – Folders – Modules – Control Modules – Client Control Modules – Server Control Modules – Running Emaga5 – Creating GUI Elements	9
Unit V	**Game Sound and Music** Player Sounds – Footsteps – Weapon Sounds – Vehicle Sounds – Environmental Sounds – Interface Sounds – Music.	9
	Practical Component	
Exercises	1. Developing a Puzzle game 2. Developing a Multiplayer game using unity 3. Developing a 2D game 4. Developing a 3D game 5. Understand and develop the UI design in games 6. Understanding and apply the role of AI in Games	30
	Recommended Learning Resources	
Print Resources	1. Jesse Schell, “Art of Game Design”, A K Peters/CRC Press, Third edition, 2019. 2. Kenneth C. Finney, “3D Game Programming- All in One”, Cengage Learning, Inc, Third Edition, 2012.	
Syllabus Design: Dr. Sukhvinder Singh, Assistant Professor, PUDoCS		

SEMESTER IV

Year	II	Course Code: CSCS206 Course Title: Computer System Architecture	Credits	4
Sem.	IV		Hours	75
			Category	C
Course Prerequisites, if any	Fundamentals of Computers			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand the concept of digital electronics and logic circuits • Working with binary and arithmetic operations • Understand the organization of CPU and working principles • Understand the Input-Output organization in a computer • Understand the Memory organization in a computer			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Digital Logic Circuits** Digital Computers – Logic Gates – Boolean Algebra – Map Simplification – Combinational – Circuits – Flip-Flops – Sequential Circuits – Digital Components	9
Unit II	**Data Representation and Transfer** Datatypes – Complements – Fixed – Point Representation – Floating Point Representation – Register Transfer – Bus and Memory Transfer – Arithmetic – Logic and Shift Microoperations	9
Unit III	**CPU Organization** Register and Stack – Instruction Format – Addressing Modes – Data Transfer and Manipulation – Program Control – RISC – Basics of Pipelining	9
Unit IV	**Input-Output Organization** Peripheral devices – I/O Interface – Asynchronous data transfer – Modes of transfer – Priority Interrupt – DMA – Serial Communication	9
Unit V	**Memory Organization:** Memory Hierarchy – Main Memory – Auxiliary Memory – Associative Memory – Cache Memory – Virtual Memory – Memory Management Hardware	9
	Practical Component	
Exercises	1. Simplify Boolean expressions using Karnaugh maps 2. Design a combinational circuit 3. Implementing Logical Left and Right Shifts 4. Understand different data types and how to calculate complements 5. Evaluate performance improvement through instruction level parallelism 6. Analyze the effect of cache performance on system performance 7. Understand the impact of memory hierarchy on access time	30
	Recommended Learning Resources	
Print Resources	1. Morris Mano, Computer System Architecture, Pearson Education, 2017.	
Syllabus Design: Dr. Sukhvinder Singh, Assistant Professor, PUDoCS		

Year	II	Course Code: CSCS207 Course Title: Design and Analysis of Algorithms	Credits	4
Sem.	IV		Hours	75
			Category	C
Course Prerequisites, if any	Basic Knowledge in Data Structures and Programming			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Analyze the efficiency of algorithms and compare their performance using appropriate metrics • Understand the general approach of Brute Force and Divide and Conquer algorithms • Understand the principles of the Greedy Method in algorithm design • Understand the principles of Dynamic Programming • Understand the principles of Backtracking and branch and bound strategies			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Notation of Algorithm – Analysis of Algorithm Efficiency – Asymptotic Notations and Basic Efficiency classes – Mathematical Analysis of Non-recursive and recursive Algorithms	9
Unit II	**Divide and Conquer** Brute Force and Divide and conquer – Binary Search – Finding the maximum and minimum – merge sort – quick sort	9
Unit III	**Greedy Method** General method – Knapsack problem – Job Sequencing – Spanning Trees – Prims's Algorithm and Kruskal's Algorithm	9
Unit IV	**Dynamic Programming** General method – Principle of Optimality – Multistage Graphs – 0/1 Knapsack – Travelling Salesman Problem	9
Unit V	**Backtracking & Branch Bound** Backtracking – General Method – 8-Queen Problem – Sum of Subsets – Hamiltonian Cycles – Branch and Bound: Introduction FIFO Solution – LC Branch and Bound – 0/1 Knapsack	9
	Practical Component	
Exercises	1. Write recursive and iterative algorithms and analyze the time complexities of using Big-O notation 2. Implement and compare the efficiency of sorting algorithms (e.g., bubble sort, quicksort) on different input sizes 3. Implement merge sort and analyze its time complexity with different input sizes 4. Implement a greedy algorithm for the knapsack problem and analyze its efficiency 5. Implement Prim's algorithm for finding the minimum cost spanning tree 6. Implement Kruskal's algorithm for the same purpose and compare the results 7. Solve the 0/1 knapsack problem using dynamic programming and analyze the time complexity 8. Implement a backtracking solution for the subset sum problem and analyze its efficiency	30

Recommended Learning Resources	
Print Resources	1. Horowitz E. and Sahani S., "Fundamentals of Computer Algorithms", Second Edition, Universities press, 2008. 2. S. Sridar, "Design and Analysis of Algorithms", Oxford University Press, 2014.
Syllabus Design: Dr. T. Vengattaraman, Associate Professor, PUDoCS	

Year	II	Course Code: CSCS208 Course Title: Database Management Systems	Credits	4
			Hours	75
Sem.	IV		Category	C
Course Prerequisites, if any	Knowledge of data structures and file-handling			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand the fundamentals of relational Model • Design real time applications using database query language (SQL) • Familiarize with the different kinds of PL/SQL objects • Understand the various database applications using the Relational model, ER model and EER model • Construct and normalize conceptual data models			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction to Relational model** Structure of relational database – Database schema – Keys – Schema diagram – Relational Query language – Relational Algebra		9	
Unit II	**Introduction to SQL** SQL data definition – basic structure of SQL Queries – set operations – null values – aggregate functions – nested subqueries		9	
Unit III	**Intermediate and advanced SQL** Join expressions, views – transaction – integrity constraints – functions and procedures – triggers		9	
Unit IV	**Database design using ER model** The Entity-Relationship model – complex attributes – mapping cardinalities – primary key – removing redundant attributes in entity sets – reducing ER diagrams to relational schemas – extended ER features		9	
Unit V	**Relational database design** Decomposition using functional dependencies – normal forms – functional dependency theory – algorithms for decomposition using functional dependencies – decomposition using multivalued dependencies		9	
Practical Component				
Exercises	1. Implement the DDL commands using SQL 2. Implement the DML commands 3. Implement the DDL constraints, DCL, and TCL commands 4. Implement various built functions and aggregate functions 5. Implement the various join operations 6. Implement the various nested subqueries 7. Creation and manipulation of Views 8. Practice the basics of PL/SQL [control structures] 9. Create the functions and procedures using PL/SQL 10. Create the Triggers using PL/SQL 11.		30	
Recommended Learning Resources				
Print Resources	1. Abraham Silberschatz, Henry F. Korth and S. Sundarshan, “Database System Concepts “, Seventh Edition, McGraw Hill International Edition, 2021.			

	2. Brumm B, “Beginning Oracle SQL for Oracle Database 18c: From Novice to Professional”, First Edition, Apress, 2019. 3. Kevin Loney, Bob Bryla, “Oracle Database 12c: The Complete Reference”, First Edition, McGraw Hill, 2013.
Syllabus Design: Dr. S. L. Jayalakshmi, Assistant Professor, PUDoCS	

Year	II	Course Code: CSCS209 Course Title: Embedded Application Development	Credits	4
Sem.	IV		Hours	75
			Category	C
Course Prerequisites, if any	• Microprocessor & Microcontrollers introduction • Assembly Language Programming • Operating System and Computer Organization Concepts			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand the basics of Embedded Systems • Appreciate the application domains of Embedded Systems • Gain proficiency in programming embedded systems • Explore interfacing techniques for sensors, actuators, and other peripheral devices commonly used in embedded applications • Develop skills in designing, implementing, and debugging embedded software			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Embedded Systems and General-purpose Computer Systems – History – Classifications – Applications – Purpose of Embedded Systems – Characteristics and Quality Attributes	9
Unit II	**Embedded Systems** Application specific – washing machine – domain specific – automotive Embedded Hardware: Memory – I/O – Interrupt – Processors – External peripherals Peripherals: Control and Status Registers – Device Driver – Timer Driver – Watchdog Timers	9
Unit III	**Microcontrollers** Microcontrollers and Embedded processors – Overview of 8051 family. 8051 hardware – I/O pins – Ports – Circuits – External Memory Programming: Data Types – I/O Programming – Logic operations – Data conversion Programs	9
Unit IV	**Designing Embedded System with 8051 Microcontroller** Factors to be considered in selecting a controller – 8051 Microcontroller – Designing with 8051 Programming: Structure of embedded program – infinite loop – compiling, linking & debugging	9
Unit V	**Real Time Operating System (RTOS)** Operating system basics – Types of OS – Real-Time Characteristics – Selection Process of an RTOS Design and Development: Embedded system development Environment – IDE – types of file generated, disassembler – de-compiler – simulator – emulator and debugging, embedded product development life-cycle, trends in embedded industry	9
	Practical Component	
Exercises	1. Configure timer control registers of 8051 and develop a program to generate given time delay 2. Port I/O: Use one of the four ports of 8051 for O/P 3. interfaced to eight LED's. Simulate binary counter (8 bit) on LED's 4. Serial I/O: Configure 8051 serial port for asynchronous serial communication with serial port of PC exchange text messages	30

	to PC and display on PC screen. Signify end of message by carriage return 5. Interface 8051 with D/A converter and generate square wave of given frequency on oscilloscope 6. Interface the microcontroller with external devices (e.g., sensors, displays, or other microcontrollers) using serial communication. Implement simple data exchange protocols and verify communication 7. Generate PWM signals to control the brightness of LEDs or the speed of a motor. Experiment with different duty cycles and frequencies 8. Write programs to store and retrieve data from non-volatile memory (e.g., EEPROM or Flash). Implement dynamic memory allocation techniques using RAM	
Recommended Learning Resources		
Print Resources	1. Shibu K V, "Introduction to Embedded Systems" Second Edition, Tata McGraw Hill, 2017. 2. Rajkamal, “Embedded Systems - Architecture, Programming and Design", Third Edition, McGraw Hill Education, 2008.	
Syllabus Design: Dr. S.K.V. Jayakumar, Professor, PUDoCS		

SEMESTER V

Year	III	Course Code: CSCS301 Course Title: Operating Systems	Credits	4
			Hours	75
Sem.	V		Category	C
Course Prerequisites, if any	Knowledge of computers & computer organization			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• To understand the basic concepts of Operating System and Process • To learn the various mechanisms of CPU scheduling, process synchronization and deadlocks • To understand how the memory is utilized • To analyze various File System methods and Disk scheduling algorithms • Evaluate system structures in various operating systems, such as Linux and Windows and identifying similarities and differences			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Overview and Process management** Introduction: Operating System Structures – Operating systems services – System calls. Process Management**:** Process Concept – process scheduling – operation on processes – Inter process communications – Threads		9	
Unit II	**Scheduling algorithms and Process Synchronization** CPU Scheduling: Basic Concepts – Scheduling Algorithms Process Synchronization**:** Critical Section problem – Semaphores – Classical problems of synchronization – Monitors Deadlock: Deadlock Characterization – Deadlock Handling – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Deadlock Recovery		9	
Unit III	**Memory Management** Main Memory: Contiguous Memory Allocation – Paging – Structure of the Page Table – Swapping Virtual Memory: Demand Paging – Page Replacement – Thrashing		9	
Unit IV	**Storage Management** Mass Storage structure: Overview – HDD (Disk) Scheduling – storage management – RAID Structure File Systems: File concepts – Access methods – Directory Structure – File Protection – File system Implementation – File System Structure – File System Operations – Allocation methods		9	
Unit V	**Case Studies** The Linux system: Design principles – kernel modules – process management – Scheduling – Memory Management – Linux File System Windows Operating system: Systems components – Windows File System		9	
Practical Component				
Exercises	1. Practice File handling utilities, Process utilities, Disk utilities, and Networking commands 2. Write a program to implement various system call operations		30	

	3. Write a program to demonstrate various File management operations 4. Write a program to simulate CPU scheduling algorithms: FCFS, SJF, Round Robin, and priority 5. Write a program to simulate Intra & Inter – Process Communication (IPC) techniques: Pipes, Messages Queues, and Shared Memory 6. Write a program to simulate solutions to Classical Process Synchronization Problems: Dining Philosophers, Producer – Consumer, Readers – Writers 7. Write a program to simulate Bankers Algorithm for Deadlock Avoidance 8. Write a program to simulate Page Replacement Algorithms: FIFO, Optimal, LRU 9. Write C programs to simulate implementation of HDD Scheduling Algorithms: FCFS, SCAN, C–SCAN 10. Case study on Linux and Windows Operating systems features and prepare a report on the same	
Recommended Learning Resources		
Print Resources	1. Abraham Silberschatz Peter B Galvin, G. Gagne, “Operating Systems Concepts”, Tenth Edition, Addison Wesley, 2018. 2. William Stallings, “Operating Systems: Internals and Design Principles”, Tenth Edition, Prentice Hall, 2021.	
Syllabus Design: Dr. S. L. Jayalakshmi, Assistant Professor, PUDoCS		

Year	III	Course Code: CSCS302 Course Title: Mathematical Foundations of Computer Science	Credits	4
Sem.	V		Hours	75
			Category	A
Course Prerequisites, if any	Basic Knowledge in Mathematics			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA(Theory): 03 hrs.		
Course Outcomes	• Understand logical statement structures • Apply operations in problem-solving • Analyze integer representations and congruences • Understand counting principles • Evaluate combinatorial solutions			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Logic and Proofs** Propositional Logic – Predicates and Quantifiers – Rules of Inference – Proofs – Methods and Strategy	15
Unit II	**Basic Structures** Sets – Functions – Sequences and Summations – Matrices Relations – properties – representation	15
Unit III	**Number Theory** Divisibility and Modular Arithmetic – Integer Representations and Algorithms – Primes and Greatest Common Divisors – Congruences	15
Unit IV	**Induction and Recursion** Mathematical Induction – Strong Induction and Well Ordering – Recursive Definitions and Structural Induction	15
Unit V	**Counting** Basics – Pigeonhole principle – Permutations and Combinations – Binomial Coefficients	15
	Practical Component	
-	-	-

Recommended Learning Resources	
Print Resources	1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Seventh Edition, McGraw Hill, Seventh Edition, 2017. 2. Trembley. J.P and Manohar. R., "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 2020.

Syllabus Design: Dr. M. Sathya, Assistant Professor, PUDoCS

<table>
<tr><td>Year</td><td>III</td><td colspan="2" rowspan="2">Course Code: CSCS303
Course Title: Computer Networks</td><td>Credits</td><td>4</td></tr>
<tr><td>Sem.</td><td>V</td><td>Hours</td><td>75</td></tr>
<tr><td colspan="4"></td><td>Category</td><td>C</td></tr>
<tr><td>Course Prerequisites, if any</td><td colspan="5">Fundamentals of Computers</td></tr>
<tr><td>Internal Assessment Marks: 40</td><td colspan="2">End Semester Marks: 60</td><td colspan="3">Duration of ESA (Theory): 03 hrs.
Duration of ESA (Practical): 03 hrs.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">● Learn the basics of Network topology
● Learn about the various physical network media
● Understand the functionalities of all the network layers
● Familiarize the protocols of different layers
● Able to implement the various network protocols</td></tr>
<tr><td>Unit No.</td><td colspan="4">Course Content</td><td>Hours</td></tr>
<tr><td colspan="6">Theory Component</td></tr>
<tr><td>Unit I</td><td colspan="4">Introduction
Introduction to Networks – Topology – Network Architecture – Reference Models – Transmission Media-Multiplexing – Switching</td><td>9</td></tr>
<tr><td>Unit II</td><td colspan="4">Data link layer
Design Issues – Error Detection and Correction – Elementary Data – Link Protocols – Sliding window Protocols</td><td>9</td></tr>
<tr><td>Unit III</td><td colspan="4">Network Layer
Design Issues – Routing – Logical Addressing – IP Working- IPV4 Vs IPV6 – Address Mapping – delivery – Forwarding and routing</td><td>9</td></tr>
<tr><td>Unit IV</td><td colspan="4">Transport Layer
The Transport Service – Service provided to the Upper Layers – Flow Control & Buffering – TCP Congestion Control – UDP – TCP Vs UDP</td><td>9</td></tr>
<tr><td>Unit V</td><td colspan="4">Application layer
Domain Naming System – DNS Namespace – Resource Records – Name Servers – Electronic mail – Messages Formats – Message Transfer</td><td>9</td></tr>
<tr><td colspan="6">Practical Component</td></tr>
<tr><td>Exercises</td><td colspan="4">1. Implementation of Basic Chat
2. Implementation of Multiple User Chat
3. Implementation of File Transmission
4. Implementation of Simple Mailing Application
5. Implementation of Client Server Application
6. Given IP address and subnet mask, Computation of
(i) Subnet addresses
(ii) Number of hosts in each subnet
(iii) IP addresses of hosts in each subnet
7. Implementation of Error Detection / Error Correction Techniques
8. Implementation of socket program Remote Procedure Call
9. Implementation of any one routing protocol
10. Implementation of congestion control protocol</td><td>30</td></tr>
</table>

Recommended Learning Resources	
Print Resources	1. Andrew S. Tanenbaum, David J. Wetherall, “Computer Networks”, Fifth Edition, Prentice Hall publisher, 2022. 2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2015. 3. James F. Kurose, Keith W. Ross,” Computer Networking - A Top-Down Approach Featuring the Internet”, Seventh Edition, Pearson Education, 2022.
Syllabus Design: Dr. G. Krishnapriya, Assistant Professor, PUDoCS	

Year	III	Course Code: CSCS304 Course Title: Theory of Computation	Credits	4
Sem.	V		Hours	75
			Category	A
Course Prerequisites, if any	• Knowledge in Mathematics for Computer Science			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs.		
Course Outcomes	• Understand foundational concepts of formal languages • Apply regular expressions to create DFA for lexical analyzers • Analyze equivalence and transformations between NFA, DFA, and TG • Evaluate context-free grammars and limitations of regular grammars • Design models using PDA			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Languages** Alphabets – String – Language – Basic Operations on Language – Concatenation – Union – Kleene Star		15	
Unit II	**Regular Expressions and Finite Automata** Regular expressions – Deterministic finite automata (DFA)		15	
Unit III	**Regular Languages** Non-Deterministic Finite Automata (NFA) – Relationship Between NFA and DFA – Transition Graphs (TG) – Properties of Regular Languages – The Relationship Between Regular Languages and Finite Automata – Kleene's Theorem		15	
Unit IV	**Non-Regular Languages and Context Free Grammars** Pumping Lemma for Regular Grammars – Context-Free Grammars (CFG)		15	
Unit V	**PDA and Context-Free Languages (CFL)** Deterministic And Non-Deterministic Pushdown Automata (PDA) – Parse Trees – Leftmost Derivation – Pumping Lemma for CFL – Properties Of CFL		15	
Practical Component				
-	-		-	
Recommended Learning Resources				
Print Resources	1. Cohen, D. I. A, "Introduction to Computer Theory", Second Edition, Wiley India, 2011. 2. Lewis, H.R. & Papadimitriou, H. R., "Elements of the Theory of Computation", Second Edition, Prentice Hall of India (PHI), 2015.			
Syllabus Design: Dr. M. Sathya, Assistant Professor, PUDoCS				

SEMESTER VI

<table>
<tr><td rowspan="2">Year</td><td rowspan="2">III</td><td rowspan="2" colspan="2">Course Code: CSCS306
Course Title: Management Strategies and Concepts</td><td>Credits</td><td>4</td></tr>
<tr><td>Hours</td><td>75</td></tr>
<tr><td>Sem.</td><td>VI</td><td>Category</td><td>A</td></tr>
<tr><td>Course Prerequisites, if any</td><td colspan="5">NIL</td></tr>
<tr><td>Internal Assessment Marks: 40</td><td colspan="2">End Semester Marks: 60</td><td colspan="3">Duration of ESA (Theory): 03 hrs.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">• Understand the fundamentals of Management Theories
• Learn the management & communication Process Concepts
• Analyse the performance of decentralized and centralized organizational structures
• Analyse the different leadership styles and their effects on team performance and organizational culture
• Evaluate the effectiveness of the strategies in enhancing productivity and efficiency</td></tr>
<tr><td>Unit No.</td><td colspan="3">Course Content</td><td colspan="2">Hours</td></tr>
<tr><td colspan="6">Theory Component</td></tr>
<tr><td>Unit I</td><td colspan="3">Management Theories
Science Theory and Practice – Management and Society – Social Responsibility and Ethics – The nature and purpose of planning – objectives – Strategies Policies and planning premises</td><td colspan="2">15</td></tr>
<tr><td>Unit II</td><td colspan="3">Decision Making
Process of decision making – organizing – Nature and purpose of organizing – Basics of departmentalization – Line/Staff Authority and Decentralization – Effective Organizing and organizational structure & culture</td><td colspan="2">15</td></tr>
<tr><td>Unit III</td><td colspan="3">Human Resource Management & Selection
Staffing – Manpower planning – Recruitment & Selection – Performance appraisal and career strategy – Organizational development</td><td colspan="2">15</td></tr>
<tr><td>Unit IV</td><td colspan="3">Managing the Human factor
Motivation – Leadership – Communication</td><td colspan="2">15</td></tr>
<tr><td>Unit V</td><td colspan="3">The System & Process of Controlling
Control techniques and Information Technology – Productivity and Operations Management – Overall and Preventive Control – Towards a Unified – Global management theory</td><td colspan="2">15</td></tr>
<tr><td colspan="6">Recommended Learning Resources</td></tr>
<tr><td>Print Resources</td><td colspan="5">1. Herald Knootz and Heinz Weihrich, “Essentials of Management”, Eleventh Edition, McGraw-Hill Publishing Company, 2020.
2. Fred R. David and Forest R. David, "Strategic Management: Concepts and Cases", Prentice Hall India Learning Private Limited, Sixteenth Edition, 2020.</td></tr>
<tr><td colspan="6">Syllabus Design: Dr. S. L. Jayalakshmi, Assistant Professor, PUDoCS</td></tr>
</table>

Year	III	Course Code: CSCS307 Course Title: Software Engineering Theory and Practice	Credits	4
Sem.	VI		Hours	75
			Category	C
Course Prerequisites, if any	• Basic knowledge of programming and information systems			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand the fundamental concepts of design thinking • Analyze and document the software requirements • Apply appropriate software engineering design concepts to develop software. • Apply software testing strategies • Understand and consider the significance of security in software development process			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction to Design Thinking** Design process - Traditional design - Design thinking - Existing sample design projects - Study on designs around us - Compositions/structure of a design - Innovative design - Breaking of patterns - Reframe existing design problems - Principles of creativity Empathy - Customer Needs - Insight-leaving from the lives of others/standing on the shoes of others - Observation.	9
Unit II	**Software Engineering and Software Requirements** Defining software engineering, Software life cycle models, Selection of a life cycle model - Requirements engineering, Types of requirements, Feasibility studies, Requirements elicitation, Requirement analysis, Requirement documentation, Requirement validation.	9
Unit III	**Software Project Planning** Size estimation, Cost estimation, Models, Constructive cost model, Software risk management, Software design, Modularity, Strategy of design, Function oriented design, Object oriented design.	9
Unit IV	**Testing Strategies** A strategic approach to software testing, Test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, The art of Debugging.	9
Unit V	**Secure Software Engineering** Introduction - The problem – Software assurance and software security – Threats to software security – Software insecurity – Benefits of detecting software security defects early – Managing secure software development – Defining Properties – Influencing the security properties of software – To assert and specify desired security properties.	9
	Practical Component	
Exercises	1. Conceptualize a novel app that will help to save: a) Energy b) Water c) Food 2. Apply the phases of Software Development Life Cycle	30

	for the following applications and develop the same : a) Library Management System b) Hospital Management System 3. Design the above two systems with security features and implement the same.	
Recommended Learning Resources		
Print Resources	1. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", First Edition, HarperCollins Publishers Ltd, 2019. 2. Roger S. Pressman, Bruce Maxim, "Software Engineering, A Practitioner's Approach", Ninth Edition, McGraw Hill International Edition, 2023. 3. Julia H. Allen, "Software Security Engineering: A Guide for Project Managers", First Edition, 2008.	
Syllabus Design: Dr. T. Chithralekha, Professor, PUDoCS ***Dr. G. Krishnapriya, Assistant Professor, PUDoCS***		

Year	III	Course Code: CSCS308 Course Title: Distributed Systems	Credits	4
Sem.	VI		Hours	75
			Category	C
Course Prerequisites, if any	Basic knowledge in operating systems and computer networks			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Learn basic concepts of Distributed Systems • Understand state-of-the-art distributed system • Design and develop Client/Server Applications • Learn to setup fault tolerance and replication servers • Design and implement CORBA and DCOM			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Definition – Goals – Hardware and Software Concepts – Client/Server Model Communication – Layered Protocols RPC – Remote Object Invocation – Message Oriented Communication	9
Unit II	**Client Server** Client Server and Naming Entity – Threads – Client Server – Code Migration – S/W Agents – Naming Entity – Location Mobile Entity	9
Unit III	**Synchronization** Distributed Transactions – Synchronization – Clock Synchronization – Logical Clocks – Global States – Election Algorithms – Mutual Exclusion – Distributed Transaction Consistency and Replication – Data Centric Consistency – Fault Tolerance – Distributed Commit – Recovery	9
Unit IV	**Distributed Objects** Distributed Object Database System – CORBA – DCOM – GLOBE	9
Unit V	**Distributed File System** Introduction - Distributed File System – Distributed Document based System – WWW – Distributed Coordination based System – JINI	9
	Practical Component	
Exercises	1. Perform arithmetic operation using RMI 2. Calculate simple and compound interest using RMI 3. Implementation of ATM using RMI 4. Implementation of Telephone Directory using RMI 5. Implementation of Quiz Server using Servelets 6. Implementation of Online Shopping System using servelets	30

	7. Implementation of matrimonial System using servelets 8. Implementation of servelet based Airline Reservation system 9. Create a Word Document with text using DCOM and Visual Basic	
Recommended Learning Resources		
Print Resources	1. Andrew S. Tanenbaum, Maarten van Steer, "Distributed Systems: Principles and Paradigms", Third Edition, Prentice Hall India, 2017. 2. George Couloursis, Jean Dollomore and Tim Kinderberg, "Distributed Systems: Concepts and Design", Addison-Wesley, Fifth Edition, 2011.	
Syllabus Design: Dr. T. Sivakumar, Assistant Professor, PUDoCS		

Year	III	Course Code: CSCS309 Course Title: Operations Research	Credits	4
Sem.	VI		Hours	75
			Category	A
Course Prerequisites, if any	Basic Mathematical and Problem-Solving Skills			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs.		
Course Outcomes	• Understand and comprehend the basics of Linear Programming Problem (LPP) • Learn LPP solving methods and explore duality in LPP • Solve assignment problems and their variants • Find feasible and optimal solutions for transportation problem • Perform critical path analysis and reviewing of a project			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction** Operation Research – Definition – Characteristics – Techniques – Applications. LPP – Introduction – Applications and components of LPP – Steps in solving LPP		15	
Unit II	**LPP** Mathematical formulation – Graphical method – Simplex method – Artificial variables – Big-M method – Two-phase method – Degeneracy and unbound solutions – Duality in LPP – Formulation – Relationship between primal and dual problems		15	
Unit III	**Assignment Model** Mathematical formulations – Hungarian Method – Variants of the Assignment problem		15	
Unit IV	**Transportation Problem** Mathematical formulation – Finding basic feasible solutions – NWCR, LCM and VAM – Optimal solution – MODI method		15	
Unit V	**Network Scheduling** Introduction – Basic components – Logical sequencing – Rules of network construction – Concurrent Activities – Critical Path Analysis -Activity Time and Floats – Project Evaluation and Review Technique (PERT) – Three Time Estimates – Critical Path Analysis of PERT network – Probability of completion of Project		15	
Practical Component				
	-			
Recommended Learning Resources				
Print Resources	1. Kanti Swarup, P.K. Gupta, Man Mohan, "Operations Research", Sultan Chand & Sons, Twentieth Edition, 2023. 2. Taha H.A., "Operations Research: An Introduction", Pearson Education, Tenth Edition, 2019.			
Syllabus Design: Dr. G. Krishnapriya, Assistant Professor, PUDoCS *Revised by: Dr. M. Nandhini, Professor, PUDoCS*				

Year	III	Course Code: CSCS310 Course Title: Unix System Programming	Credits	4
Sem.	VI		Hours	75
			Category	C
Course Prerequisites, if any	• Computer Organization and Architecture • Operating System			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand Unix history, features, and system architecture • Manage files, directories, processes, and memory • Implement IPC with shared memory and semaphores • Develop network applications using socket programming • Write and execute shell scripts for text and pattern manipulation			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Introduction to Unix – History – Salient features of Unix – Unix System Architecture – Unix Programming Environment – Unix Process	9
Unit II	**Standard I/O, Process and Memory Management** File Management: File input/output – Directory related System Calls – Process Management Processes: Creation – Execution – Termination – Process States – Process Control – Process groups – Thread – Memory Management	9
Unit III	**Inter-Process Communication** Introduction to IPC – Shared Memory: Creating Shared Memory – Controlling Shared memory Segment – Process Synchronization: Semaphore	9
Unit IV	**Socket Programming** Socket – Types of Sockets – Socket Data Structure – System Calls – I/O Models – Name and Address Conversion – Resource records	9
Unit V	**Tools and Programming** Shell Scripting – Shell Scripting Operations – Text Manipulation – Pattern Matching – Text Transformation	9
	Practical Component	
Exercises	1. Perform operations like file creation, deletion, copying, moving, listing directory contents 2. Write a shell script that takes a directory name as an argument and lists all files and directories inside it 3. Write programs using 'fork', 'exec', and 'Wait' system calls to create processes 4. Create a program that uses unnamed pipes for communication between a parent and its child process 5. Write a simple client-server application using TCP sockets where the client sends a message to the server, and the server echoes it back	30

	6. Implement a program that manipulates file permissions, accesses file metadata (like inode information), and performs file locking 7. Develop a simple shell that can interpret commands, launch programs, and support basic piping and redirection	
Recommended Learning Resources		
Print Resources	1. Vineeta khemchandani, Dappan Anand, Mishra, Sandeep Harit, "Unix Programming", BPB Online, 2022.	
Syllabus Design: Dr. S. K. V. Jayakumar, Professor, PUDoCS		

Year	III	Course Code: CSCS311 Course Title: Network Programming	Credits	4
Sem.	VI		Hours	75
			Category	C
Course Prerequisites, if any	• Computer Networking Fundamentals • Programming Languages			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand client-server networking and socket API • Learn server architectures: single-threaded, multithreaded, and async servers • Implement message queues, caching, and HTTP handling • Understand various networking protocols (TCP, UDP, POP, IMAP, etc.) • Explore case studies using Cisco Packet Tracer, Network Simulator 2, and GNS3			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Client Server Networking – UDP – TCP – DNS – Client-server Model – Socket API – Socket Addresses	9
Unit II	**Architecture of Servers** Data and Errors on Internet: Strings and bytes – SSL/TLS – Architecture of Server – Single Threaded Server – Multithreaded Servers – Async Servers	9
Unit III	**Message Queues and Caches** Memory Caching - Hashing and Sharding - Message Queues – HTTP Client – Server Handling HTTP – World Wide Web – SMTP	9
Unit IV	**Protocols** TCP – UDP – POP – IMAP – IPV4 – IpV6 – BGP – Telnet – SSH – FTP – RPC	9
Unit V	**Case Studies** Cisco Packet Tracer – Network Simulator 2 – GNS3	9
	Practical Component	
Exercises	1. a) Study of different types of network cables and practically implement cross wired cable and straight through cable using clamping tool b) Study of network devices and network IP in detail 2. Study of network IP and practically connect the computers in LAN a) Study of basic network command and network configuration commands b) Configure a network topology using CPT 3. Configure a network using Distance vector/Link state routing protocol 4. Simulation of Sliding Window Protocol 5. Half Duplex Chat Using UDP 6. Full Duplex Chat Using TCP/IP	30
	Recommended Learning Resources	
References	1. John Galbraith, "Network Programming in Python: The Basic", First Edition, BPB Publications, 2022.	
Syllabus Design: Dr. S.K.V. Jayakumar, Professor, PUDoCS		

SEMESTER VII

<table>
<tr><td>Year</td><td>IV</td><td colspan="2" rowspan="2">Course Code: CSCS401
Course Title: Web Engineering</td><td>Credits</td><td>4</td></tr>
<tr><td>Sem.</td><td>VII</td><td>Hours</td><td>75</td></tr>
<tr><td colspan="4"></td><td>Category</td><td>C</td></tr>
<tr><td>Course Prerequisites, if any</td><td colspan="5">Basic understanding of programming concepts</td></tr>
<tr><td>Internal Assessment Marks: 40</td><td colspan="3">End Semester Marks: 60</td><td colspan="2">Duration of ESA (Theory): 03 hrs.
Duration of ESA (Practical): 03 hrs</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">• Understand the process of web publishing
• Acquire skills developing web pages using HTML
• Acquire skills to style the web pages using CSS
• Acquire skills to build server-side web components
• Explore the mobile web development process</td></tr>
<tr><td>Unit No.</td><td colspan="3">Course Component</td><td colspan="2">Hours</td></tr>
<tr><td colspan="6">Theory Component</td></tr>
<tr><td>Unit I</td><td colspan="3">Introduction to World Wide Web
Introduction to web publishing – Web browsers – Web servers – Uniform Resource Locators – Using browser-based developer tools.</td><td colspan="2">9</td></tr>
<tr><td>Unit II</td><td colspan="3">Introduction to HTML and CSS
Structuring a web page with HTML – Basic elements – Lists – Links – Tables – Images – Forms
Using CSS to style a site – CSS for positioning – Integrating Multimedia elements</td><td colspan="2">9</td></tr>
<tr><td>Unit III</td><td colspan="3">Introduction to JavaScript
The structure – Operators – Variables – Control structures – Functions – Arrays – Objects – Validation</td><td colspan="2">9</td></tr>
<tr><td>Unit IV</td><td colspan="3">Introduction to PHP
Setting up the server – PHP language basics – built–in functions – library functions – using includes – database connectivity – sending email – cookies and sessions – File uploads</td><td colspan="2">9</td></tr>
<tr><td>Unit V</td><td colspan="3">Mobile Web
Mobile browsing needs – text on mobile web – design and page layout – links – images and multimedia – CSS for mobile – making use mobile features – Best practices</td><td colspan="2">9</td></tr>
<tr><td colspan="6">Practical Component</td></tr>
<tr><td>Exercises</td><td colspan="3">1. Build your resume using simple static html
2. Enrich your resume with CSS
3. Implement an HTML Form with JavaScript validation
4. Build a web application to demonstrate event handling in JavaScript
5. Add a server-side component to the task #3
6. Build a server-side data storage web application
7. Build a web application to demonstrate session handling
8. Build a web application to demonstrate cookies handling
9. Implement mobile web application
10. Implement file uploads in a web application</td><td colspan="2">30</td></tr>
<tr><td colspan="6">Recommended Learning Resource</td></tr>
</table>

Print Resources	1. Laura Lemay, Rafe Coburn, Jennifer Kyrnin, “Sams Teach yourself HTML, CSS & Javascript Web Publishing, Pearson Education, 2016.
Syllabus Design: Dr. K. S. Kuppusamy, Associate Professor, PUDoCS	

Year	III	Course Code: CSCS402 Course Title: System Modelling and Simulation	Credits	4
			Hours	75
Sem.	VII		Category	C
Course Prerequisites, if any	Basic knowledge in statistics			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand the fundamentals of modeling and simulation • Learn about statistical models and input modelling • Understand the techniques for random number generation • Perform the simulation of dynamic systems • Verify the simulation models			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Simulation tool – Advantages and disadvantages of Simulation – Areas of application– Systems and system environment – Components of a system – Discrete and continuous systems – Model of a system – Types of Models – DESS – Simulation of queuing systems – General Principles	9
Unit II	**Statistical Models in Simulation** Review of terminology and concepts – Useful statistical models – Discrete distributions – Continuous distributions – Poisson process – Empirical distributions – General Principles – Characteristics of queuing systems – Queuing notation – Long-run measures of performance of queuing systems – Steady-state behavior of M/G/1 queue – Networks of queues	9
Unit III	**Random-Number Generation** Properties of random numbers – Generation of pseudo-random numbers – Techniques for generating random numbers – Tests for Random Numbers – Inverse transform technique Acceptance – Rejection technique	9
Unit IV	**Input Modeling** Data Collection – Identifying the distribution with data – Parameter estimation – Goodness of Fit Tests – Fitting a non-stationary Poisson process – Selecting input models without data – Multivariate & Time – Series input models – Types of simulations with respect to output analysis – Stochastic nature of output data – Measures of performance and their estimation	9
Unit V	**Simulation Models** Measures of performance and their estimation – Output analysis for terminating simulations – Output analysis for steady – state simulations – Verification, Calibration and Validation – Optimization, Model building, Verification and Validation – Verification of simulation models – Calibration and Validation of models, Optimization via Simulation	9
	Practical Component	
Exercises	1. Simulation of Random Numbers generation 2. Implement Chi-square goodness-of-fit test 3. Implement One-sample Kolmogorov-Smirnov test 4. Implement Test for Standard Normal Distribution	30

	5. Implement Monte-Carlo Simulation 6. Simulation of Single Server Queuing System 7. Simulation of Two-Server Queuing System 8. Simulate and control a conveyor belt system 9. Implement Two-sample Kolmogorov-Smirnov test	
Recommended Learning Resources		
Print Resources	1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, "Discrete-Event System Simulation", Fifth Edition, Pearson Education, 2013. 2. Lawrence M. Leemis, Stephen K. Park, "Discrete-Event Simulation: A First Course", Pearson Education, 2013.	
Syllabus Design: Dr. G. Krishnapriya, Assistant Professor, PUDoCS		

Year	IV	Course Code: CSCS403 Course Title: Wireless Communication Networks	Credits	4
Sem.	VII		Hours	75
			Category	C
Course Prerequisites, if any	Knowledge in computer networks			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand basics of Wireless Communication Networks • Understand the Satellite Communications concepts and compare generations wireless communications • Explore IEEE 802.11WLAN standard • Explore WAP and its application • Understand WLAN technologies			

Unit No.	Course Component	Hours
Theory Component		
Unit I	**Introduction** Wireless Communication Technology – Antennas and Propagation – Antennas, Propagation Modes, Fading in the Mobile Environment – Signal Encoding Techniques – Signal Encoding Criteria, Digital Data – Analog Signals, Analog Data – Analog Signals, Analog Data – Digital Signals	9
Unit II	**Satellite Communications** Wireless Networking – Satellite Communications – Satellite Parameters and Configurations, Capacity Allocation – Frequency Division, Capacity Allocation –Time Division Cellular Wireless Networks – Principles of Cellular Networks, First Generation Analog, Second Generation – TDMA, CDMA, 3G Systems	9
Unit III	**Wireless LAN Standards** Evolution of IEEE 802.11 – Introduction to IEEE 802.11 – General Description – Medium Access Control (MAC) for the IEEE 802.11 – WLANs Physical Layer for IEEE 802.11 – WLANs; Radio Systems – IR Systems Applications	9
Unit IV	**Mobile IP** Introduction, operation of Mobile IP, Mobile IP terminologies, Wireless Access Protocols: Introduction, Architecture overview, Wireless application environment	9
Unit V	**Wireless LAN Technology** Wireless LAN – application, requirements, Technology: Infrared, spread spectrum, Narrowband microwave (radio), Introduction Bluetooth Technologies (Only Overview)	9
Practical Component		
Exercises	1. Study about different Wireless devices like Wi-Fi Dongler, Wireless Access Point, Antenna, Wi-Fi Router 2. Configure a wireless LAN using CISCO Packet Tracer 3. Develop a client server application using Wireless LAN 4. Simulate BlueTooth Communication after pairing in CISCO Packet Tracer	30

Recommended Learning Resource	
Print Resources	1. William Stallings, “Wireless Communications and Networks” 2nd edition, Pearson Prentice Hall, 2005.
Syllabus Design: Dr. T. Sivakumar, Assistant Professor, PUDoCS	

Year	IV	Course Code: CSCS404 Course Title: Artificial Intelligence	Credits	4
Sem.	VII		Hours	75
			Category	C
Course Prerequisites, if any	Basic Programming Skills			
Internal Assessment Marks: 40	End Semester Marks: 60		Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.	
Course Outcomes	● Familiarize with the diverse traits of a problem-solving agent ● Explore methods for tackling problems amidst different constraints ● Implement AI techniques in various applications ● Grasp the distinct models of learning ● Develop an expert system			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Foundation and History of AI – Intelligent Agents – Agents and Environments – The Concept of Rationality – Nature of Environments – Structure of Agents – Problem Solving Agents – Examples	9
Unit II	**Searching** Searching for Solutions, Uniformed Search Strategies – Heuristics Search Strategies – Local Search Algorithms and Optimization Problems – Hill Climbing- Simulated Annealing – Local Beam Search – Genetic Algorithms – Optimal Decisions in Games – Alpha-Beta Pruning	9
Unit III	**Agents** Logical Agents – Knowledge-Based Agents – The Wumpus World – Logic – Propositional Logic – Propositional Theorem Proving – Effective Propositional Model Checking – Agents Based on Propositional Logic	9
Unit IV	**First Order Logic** Introduction – Syntax and Semantics – Inference – Propositional Vs First-Order Inference – Unification and Lifting – Forward Chaining – Backward Chaining – Resolution	9
Unit V	**Learning** Forms of Learning – Supervised Learning – Learning Decision Trees – Hypothesis – Theory of Learning – Prolog – Programs – Data Objects	9
	Practical Component	
Exercises	1. Implement Breadth First Search 2. Implement Depth First Search 3. Implement Tic-Tac-Toe game 4. Implement 8-Puzzle problem 5. Implement Water-Jug problem 6. Implement Monkey Banana Problem 7. Implement Alpha-Beta Pruning 8. Develop an expert system using Prolog	30

Recommended Learning Resources	
Print Resources	1. S. Russell and P. Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education, Third Edition, 2010. 2. Max Bramer, Logic Programming with Prolog, Springer, 2005.
Syllabus Design: Dr. P. Shanthi Bala, Professor, PUDoCS	

Year	IV	Course Code: CSCS405 Course Title: Compiler Design	Credits	4
Sem.	VII		Hours	75
			Category	C
Course Prerequisites, if any	• Knowledge in any programming language such as Java or C • Knowledge in Assembly Programming, Basic Arithmetic, and Data Structures			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand the functional components of compilers • Apply knowledge of lexical analysis by implementing scanners • Analyze and differentiate between various parsing techniques • Evaluate and integrate syntax-directed definitions and type checking in compiler construction • Design and create components of a runtime environment and a code generator			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction** Language Processors – Structure of a Compiler – Evolution of Programming Languages – Applications of Compiler Technology – Tool based Approach to Compiler Construction		9	
Unit II	**Lexical Analysis** Interface with Input – Parser and Symbol Table – Tokens, Patterns and Lexemes – Difficulties in Lexical Analysis – Error Reporting – Regular Definitions – Transition Diagrams – Lex		9	
Unit III	**Syntax Analysis** CFGs – Ambiguity – Associatively – Precedence – Top-Down Parsing – Recursive – Descent Parsing – FIRST and FOLLOW – LL (1) Grammars – Predictive Parsing – Bottom-Up Parsing – LR Parsing		9	
Unit IV	**Syntax Directed Definitions** Inherited and Synthesized Attributes – Dependency Graphs – Ordering the Evaluation of Attributes – L and S Attributed Definitions – Type Checking		9	
Unit V	**Run Time Environments** Storage Organization – Stack Allocation of Space – Parameter Passing – Symbol Table – Dynamic Storage Allocation **Code Generation** Issues in the Design of a Code Generator – Addresses in the Target Code – Basic Blocks and Flow Graphs – Optimization of Basic Blocks – Code Generator – Peep Hole Optimization		9	
Practical Component				
Exercises	1. Using Lex or a similar tool, implement a lexical analyzer for a simple programming language or a subset of an existing language 2. Write a recursive descent parser in a programming language of your choice for a simple arithmetic expression grammar that includes addition, subtraction, multiplication, division, and parentheses. Ensure your parser handles operator precedence correctly 3. Implement a program that builds a parse tree for an expression and evaluates its attributes according to your definitions			

	4. Implement a simple type checker that can handle basic data types (integers, floats), type conversions, and function/operator overloading 5. Create a simulation of a runtime environment that demonstrates stack allocation, parameter passing, and dynamic storage allocation 6. Given a set of basic blocks, implement an optimization routine that applies peephole optimization techniques	
Recommended Learning Resources		
Print Resources	1. Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, "Compilers: Principles, Techniques, & Tools", Second Edition, Pearson Addison Wesley, 2023. 2. Allen I. Holub, "Compiler Design in C", First Edition, Pearson India, 2015.	
Syllabus Design: Dr. M. Sathya, Assistant Professor, PUDoCS		

Year	IV	Course Code: CSCS406 Course Title: Cyber Security	Credits	4
Sem.	VII		Hours	75
			Category	C
Course Prerequisites, if any	Basic Knowledge of Programming and Information Security Principles			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Learn the definitions and categories of cybercrimes • Comprehend the tools and techniques employed in cybercrimes • Examine the legal frameworks surrounding cybercrime legislation • Assess the effectiveness of cybersecurity measures • Examine current cyber threats and vulnerabilities			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction to Cybercrime** Cybercrime Definition – Cybercrime and Information Security – Classification of Cybercrimes – Email Spoofing, Spamming, Data Diddling, Web Jacking, Hacking, Password Sniffing – Categories of Cybercrime – Passive attack – Active attack – Reconnaissance		9	
Unit II	**Tools and Methods used in Cybercrime** Cyberstalking – Cybercafe and Cybercrimes – Botnets – Proxy Servers and Anonymizers – Password Cracking – Keyloggers and Spyware – DoS and DDoS attacks – Virus and Worms – Trojan horses and Backdoors – SQL injection – Steganography		9	
Unit III	**Mobile and Wireless Devices** Proliferation of Mobile and Wireless Devices – Trends in Mobility – Security Challenges Posed by Mobile Devices – Authentication Service Security – Attacks on mobiles and cellphones – Credits Card Frauds in mobile and Wireless Computing Era – Organizational measures for Handling Mobile		9	
Unit IV	**Phishing and Identify Theft** Buffer Overflow – Phishing: Methods of Phishing, Phishing Techniques, Spear Phishing, Types of Phishing Scams, Phishing Tool Kits and Spy Phishing, Phishing Countermeasures – Identify Theft (ID Theft): Types of Identify Theft, Techniques of ID theft – ID Theft Counter Measures – Personally Identifiable Information		9	
Unit V	**Cybercrime and Cyber Security Legal Perspectives** The Indian IT Act – Challenges to Indian Law and Cybercrime Scenario in India – Digital Signatures and The Indian IT Act – Amendments to the Indian IT Act – Cybercrime and Punishment		9	
Practical Component				
Exercises	1. Create a simple program that encrypts and decrypts a text message using a basic cipher (e.g., Caesar cipher). Demonstrate encryption of a given plaintext and then decryption back to the original text 2. Simulate a basic SQL injection attack against a sample web application. Demonstrate how unauthorized access to data can be obtained through poorly sanitized input fields. Show the effect of the attack and suggest mitigation strategies		30	

	3. Use a password cracking tool on a set of hashed passwords. Demonstrate the process of cracking by identifying weak passwords from the hash values. Discuss the importance of strong password policies 4. Set up and configure a basic firewall on a network or computer system. Demonstrate how to block and allow specific traffic types. Test the firewall setup by attempting to access the protected resources with varying types of network traffic 5. Analyze a set of emails to identify characteristics of phishing attempts. Explain the indicators of phishing and suggest methods for verifying the authenticity of suspicious emails. Discuss the impact of phishing attacks and preventive measures 6. Create virtualized network environments with cybersecurity simulation software, guiding participants through defense strategies against various cyber-attacks 7. Equip participants with forensic analysis tools, presenting simulated cyber-attack scenarios to investigate, analyze evidence, and prepare forensic reports	
Recommended Learning Resources		
Print Resources	1. Nina Godbole and Sumit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, First Edition, Wiley India Pvt. Ltd., 2011. 2. Anand Shinde, “Introduction to Cyber Security: Guide to the World of Cyber Security”, First Edition, Notion Press, 2021.	
Syllabus Design: Dr. M.Sathya, Assistant Professor, PUDoCS		

Year	IV	Course Code: CSCS407 Course Title: Internet of Things	Credits	4
Sem.	VII		Hours	75
			Category	C
Course Prerequisites, if any	Basic knowledge of programming and networking			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand IoT fundamentals, including design, protocols, and technologies • Explore domain-specific applications such as home automation and industry • Learn about M2M applications and system management • Develop IoT systems using platforms like Raspberry Pi • Manage IoT server and cloud infrastructure, focusing on security			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Definition, Characteristics of IoT, Physical Design of IoT, Protocols, Logical Design of IoT, IoT Enabled Technologies, IoT Levels and Templates	9
Unit II	**Domain Specific IoT Applications** Home Automation, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle	9
Unit III	**M2M and IoT System Management** M2M Applications, Software Defined Networks, Network Function Virtualization. Need for IoT System Management, Simple Network Management Protocol, IoT System Management with NETCOZF-YANG	9
Unit IV	**Developing IoT Systems** IoT Platforms Design Methodology, Steps for IoT Design, Case Study on IoT System for Weather Monitoring, Introduction to Raspberry PI, Interfaces (serial, SPI, I2C), Programming Raspberry Pi, IoT Devices	9
Unit V	**IoT Server and Cloud Management** Introduction to Cloud Storage Models and Communication APIs, Webserver – Web Server for IoT, Cloud for IoT, Security Management in an IoT System	9
	Practical Component	
Exercisers	1. Identify and list different types of IoT devices and their functionalities 2. Sketch a physical design for a home automation system using IoT devices 3. Compare and contrast different IoT protocols such as MQTT, CoAP, and HTTP 4. Set up a basic communication protocol between two IoT devices using MQTT 5. Discuss the role of cloud computing in enabling IoT solutions 6. Implement a simulation of the home automation system using IoT platforms like Arduino or Raspberry Pi 7. Investigate and compare M2M applications in industries such as healthcare and logistics	30

	8. Program a Raspberry Pi to collect weather data from sensors and display it on a web server 9. Explore different cloud storage models (e.g., public, private, hybrid) and their suitability for IoT applications 10. Implement security measures such as encryption and authentication in an IoT system using cloud-based services	
Recommended Learning Resources		
Print Resources	1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things - A Hands-on Approach”, First Edition, Orient Blackswan Private Limited, 2015. 2. Rajesh Singh, Anita Gehlot, Bhupendra Singh, Sushabhan Choudhury, ” Internet of Things (IoT) Enabled Automation in Agriculture”, Second Edition, CRC Press, 2022.	
Syllabus Design: Dr. T. Vengattaraman, Associate Professor, PUDoCS		

SEMESTER VIII

Year	IV	Course Code: CSCS408 Course Title: Machine Learning	Credits	4
			Hours	75
Sem.	VIII		Category	C
Course Prerequisites, if any	Probability and Statistics			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand the basic concepts and types of Machine Learning (ML) • Prepare the data for ML model, train the model and evaluate the model's performance • Understand the fundamentals of features and feature engineering • Build a ML model with the appropriate supervised algorithm for the data • Build a ML model with the appropriate unsupervised algorithm for the data			

Unit No.	Course Content	Hours
	Theory Component	
UNIT I	**Introduction to Machine Learning** Human Learning – MachineLearning –Types of Machine Learning – Supervised learning – Unsupervised Learning – Reinforcement Learning – Applications **Preparing to model** Types of data – structure – quality and remediation – pre–processing	9
UNIT II	**Modelling and Evaluation** Selecting – Training – Model representation and interpretability – Performance evaluation **Feature Engineering** Introduction – Transformation – Feature subset selection – Issues in high dimensional data – Feature selection – Key drivers – Measures – process – Approaches	9
UNIT III	**Supervised Learning – Classification** Introduction – Example – Model – Learning steps – Algorithms – k–Nearest neighbor – Decision tree – Random Forest model – Support Vector machines	9
UNIT IV	**Supervised Learning – Regression** Introduction – Example – Model – Algorithms – Simple and Multiple linear regression – Assumptions – Main problems in regression analysis – Logistic regression – Maximum Likelihood estimation	9
UNIT V	**Unsupervised Learning** Introduction – Applications – Clustering – Types – Partitioning methods – Hierarchical clustering – Density-based methods – DBSCAN – The Apriori algorithm for association rule learning	9
	Practical Component	

Exercises	1. Develop a Python script that uses a decision tree classifier forprediction 2. Develop a ML model that runs a random forest for classification 3. Create a Python program that uses SVM to classify images fromthe MNIST dataset 4. Implement K–Means clustering to segment customers into groups based on their shopping data such as purchase historyand customer demographics 5. Implement a linear regression model **6.** Develop a program to perform multiple linear regression topredict house prices Implement logistic regression to classify emails as spam or notspam	30
Recommended Learning References		
Print Resources	1. Saikat Dutt, Chandramouli.S, Amit Kumar Das., " Machine Learning", Pearson, 2018. 2. Alpaydin, E., "Introduction to Machine Learning", MIT Press,Fourth Edition, 2020.	
Syllabus Design: Dr. M. Nandhini, Professor, PUDoCS		

Year	IV	Course Code: CSCS409 Course Title: Full Stack Development	Credits	3
Sem.	VIII		Hours	75
			Category	C
Course Prerequisites, if any	Basic programming concepts, OOPs, Web Technology, Database, any Scripting Languages			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Create responsive web pages using HTML and CSS • Develop interactive web applications with JavaScript • Understand the concept of ReactJS component-based architecture • Develop RESTful APIs with Node.js and Express.js • Design scalable MongoDB database schemas for web applications			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**HTML and CSS** Tags – Attribute and Elements – Comments – Lists and Links – Images and Tables – CSS to HTML – Selectors – Properties and Values – CSS Box Model – Margins – Padding – Borders – Text,Font Properties	9
Unit II	**Java Script** Internal and external script – Document and Window Object – Variables and Operators – Data Types and Type Conversion – Math and String Manipulation – Objects and Arrays – Conditional Statements – Functions – Java libraries – jQuery – Angular	9
Unit III	**ReactJS Development** Templating using JSX – Components – State and Props – Lifecycle of Components – Rendering List and Portals – Error Handling – Routers – Redux and Redux Saga – Immutable.js – Service Side Rendering – Unit Testing – Webpack	9
Unit IV	**NodeJS Development** Basics and Setup Console – Node js Command Utilities – Node js Module – Concepts – Events – Node js with Express js – Node js Database Access	9
Unit V	**MongoDB** SQL and NoSql Concepts – Create and Manage MongoDB – Migration of Data – MongoDB with PHP – MongoDB with NodeJS – Services – MongoDB with Python	9
	Practical Component	
Exercisers	1. Applying all the concept of HTML and CSS for the building of Web portal 2. Create a dynamic and interactive web page to interact with visitors and execute complex actions 3. Build complex UI interactions that communicate with the server in record time with JavaScript–driven pages 4. Build back–end services like APIs, Web App or Mobile App using Nodejs 5. Using JSON store structure and unstructured data	30
	Recommended Learning Resources	

Print Resources	1. Shama Hoque, “Full Stack React Projects: Learn MERN stack development by building modern web apps using MongoDB, Express, React, and Node.js”, Second Edition, 2020. 2. Eric Sarrion, “JavaScript from Frontend to Backend: Learn full stack JavaScript development using the MEVN stack with quick and easy steps” Packt, 2022.
Syllabus Design: Dr. Sukhvinder Singh, Assistant Professor, PUDoCS	

Year	IV	Course Code: CSCS410 Course Title: 5G Communication Technologies	Credits	4
			Hours	75
Sem.	VIII		Category	C

Course Prerequisites, if any	Basic knowledge of computers	
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.
Course Outcomes	• Understand the basics of 5G Communication • Understand the fundamentals of 5G Architecture • Understand the various 5G radio-access technologies • Understand the various 5G Enabling Technologies • Learn about the 5G use cases	

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Background** Introduction to Cellular Technologies: Frequency reuse – Handoff – Capacity – Evolution of 1G, 2G, 3G, 4G standards and architectures Propagation mechanisms: Doppler spread – Delay spread – Coherence time and bandwidth – all types of fading (non-detail study alone)	9
Unit II	**5G Architecture** Introduction – 5G Architecture options – 5G Core Network Architecture – 5G RAN Architecture – Network Slicing – 5G physical Layer – 5G Multiple Access Principle – Physical channels and signals – frame structure – Channel structures and beamforming basics – Random Access – Downlink and Uplink User Data transmission – Downlink and uplink signaling transmission – MIMI and beamforming operation – Channel coding – Dual connectivity – Data rates – Physical Layer measurements – UE capability	9
Unit III	**5G Radio Access Technologies** Access design principles for multi-user communications – Orthogonal multiple-access systems – Spread spectrum multiple access systems – Capacity limits of multiple-access methods – OFDM numerology for small-cell deployments – Radio access for dense deployments – Radio access for V2X communication	9
Unit IV	**5G Enabling Technologies** MIMO: Introduction – Single User and Multi user MIMO – Capacity of Massive MIMO – Resource allocation and transceiver algorithms – Channel models – mmWave – Channel Propagation – Hardware Technologies – Architecture and mobility – Beamforming – Physical layer techniques	9
Unit V	**5G Use Cases** Machine type communication: Fundamental techniques – Massive MTC – Ultra-reliable low-latency MTC Device to Device Communication: Radio resource management for mobile broadband D2D – Multi-hop D2D communications for proximity and emergency services – Multi-operator D2D communication	9
	Practical Component	

Exercisers	1. Study and simulation of Handoff techniques 2. Study and simulation of types of fading 3. Computation of channel capacity 4. Calculation of bandwidth of different generations 5. Problems based on 5G Frame Structure 6. 5G Communications Link Analysis with Ray Tracing 7. Model and analyze 5G NR Waveforms generation 8. Channel modelling in 5G 9. MIMO Wireless System Design for 5G 10. 5G Beamforming Design	30
Recommended Learning Resources		
Print Resources	1. Theodore S. Rappaport, "Wireless Communications: Principles and Practice", Cambridge University Press, 2024. [Unit 1] 2. Osseiran, Afif, Jose F. Monserrat, and Patrick Marsch, "5G Mobile and Wireless Communications Technology", First edition, Cambridge University Press, 2016. 3. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", First Edition, Wiley, 2015. 4. Harri Holma, Antti Toskala, Takehiro Nakamura, "5G Technology 3GPP New Radio", First Edition, John Wiley & Sons, 2020.	
Syllabus Design: Dr. T. Chithralekha, Professor, PUDoCS		

Year	IV	Course Code: CSCS411 Course Title: Data Mining	Credits	4
Sem.	VIII		Hours	75
			Category	C
Course Prerequisites, if any	Database Management Systems			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Gain a comprehensive understanding of data mining concepts • Acquire knowledge in data preprocessing techniques • Gain knowledge in pattern mining • Attain knowledge and skills in classification • Understand various clustering algorithms			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Overview and History – Data Mining – Types of data – Kinds of Patterns – Technologies Used – Applications – Major Issues in Data Mining – Data Objects and Attribute Types – Basic Statistical Descriptions of Data	9
Unit II	**Data Preprocessing & Data Warehouse** Data Preprocessing Overview – Data Cleaning – Data Integration – Data Reduction – Data Transformation – Data Warehouse: Basic Concepts – Data Cube and OLAP – Data Generalization by Attribute-Oriented Induction	9
Unit III	**Pattern Mining** Pattern Mining Concepts – Market Basket Analysis – Frequent Itemsets – Closed Itemsets and Association Rules – Frequent Itemset Mining Methods – Pattern Evaluation Methods	9
Unit IV	**Classification** Fundamentals – Decision Tree Induction – Bayes Classification – Rule Based Classification – Model Evaluation and selection – Techniques to Improve Classification Accuracy	9
Unit V	**Clustering** Cluster Analysis – Partitioning methods – Hierarchical methods – Agglomerative, Divisive hierarchical clustering – DBSCAN – Evaluation	9
	Practical Component	
Exercises	1. Perform preprocessing for the given dataset 2. Program to Integrate two datasets with common attributes 3. Program to transform categorical data into numerical format for analysis 4. Program to create a basic data cube and perform OLAP operations 5. Implement the Apriori algorithm for mining frequent itemsets 6. Implement K-means clustering algorithm 7. Implement K-Medoids algorithm 8. Implement DBSCAN algorithm	30

Recommended Learning Resources	
Print Resources	1. Jiawei Hen, Micheline Kambler, Jian Pie, "Data Mining Concepts and Techniques", Morgan Kaufman, 2012. 2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson India Education Services Pvt. Ltd, 2016.

Syllabus Design: Dr. P. Shanthi Bala, Professor, PUDoCS

Year	IV	Course Code: CSCS412 Course Title: High Performance Computing	Credits	4
Sem.	VIII		Hours	75
			Category	C
Course Prerequisites, if any	Knowledge in Computer System Architecture and Operating Systems			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand the historical context, structure, and broad impact of supercomputing • Grasp key features and enabling technologies shaping HPC systems • Apply parallel algorithms such as Fork-Join and Divide and Conquer in HPC systems • Analyze components such as Amdahl's Law and memory hierarchy in symmetric multiprocessor setups • Examine case studies like OpenMP API and OpenACC to understand their applications in HPC			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Introduction: High Performance Computing Discipline – History of Supercomputing – Anatomy of Supercomputer – Impact of Supercomputing on Science – Society and Security	9
Unit II	**HPC Architecture** Key Properties of HPC Architecture – Enabling Technology – Vector and Pipelining – Single-Instruction – Multiple Data Architecture – Multiprocessors – Heterogeneous Computer Structures	9
Unit III	**Parallel Algorithm** Introduction, Fork-Join – Divide and Conquer – Manger-Worker – Halo Exchange – Permutation: Cannon's Exchange – Task Dataflow: Breath First Search	9
Unit IV	**Symmetric Multiprocessor Architecture** Amdahl's Law Plus – Processor Core Architecture – Memory Hierarchy – PCI Bus – External I/O Interfaces	9
Unit V	**Case Studies** OpenMP API, Essential API, Open ACC	9
	Practical Component	
Exercises	1. Install MPICH library and write a "Hello World" program 2. Write a parallel program to calculate the value of PI/Area of Circle using OpenMP library 3. Write a parallel program to multiply two matrices using MPI library and compare the execution time with it's OpenMP and Serial version 4. Write a program in C to multiply two matrices of size 10000 x 10000 each and find it's execution-time using "time" command. Try to run this program on two or more machines having different configurations and compare execution-times obtained in each run. Comment on which factors affect the performance of the program 5. Install MPICH on two and more machines and create a MPI cluster. Execute MPI programs on this cluster and check the performance 6. Implement a program to demonstrate balancing workload on MPI platform	30

Recommended Learning Resources	
Print Resources	1. Thomas Sterling, Matthew Anderson, Maciej Brodowicz, "High Performance Computing", Morgan Kaufmann, 2017. 2. Severance, Charles, and Kevin Dowd. "High performance computing", OpenStax CNX, 2015.
Syllabus Design: Dr. S.K.V. Jayakumar, Professor, PUDoCS	

Year	IV	Course Code: CSCS413	Credits	4
Sem.	VIII	Course Title: Cloud Computing	Category	C
Course Prerequisites if any	Knowledge of Distributed Systems and Databases			
Internal Assessment Marks: 40	End Semester Marks: 60		Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.	
Course Outcomes	• Understand cloud computing's evolution and characteristics • Comprehend the architecture of cloud computing and differentiate between Infrastructure as a Service (IaaS) and Software as a Service (SaaS) • Recognize PaaS features and examples • Compare scaling hardware using SLAs and billing principles • Evaluate cloud security measures			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Overview of Computing Paradigm – Recent trends in Computing – Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing – Evolution of cloud computing – Cloud Computing (NIST Model) Characteristics – Pros and Cons of Cloud Computing, Cloud computing vs. Cluster computing vs Grid computing – Role of Open Standards	9
Unit II	**Infrastructure as a Service (IaaS) & Software as a Service SaaS** Cloud Computing Architecture – Cloud computing stack – Service Models (XaaS) – Deployment Models. Infrastructure as a Service (IaaS) – Introduction – Virtualization, Hypervisors, Machine Image, Virtual Machine (VM) – Examples	9
Unit III	**Platform as a Service (PaaS)** Platform as a Service (PaaS) – Introduction – Cloud Platform and Management –Examples, Microsoft Azure, SalesForce.com – Software as a Service – Introduction – Web services – Web 2.0 – Web OS – Case Study on SaaS	9
Unit IV	**Service Management in Cloud Computing** Service Management in Cloud Computing – Service Level Agreements (SLAs) – Billing & Accounting – Comparing Scaling Hardware: Traditional vs. Cloud – Economics of scaling, Scalability & Cloud Services	9
Unit V	**Cloud Security** Cloud Security – Infrastructure Security – Data security and Storage – Data privacy and security Issues, Jurisdictional issues – Identity & Access Management – Access Control – Trust, Reputation, Risk	9
	Practical Component	
Exercises	1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8 2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs 3. Install Google App Engine. Create ‘hello world’ app and other simple web applications using python/java 4. Use GAE launcher to launch the web applications 5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim	30

	6. Find a procedure to transfer the files from one virtual machine to another virtual machine 7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version) 8. Install Hadoop single node cluster and run simple applications like word count	
Recommended Learning Resources		
Print Resources	1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", First Edition, Wiley, 2013. 2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", First Edition, Wiley, 2010.	
Syllabus Design: Dr. M. Sathya, Assistant Professor, PUDoCS		

Year	IV	Course Code: CSCS414 Course Title: Deep Learning	Credits	4
			Hours	75
Sem.	VIII		Category	C
Course Prerequisites, if any	Machine Learning			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs. Duration of ESA (Practical): 03 hrs.		
Course Outcomes	• Understand the basic architecture and workings of neural networks • Understand the fundamentals of deep neural networks • Understand the architectures and workings of deep networks • Build the model for data variants using deep network • Build and train CNN and RNN deep learning architectures			

Unit No.	Course Content	Hours
	Theory Component	
UNIT I	**Foundations of Neural Networks and Deep Learning** Neural Networks – Training Neural Networks – Activation Functions – LossFunctions – Hyperparameters	9
UNIT II	**Fundamentals of Deep Networks** Defining Deep Learning – Common Architectural Principles of Deep Networks – Parameters – Layers – Activation Functions – Loss Functions – Optimization Algorithms – Hyperparameters – Building Blocks of Deep Networks – RBMs– Autoencoders – Variational Autoencoders	9
UNIT III	**Major Architectures of Deep Networks** Unsupervised Pretrained Networks – Convolutional Neural Networks (CNNs) – Architecture – Input, Convolutional, Pooling, fully connected Layers – Applications – Recurrent Neural Networks (RNN) – Modeling the Time Dimension – 3D Volumetric Input – Architecture – LSTM Networks	9
UNIT IV	**Building Deep Networks** Matching Deep Networks to the Right Problem – Modeling CSV Data with Multilayer Perceptron Networks – Modeling Handwritten Images Using CNNs – Modeling Sequence Data using RNN	9
UNIT V	**Tuning Deep Networks** Concepts: Matching Input Data and Network Architectures – Relating Model Goal and Output Layers – Working with Layer Count, Parameter Count, and Memory – Feed-Forward Multilayer Neural Networks – Controlling Layer and Parameter Counts – Weight Initialization Strategies – Using Activation Functions – Applying Loss Functions – Understanding Learning Rates – Applying Methods of Optimization – Controlling Epochs and Mini – Batch Size – Regularization – Max–Norm Regularization – Dropout– Dealing with Overfitting	9

Practical Component		
Exercises	1. Implement a simple perceptron model and train it to perform binary classification on a given dataset. Use the sigmoid activationfunction and gradient descent for training 2. Build a multilayer feed–forward neural network from scratch. Train the network using the backpropagation algorithm on a givendataset 3. Implement and train the CNN on the MNIST dataset for handwritten digit classification 4. Develop a RNN using Keras or PyTorch and train it to generate textbased on a given dataset **5.** Fine–tune a pre–trained CNN model using python	30
Recommended Learning References		
Print Resources	1. Josh Patterson and Adam Gibson, "Deep Learning – A Practitioner's Approach", O'Reilly Media, First Edition, 2017. **2.** Nikhil Buduma and Nicholas Locascio, "Fundamentals of Deep Learning: Designing Next Generation Machine Intelligence Algorithms", O'Reilly Media, Frist Edition, 2017.	
Syllabus Design: Dr. M. Nandhini, Professor, PUDoCS		

Multi-Disciplinary Course

<table>
<tr><td>Year</td><td>I / II</td><td colspan="2" rowspan="2">Course Code: COMS101
Course Title: Introduction to Python Programming</td><td>Credits</td><td>3</td></tr>
<tr><td></td><td></td><td>Hours</td><td>60</td></tr>
<tr><td>Sem.</td><td>I / III</td><td colspan="2"></td><td>Category</td><td>A</td></tr>
<tr><td>Course Prerequisites, if any</td><td colspan="5">Problem-solving skills</td></tr>
<tr><td>Internal Assessment Marks: 40</td><td colspan="2">End Semester Marks: 60</td><td colspan="3">Duration of ESA (Theory): 03 hrs.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">• Understand Python programming constructs
• Learn about different data structures in Python
• Write programs using functions
• Explore the use of Python modules and packages
• Perform Visualization using Python package</td></tr>
<tr><td>Unit No.</td><td colspan="3">Course Content</td><td colspan="2">Hours</td></tr>
<tr><td colspan="6">Theory Component</td></tr>
<tr><td>Unit I</td><td colspan="3">Introduction
Python Basics: Working – Identifiers – Comments – Types – Operations – Buit-in, library functions
Strings: Accessing – Properties – Operations
Control-flow Instructions: Decision Control – logical operators – conditional expressions Repetition control instruction – break and continue – pass Statement</td><td colspan="2">12</td></tr>
<tr><td>Unit II</td><td colspan="3">Console Input/Output
Console Input – Console Output – Formatted printing
Lists
Definition – Accessing – Operations – Methods – Varieties – Comprehension
Tuples
Definition – Accessing – Operations – Varieties – Comprehension – Conversion – Iterators and Iterables – zip()</td><td colspan="2">12</td></tr>
<tr><td>Unit III</td><td colspan="3">Sets
Definition – Accessing – Operations – Functions – Mathematical set operations – Updating set operations Dictionaries
Definition – Accessing – Operations – Functions – Nested Dictionary</td><td colspan="2">12</td></tr>
<tr><td>Unit IV</td><td colspan="3">Functions
Definition – Communication – Types – Unpacking – Lambda, Recursive functions
Modules and Packages
Creation and importing</td><td colspan="2">12</td></tr>
<tr><td>Unit V</td><td colspan="3">Exception handling
Syntax errors – handling exceptions – try-except – user-defined exceptions – else, finally blocks – Tips
Visualization - Matplotlib package – Plotting Graphs</td><td colspan="2">12</td></tr>
<tr><td colspan="6">Recommended Learning Resources</td></tr>
<tr><td>Print Resources</td><td colspan="5">1. Aditya Kanetkar, Yashavant Kanetkar, Let us Python, BPB Publisher, 6th Edition, 2023.</td></tr>
<tr><td colspan="6">Syllabus Design: Dr. R. Sunitha, Associate Professor, PUDoCS</td></tr>
</table>

Year	I	Course Code: COMS102 Course Title: Foundations of Information Technology	Credits	3
			Hours	60
Sem.	II		Category	A
Course Prerequisites, if any	Basic knowledge of Computers			
Internal Assessment Marks: 40	End Semester Marks: 60	Duration of ESA (Theory): 03 hrs.		
Course Outcomes	• Familiarize the fundamentals of Information Technology. • Understand the management of hardware and software • Describe the basics of networking • Discuss about data management and security aspects of data • Ability to troubleshoot computer systems			

Unit No.	Course Content	Hours
	Theory Components	
Unit I	**Introduction** Overview of IT – Computer Basics – Software fundamentals – Networks & Internet – IT ethics and policies	12
Unit II	**Hardware and Software Management** Computer Assembly and maintenance - Operating Systems – Software installation and maintenance – Virtualization, Cloud Computing	12
Unit III	**Networking Essentials** Network Fundamentals – Hardware – Protocols and services – Wireless Networking – Security	12
Unit IV	**Data Management and Security** Data and fundamentals of Database – Data Backup and recovery – Cyber Security – Encryption and Cryptography	12
Unit V	**IT Support and Troubleshooting** Help desk and IT support – Troubleshooting methodologies – Diagnostic tools and utilities – Future trends in IT	12
	Recommended Learning Resources	
Print Resources	1. Floyd Fuller, Brian Larson, Computers: Understanding Technology, EMC Paradigm, Fourth Edition, 2011. 2. Mike Meyers, CompTIA A+ Certification All-in-One Exam Guide, McGraw-Hill Education, Eleventh Edition, 2023. 3. Jeffrey S. Beasley, Piyasat Nilkaew, Networking Essentials, Prentice Hall Certification, Third Edition, 2012. 4. Charles J. Brooks, Christopher Grow, Philip Craig, and Donald Short , Cybersecurity Essentials, Sybex Publisher, First Edition, 2018.	
Syllabus Design: Dr. R.Sunitha, Associate Professor, PUDoCS		

PONDICHERRY UNIVERSITY
(A CENTRAL UNIVERSITY)

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

Master of Technology
(Network & Information Security)

(Choice Based Credit System)
(Effective from the academic year 2020-2021)

CURRICULUM & SYLLABUS

CSNS 611: MATHEMATICS FOR NETWORK ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic knowledge on discrete mathematics – basic set theory and proof techniques, mathematic induction, graphs, relations, functions, and logic.*

Objectives:

- *To develop the ability to use the concepts of Special Functions for solving problems on Networks.*
- *To analyze the Graph Theory algorithms and understand its applications in Networks.*
- *To impart knowledge on Numerical Methods that will come in handy to solve numerically the problems that arise in engineering. This will also serve as a precursor for future research.*
- *To acquire skills in analyzing Queuing Models.*

***Course Outcome*:**

- *Ability to use the concepts of Special Functions in order to solve the problems related to Networks.*
- *Understand the concept of various Graph Theory algorithms along with its applications in Networks.*
- *Knowledge on Numerical Methods so that various numerical problems that arise in engineering can be solved.*
- *Obtain the skills to do analysis on the Queuing Models.*

Module-I: 9 hrs

Graph Theory Introduction: Introduction to Graphs - Paths - Cycles - And Trails - Vertex Degrees and Counting - Directed Graphs - Trees and Distance: Basic Properties - Spanning Trees and Enumeration - Optimization and Trees.

Module-II: 9 hrs

Matching Connectivity and Flow: Matching and Covers Algorithms and Applications - Matching in General Graphs. - Connectivity and Paths: Cuts and Connectivity - k-connected graphs – Network Flow Problems.

Module-III: 9 hrs

Planar Graphs - Edges and Cycles: Planar Graphs - Embedding and Euler s Formula - Characterization of Planar graphs - Parameters of Planarity - Line Graphs and Edge-Coloring - Hamiltonian Cycles -Coloring and Cycles - Applications in Networks.

Module-IV: 9 hrs

Introduction To Probability Theory: Probability concepts - Random variables - moments - Moment Generating function - Binomial - Poisson - Geometric - Exponential - Gamma - Application in Networks.

Module-V: **9 hrs**

Queuing Theory: Markovian queuing models - Multi-server queues - M/G/1 Queues - Applications in Networks.

Text Book(s):

1. *R J Wilson, Introduction to Graph Theory, 5th Edition, Pearson Education 2015.*
2. *ReinhardDiestel Graph Theory, 5th Edition, Springer- Verlog 2017*
3. *Probability and Queuing Theory, Gunavathi K, S Chand & Company, December 2010.*

Reference Book(s):

1. *Probability - Statistics and Random Processes, T Veerarajan, McGraw Hill Education 3rd edition, July 2017*
2. *Probability, Statistics and Queuing Theory, Sundarapandian V, Prentice Hall India Learning Private Limited; 1 Edition (2009)*
3. *Jay Yellen, Jonathan L.Gross Graph Theory and Its Applications, CRC Press LLC 1998.*

CSNS 612: PRINCIPLES OF MODERN CRYPTOGRAPHY

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic knowledge Of Mathematics, Algorithms, Computer Networks.*

Objectives:

- *To give insight about the underlying mathematics in cryptographic algorithms.*
- *To give an exposure to different cryptographic algorithms.*
- *To provide insight into the working of Authentication Mechanisms and Key Management.*

Course Outcome:

- *Knowledge about the mathematics involved in the cryptographic algorithms.*
- *Knowledge about the working of different existing cryptographic algorithms.*
- *Application of cryptographic algorithms in terms of security features.*

Module-I: 9 hrs

Introduction: Security Goals, Cryptographic attacks, Services and Mechanism, Techniques for Security Goals Implementation – Mathematics of Cryptography – Modular Arithmetic, Congruence and Matrices

Module-II: 9 hrs

Traditional Symmetric Key Ciphers : Mathematics of Symmetric Key Cryptography – Algebraic Structures - Introduction to Modern Symmetric Key Ciphers- DES, Blowfish, IDEA, AES, RC5, - Modes of operation of Modern Symmetric Key Ciphers

Module-III: 9 hrs

Mathematics of Asymmetric Key Cryptography: Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence - Asymmetric Key Cryptography – RSA, ElGamal Cryptosystem, Elliptic Curve Cryptosystem, Public Key Infrastructure and Digital Certificates

Module-IV: 9 hrs

Message Integrity and Message Authentication: Random Oracle Model, Message Authentication – Cryptographic Hash Functions – MD5, SHA-512 - Digital Signature – Process, Services, Attacks on Digital Signature, Digital Signature Schemes – RSA, El Gamal, Elliptic Curve – Variations and Applications

Module-V: 9 hrs

Entity Authentication: Password based Authentication, Challenge Response Protocols, Zero Knowledge Protocols, Biometrics – Key Management – Symmetric key Distribution, Kerberos, Symmetric Key Agreement, Public Key Distribution, Hijacking.

Text Book(s):

1. *Behrouz A. Forouzan and DebdeepMukhopadhyay, Cryptography and Network Security, third edition, Tata McGraw Hill, 2016*
2. *W. Stallings, Cryptography and Network Security Principles and practice, Seventh Edition, Pearson Education Asia, 2017.*
3. *AtulKahate, Cryptography and Network Security, Third Edition, McGraw Hill, July 2017*

Reference Book(s):

1. *Michael Stinson. D. Cryptography: Theory and Practice, third edition, Chapman & Hall/CRC, 2010*
2. *Modern cryptography: theory & practice, Wembo Mao, Pearson Education; First Edition, 2004.*

CSNS 613: OPERATING SYSTEMS: ADMINISTRATION AND SECURITY

L	T	P	C
3	0	0	3

Pre-requisite:

- *Familiarity with basic hardware and software aspects of computer systems organization.*

Objectives:

- *To introduce the concepts of various functions of operating systems*
- *To help understand the basic administration of a Linux system and concept of open source environment.*
- *To throw light on concepts of securing operating systems.*
- *To provide insight on various scheduling and memory management schemes.*

Course Outcome:

- *Familiarize with various functions of operating systems*
- *Knowledge in basic administration of a Linux system.*
- *Ability to understand the concepts of securing operating systems.*
- *Ability to compareof different operating system.*

Module-I: 9 hrs

Introduction to Computer Architecture: Introduction - Computer system Organization and Architecture- Operating System structure and operations- Protection and Security- Process Management- Process Scheduling – Inter process communication- Multi threading models- Semaphores- Deadlocks- Mutex - Critical Section problems.

Module-II: 9 hrs

Memory Management and File Systems: Main Memory: Background - Swapping - Contiguous Memory Allocation - Segmentation - Paging - Structure of the Page Table algorithms Virtual Memory: Background - Demand Paging - Copy-on-Write - Page Replacement - Allocation of Frames - Disk Structure - Disk Scheduling - Disk Management - Swap-Space Management - RAID Structure - Stable-Storage Implementation- File Concept - Access Methods - Directory and Disk Structure

Module-III: 9 hrs

Windows and Other Operating Systems: Design Principles - System Components - Terminal Services and Fast User- Switching - File System -Networking - Programmer Interface -Influential Operating Systems: Feature Migration- Early Systems – Atlas - XDS-940 - THE - RC 4000 - CTSS – MULTICS - IBM OS/360 - TOPS-20 -CP/M and MS/DOS - Macintosh Operating System and Windows – Mach.

Module-IV: **9 hrs**

Linux Administration and Other Services:Open source operating system- Linux Kernel architecture- User administration in Linux- Services offered by Linux OS- Configuration of email service, web service, DNS in Linux- Syntactical Interpretation of various files related to different services in Linux

Module-V: **9 hrs**

Secure Operating Systems:Protection: Principles of Protection - Domain of Protection - Access Matrix - Implementation of the Access Matrix - Access Control - Revocation of Access Rights - Capability-Based Systems - Language-Based Protection Security: The Security Problem - Program Threats - System and Network Threats - Cryptography as a Security Tool - User Authentication - Implementing Security Defenses - Firewalling to Protect Systems and Networks - Computer-Security Classifications.

Text Book(s):

1. *Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley & Sons ,Inc., 10th Edition, 2018.*
2. *William Stallings, "Operating System: Internals and Design Principles", Prentice Hall, 8th Edition, 2014.*

Reference Book(s):

1. *Tom Adelstein and Bill Lubanovic, "Linux System Administration", O'Reilly Media, Inc., 1st Edition, 2007.*
2. *Trent Jaeger, "Operating Systems Security", Morgan & Claypool Publishers, 2008.*

CSNS 614: NETWORK MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite:

- *Introduction to Computer Networks and Data Structure.*

Objectives:

- *To provide the technical understanding and managerial view of various network operations.*
- *To give basic knowledge on how heterogeneous architectures can easily be handled.*
- *To understand SNMP protocol and its roles in providing information about network devices to a management station.*

Course Outcome:

- *Familiarize the concepts of network management*
- *Knowledge about various ciphers.*
- *Gain in-depth theoretical and practical knowledge of network management and in particular SNMP (Simple Network Management Protocol).*
- *Ability to compare the available network management architectures.*

Module-I: 9 hrs

Problem Definition& Overview of Network Management: What is Network Management? - Case histories on Network System - and Service Management - Challenges of IT managers - Network management business drivers - examples of management tools.

Hands on:-UsingNS2/NS3/WireShark practice Packet Capturing during web page requests and reply - Investigate the packets for protocols, the values of the header fields and the packet sizes.

Module-II: 9 hrs

Basic Foundation and Management Concepts: Network Management Goals, Standards & Models –Organization, Functional, Information, Communication Model - Network Monitoring - ASN.1, MIB, SMI,SMIv2, Role of NMS.

Hands On-1. Explore the features of network monitoring software (Eg. WireShark) likeFilters, Flow Graphs (TCP), Statistics, and Protocol Hierarchies.

Hands On-2. Create files on Web Server –Try accessing the files from a remote machine - Capture the packets and observe the log file.(Same can be done for Folders on the Web Server and observe the log)

Module-III: **9 hrs**

SNMP Network Management:SNMPv1 Network Management Standard – Organization, Communication, and Functional Models - Structure of SNMP Management Information Standards – Headers – Messages – Operations – SNMPv2 System Architecture – Protocol – Protocol Specification – SNMPv3 Architecture.

Hands On -Install any open source NMS in the system (Like OpenNMS) and explore OAMP.

Module-IV: **9 hrs**

RMON and TMN: Remote Network Monitoring: RMON -Groups and Functions, RMON2 - Monitoring of Upper Layer Protocols. - Telecommunications Management Network: TMN Introduction-TMN Operations– Conceptual Model – Standards– Management Service Architecture – Implementation issues.

Hands On: Design a Network with 1 router, 2 Switches, Server (PDC) and 3 to 4 clients - Establish communication between the devices - Create the rules in the router to drop/restrict the packets between nodes -Monitor the network activity

Module-V: **9 hrs**

Advance Network Management: Cloud Network Architecture Management – Software Defined Network (SDN) – CORBA Based Management – XML Based Management – Comparison of Management Protocols.

Text Book(s):

1. *Mani Subramanian, Network Management, 2nd Edition, Pearson Education India Release, ISBN: 9788131727591, February 2010.*
2. *William Stallings, SNMP, SNMPv2, SNMPv3, and RMON1 and 2, 3rd Edition, Person Education Asia, 1999.*
3. *Simple Network Management Protocol (SNMP) 5.2.11, Ericsson AB, 2018.*
4. *A.Clemm, "Network Management Fundamentals", Cisco Press, ISBN-13 978-158720-137-0, 2007.*

Reference Book(s):

1. *http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.125.3183&rep=rep1&type=pdf*
2. *https://www.usi.edu/business/aforough/Chapter%2020.pdf*
3. *https://www.opennms.org/en*
4. *https://www.cisco.com/c/en/us/products/collateral/services/high-availability/white_paper_c11-453503.html*
5. *https://ns2projects.org/ns2-simulator-free-download/*
6. *https://www.wireshark.org/download.html*

Available Journals for Network Management:

1. *https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=4275028*
2. *https://onlinelibrary.wiley.com/journal/10991190*
3. *https://link.springer.com/journal/10922*
4. *https://dl.acm.org/citation.cfm?id=J332*

CSNS 615: FOUNDATIONS OF MODERN NETWORKING

L	T	P	C
3	0	0	3

Pre-requisite:

- *Networking Basics: OSI Model, TCP, UDP, TCP/IP.*

Objectives:

- *Understand the principles behind the Modern Network approaches such as SDN NFV and IoT.*
- *To analyse Data Center topologies and virtualized environment.*
- *Understand the data traversal over virtualized environment for IoT.*
- *To design algorithms for virtualization over multi-tenant environments.*

Course Outcome:

- *Get familiar with the basic principles behind the Modern Network approaches.*
- *Should understand the concept of virtualization and explore it to the fullest.*
- *Ability to analyze Data Center topologies and virtualized environment*
- *Knowledge about IoT security.*
- *Ability to design algorithms for virtualization over multi-tenant environments*

Module-I: 9 hrs

Modern Networking: Networking Ecosystem -Network Architecture – 4G/5G - Cloud Computing - Internet Of Things - Types of Network and Internet Traffic - Demand: Big Data, Cloud Computing, and Mobile Traffic - Requirements: QoS and QoE - Routing Congestion Control - SDN and NFV - Modern Networking Elements

Module-II: 9 hrs

Software Defined Networks: Network Requirements - The SDN Approach - SDN- and NFV-Related Standards - SDN Data Plane - OpenFlow Logical Network Device - OpenFlow Protocol - SDN Control Plane Architecture - REST API - SDN Application Plane

Module-III: 9 hrs

Virtualization: Background and Motivation for NFV - Virtual Machines - NFV Concepts - NFV Reference Architecture - NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration - NFV Use Cases - SDN and NFV

Module-IV: 9 hrs

The Internet of Things: Components: The IoT Era - Scope of the Internet of Things - Components of IoT-Enabled Things - IoT World Forum Reference Model - ITU-T IoT Reference Model - IoTivity - Cisco IoT System - ioBridge - SDN and NFV over IoT Deployment- DevOps

Module-V: **9 hrs**

Security: Security Requirements - SDN Security - NFV Security - ETSI Security Perspective - IoT Security - The Patching Vulnerability - IoT Security and Privacy Requirements Defined by ITU-T – An IoT Security Framework - The Impact of the New Networking on IT Careers

Text Book(s):

1. *William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud", Publisher: Addison-Wesley, 2015.*
2. *Jim Doherty, "SDN and NFV Simplified: A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization", 1st Edition, 2016.*

Reference Book(s):

1. *Paresh Shah, Syed Farrukh Hassan, RajendraChayapathi, "Network Function virtualization with a touch of SDN", 2016.*
2. *Paul Goransson Chuck Black, "Software Defined Networks A Comprehensive Approach", I st Edition, 2014.*

CSNS 616: CRYPTOGRAPHY LAB

L	T	P	C
0	0	2	2

Skills to be required:

- *Basic knowledge on Java programming*

Lab Software Requirement:

- *Hardware Requirements - Standalone desktop or server supporting 30 terminals or more*
- *Software Requirements - Java or equivalent complier GnuPG*

Course Outcome:

- *Implement Cipher techniques.*
- *Develop the various security algorithms.*
- *Use different open source tools for network security and analysis.*

List of Exercise:

1. a) Transmission Control Protocol using One Way Communication
   b) Transmission Control Protocol using Two Way Communication
   c) Multicast
2. Program to perform encryption and decryption using the following algorithms:
   a) Caesar Cipher
   b) Playfair Cipher
   c) Hill Cipher
   d) Vigenere Cipher
3. Implement the algorithm logic for the following:
   a) DES
   b) RSA Algorithm
   c) Diffiee-Hellman
4. MD5
5. Calculate the message digest of a text using the SHA-1 algorithm
6. Implement the Signature scheme - Digital Signature Standard

CSNS 617: OS LAB

L	T	P	C
0	0	2	2

Skills to be required:

- *Knowledge on C / C++ / Java programming language*

Lab Software Requirement:

- *Standalone desktop with java or any equivalent compiler installed.*

Course Outcome:

- *Will be able to choose the best CPU scheduling algorithm for a given problem instance.*
- *Identiy the performance of various page replacement algorithms.*
- *Experiment with deadloack situations and develop algorithm to avoid it.*

List of Exercise:

1. Implement the following CPU Scheduling Algorithms:
    i. First Come First Serve
    ii. Shortest Job First
    iii. Priority Scheduling
    iv. Round-Robin Scheduling
2. Implement Paging technique for Memory Management using
    i. Best - Fit
    ii. First - Fit
    iii. Worst - Fit
3. Implement Producer – Consumer Problem using Semaphore.
4. Implement Bankers Algorithm for Deadlock Avoidance
5. Implement Shared Memory and Inter Process Communication concept
6. Implement all Page Replacement algorithms:
    i. FIFO
    ii. LRU
    iii. LFU

M.Tech. (NIS)

Second Semester

CSNS 621: RESOURCE MANAGEMENT TECHNIQUES

L	T	P	C
3	0	0	3

Pre-requisite:

- *Fundamental knowledge of calculus and linear programming problem*
- *Mathematical models*
- *Basic mathematical concepts such as sets, functions, vectors, matrices, etc*

Course Objectives:

- *To introduce the fundamental concepts of Operation Research and Optimization*
- *To provide insight into various LPP methods and duality*
- *To explain transportation and assignment problem*
- *Discuss sequencing theory*
- *Describe network routing and scheduling*

Course Outcome:

- *Ability to understand the various problems related to resource management and optimization techniques.*
- *Acquire Knowledge in developments in High Speed Networks.*
- *Acquire Knowledge about underlying mathematical techniques to support real-time traffic and congestion control.*

Module I : 9 hrs

Operations Research: Introduction – Applications of OR – **Linear Programming Problem:** Introduction – Formulation of Linear Programming Model- Illustration on Mathematical Formulation of LPP – Graphical Solution – General LPP – Canonical and Standard forms of LPP **Optimization:** Introduction – Classification of Optimization Problems– Mathematical models in Optimization – Types of Optimization Models

Module II : 9 hrs

LPP Methods: Introduction –Simplex method- Fundamental Properties of Solution – The Computational Procedure – Use of Artificial Variables – Degeneracy in LPP – Big M Method – Applications of Simplex Method **Duality:** Duality LPP – General Prime-Dual Pair – Formulating a Dual Problem – Primal-Dual Pair in Matrix Form – Duality Theorems– Two-Phase Method

Module III : 9 hrs

Transportation Problem: Introduction – Mathematical Model for Transportation Problem – Types: Balanced Transportation Problem – Unbalanced Transportation Problem – Transportation algorithm: MODI Method – Applications of TP : **Assignment Problem:** Introduction – Mathematical Formulation of the Problem – Types of Assignment Problem – Hungerian Method – Applications of AP

Module IV : **9 hrs**

Sequencing Problem: Introduction – Problem of Sequencing – Basic Terms used in Sequencing – Processing *n* Jobs through Two Machines – Processing *n* Jobs through *k* Machines

Module V : **9 hrs**

Network Routing: Network Flow Problems – Minimal Spanning Tree Problem – Shortest Route Problems – Applications of Shortest Route Problem **Network Scheduling:** Introduction– Logical Sequencing – Concurrent Activities – Critical Path Analysis – PERT – CPM

Text Book(s):

1. R.Panneerselvam, "Operations Research", PHI, 2006.
2. Kanti Swaroop, Man Mohan and P.K. Gupta, "Operations Research", Sultan Chand and Sons, 2005.
3.Hamdy A Taha, "Operations Research –An Introduction", 10th edition, Prentice Hall India, 2017

Reference Book(s):

1. *Philips, Ravindran and Solberg, "Operations Research", John Wiley, 2002*

CSNS 622: NETWORK SECURITY

L	T	P	C
3	0	0	3

Pre-requisite:

- *Good understanding of the basics of TCP/IP.*

Objectives:

- *To understand the concept behind Network Security and its importance.*
- *To know application and network layer security.*
- *To provide knowledge on wireless and mobile security.*

***Course outcome*:**

- *Exposure on various protocols.*
- *Learn Security issues and overcome means with protocols.*
- *Gain knowledge on various secure mechanisms through set of protocols.*
- *Knowledge about security features in various layers of networking.*

Module-I: 9 hrs

Introduction: Introduction to Security in Networks – Characteristics of Networks – Intrusion – Kinds of security breaches – Plan of attack - Points of vulnerability – Methods of defense – Control measures – Effectiveness of controls

Module-II: 9 hrs

Application Layer Security:PGP and S/MIME – Email – PGP –S/MIME – SSL Architecture –Handshake ,Change Cipher Space, Alert And Record Protocols – SSL Message Formats – Transport Layer Security

Module-III: 9 hrs

Network Layer Security: Modes – Two Security Protocols – Security Association – Security Policy – Internet Key Exchange – System Security: Description – Buffer Overflow And Malicious Software – Malicious Programs – Intrusion Detection System – Firewall – Types of Firewall – Firewall Configuration- Virtual Private Networks

Module-IV: 9 hrs

Wireless Network Security: Wireless Security – Mobile Device Security -Wireless LAN Overview - Wireless LAN Security - Wireless Application Protocol Overview - Wireless Transport Layer Security - WAP End-To-End Security

Module-V: 9 hrs

Security In Mobile And Iot: Security - Threats To SDN – NFV Security Attack Surfaces – ETSI Perspective – Cloud Security – Security Issues – Risks – Data Protection – Security As A Service – Addressing Cloud Security -IOT Security – Vulnerability Patching – Requirements By ITU-T – Security Framework

Text Book(s):

1. *Behrouz A Forouzan,Cryptography and Network Security , McGraw-Hill Education, 2011*
2. *William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall India, 4th Edition*
3. *Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" William Stallings Publisher: Addison-Wesley 2015*
4. *William Stallings, Cryptography and Network Security: Principles and Standards, Prentice Hall India, 3rd Edition, 2003*

Reference Book(s):

1. *Charles P. Pleeger, Security in Computing, Person Education Asia.*
2. *Charlie Kaufman, Radia Perlman and Mike Speciner, Network Security: Private Communication in a public world, Prentice Hall India, 2nd Edition, 2002*
3. *William Stallings, Network Security Essentials: Applications and standards, Person Education Asia, 2000*
4. *Jyrki T. J. Penttinen , Wireless Communications Security: Solutions for the Internet of Things, John Wiley & Sons,2016*

CSNS 623: DISTRIBUTED SYSTEMS AND SECURITY

L	T	P	C
3	0	0	3

Pre-requisite:

- *Good knowledge of network security and introduction to threats.*

Objectives:

- *Become knowledgeable in the concepts of distributed systems and security.*
- *To know the common security issues in the distributed system.*
- *Get the exposure to Threats and Vulnerabilities.*
- *To acquire knowledge on Host level and service level solutions.*

Course Outcome:

- *Knowledge in the concepts of distributed systems and security.*
- *Knowledge about engineering security principles.*
- *Gain exposure to Threats and Vulnerabilities in different levels of the system.*
- *Clear understanding on Host level and Service level solutions.*

Module-I: **9 hrs**

Introduction: Security in Engineering - Secure Development Lifecycle Processes - A Typical Security Engineering Process – Security Engineering Guidelines and Resources. Common Security Issues and Technologies: Security Issues, Common Security Techniques

Module-II: **9 hrs**

Host-Level Threats and Vulnerabilities: Transient code Vulnerabilities - Resident Code Vulnerabilities - Malware: Trojan horse – Spyware - Worms/Viruses – Eavesdropping – Job Faults. Infrastructure-Level Threats and Vulnerabilities: Network-Level Threats and Vulnerabilities - Grid Computing Threats and Vulnerabilities – Storage Threats and Vulnerabilities – Overview of Infrastructure Threats and Vulnerabilities.

Module-III: **9 hrs**

Application-Level Threats and Vulnerabilities: Application-Layer Vulnerabilities – Injection Vulnerabilities - Cross-Site Scripting (XSS) - Improper Session Management - Improper Error Handling - Improper Use of Cryptography - Insecure Configuration Issues - Denial of Service - Canonical Representation Flaws - Overflow Issues. Service-Level Threats and Vulnerabilities: SOA and Role of Standards - Service-Level Security Requirements - Service-Level Threats and Vulnerabilities - Service-Level Attacks - Services Threat Profile

Module-IV: **9 hrs**

Host-Level Solutions: Sandboxing – Virtualization - Resource Management – Proof-Carrying Code -Memory Firewall – Antimalware - Infrastructure-Level Solutions: Network-Level Solutions - Grid-Level Solutions - Storage-Level Solutions. Application-Level Solutions: Application-Level Security Solutions.

Module-V: **9 hrs**

Service-Level Solutions: Services Security Policy - SOA Security Standards Stack – Standards in Dept - Deployment Architectures for SOA Security - Managing Service-Level Threats - Compliance in Financial Services - SOX Compliance - SOX Security Solutions – Multilevel Policy-Driven Solution Architecture - Case Study: Grid - The Financial Application – Security Requirements Analysis. Future Directions - Cloud Computing Security – Security Appliances - User centric Identity Management - Identity-Based Encryption (IBE) - Virtualization in Host Security.

Text Book(s):

1. *AbhijitBelapurakar, AnirbanChakrabarti."Distributed Systems Security: Issues. Processes and solutions.*

Reference Book(s):

1. *RachidGuerraoui "Stabilization, Safety, and Security of Distributed Systems", Springer, 2010.*

CSNS 624: NETWORK PROTOCOLS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic understanding of computer networking and cryptography.*

Objectives:

- *To have exposure on various protocols.*
- *To introduce various ISO protocols.*
- *Be exposed to various wireless and networking protocols.*
- *To educate on different network addressing means.*

Course Outcome:

- *Ability to understand the purpose and usage of various protocols.*
- *Knowledge about cryptographic techniques.*
- *Knowledge about digital signature and authentication protocols.*
- *Knowledge on Virtual Private Network and Network Security along with its importance.*

Module-I: **9 hrs**

Application Layer Protocols: TCP/IP, HTTP, SHTTP, LDAP, MIME,- POP& POP3-RMON-SNTP-SNMP. Presentation Layer Protocols-Light Weight Presentation Protocol Session layer protocols –RPC protocols-transport layer protocols-ITOT,RDP,RUDP,TALI,TCP/UDP, compressed TCP. Network layer Protocols – routing protocols-border gateway protocol-exterior gateway protocol-internet protocol IPv4- IPv6-Internet Message Control Protocol- IRDP

Module-II: **9 hrs**

Data Link layer Protocol:ARP – InARP – IPCP – IPv6CP – RARP – SLIP .Wide Area Network Protocols- ATM protocols – Broadband access Protocols – Point to Point Protocols – Other WAN Protocols- security issues.

Module-III: **9 hrs**

Local Area Network and LAN Protocols: ETHERNET Protocols – VLAN protocols – Wireless LAN Protocols – Metropolitan Area Network Protocol – Storage Area Network and SAN Protocols -FDMA, WIFI and WIMAX Protocols- security issues - Mobile IP – Mobile Support Protocol for IPv4 and IPv6 – Resource ReservationProtocol - Multi-casting Protocol – BGMP – IGMP – MSDP.

Module-IV: **9 hrs**

ISO Protocols:Application Layer- ISO ACSE: Association Control Service Element -ISO CMIP: Common Management Information Protocol - CMOT: CMIP over TCP/IP - ISO FTAM - ISO ROSE - ISO RTSE - ISO VTP - ISO-PP - ISO-SP - ISO-TP: OSI - TP0, TP1, TP2, TP3, TP4 - Network Layer CLNP: Connectionless Network Protocol (ISO-IP) -ISO CONP - ES-IS: IDRP - IS-IS - Cisco Protocols: CDP: Cisco Discovery Protocol - CGMP – DTP – EIGRP - HSRP IGRP - ISL & DISL – RGMP - TACACS – VTP – XOT - Novell

NetWare and Protocols - IPX - NCP - NLSP – SPX - IBM SMB – APPC - SNA NAU - NetBIOS – NetBEUI – APPN – DLSw - QLLC – SDLC - AppleTalk - SS7/C7 Protocols – BISUP – DUP - ISUP - MTP2 and MTP3: - SCCP – TCAP – TUP – CIFS - Microsoft SOAP - Xerox IDP - Toshiba FANP.

Module-V: **9 hrs**

Wireless Personal Area Network:IEEE 802.15 and Bluetooth – WPAN Communication Protocols – IEEE 802.16- IEEE 802.16A.WCDMA – Services – WCDMA Products – Networks- device addressing – System Addressing – Radio Signaling Protocol – Multimedia Signaling Protocol.

Text Book(s):

1. *Jielin Dong, "Networks Protocols Handbook", Jawin Technologies Inc., 2005.*
2. *Bruce Potter and Bob Fleck, "802.11 Security", O'Reilly Publications, 2002.*
3. *Lawrence Harte, "Introduction to WCDMA", Althos Publishing, 2004.*

Reference Book(s):

1. *Ralph Oppliger "SSL and TSL: Theory and Practice", Arttech House, 2009.*
2. *Jessica Fridrich, "Steganography in Digital Media: Principles, Algorithms, and Applications", Cambridge university press, 2010.*
3. *Lawrence Harte, "Introduction to CDMA- Network services Technologies and Operations", Althos Publishing, 2004.*
4. *Lawrence Harte, "Introduction to WIMAX", Althos Publishing, 2005.*

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CSNS 625: WIRELESS COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Good understanding of the basics in networking.*

Objectives:

- *To study about wireless LAN standards and it's important.*
- *To provide knowledge on Bluetooth and WAP.*
- *To understand the various standards available in wireless networks.*
- *To know about satellite communication.*

Course Outcome:

- *Familiarity with resource management techniques.*
- *Ability to solve problems in linear programming and Integer programming.*
- *Clear understanding on the Bluetooth and WAP techniques and satellite communications.*
- *Exposure to CPM and PERT.*

Module-I: **9 hrs**

Introduction: Introduction to Wireless Networks - Wireless Network Topologies - Characteristics of the Wireless Medium -GSM Cellular Network concept - Cellular transmission principles Typical cell layout - Signals Transmission interference- Cell splitting - TDMA technology – Spread spectrum and CDMA technology - GPRS – 3G- 4G and Long term evolution- 5G

Module-II: **9 hrs**

Wireless LAN Standards: Evolution of IEEE 802.11- Introduction to IEEE 802.11 -General Description- Medium Access Control (MAC) for the IEEE 802.11 -WLANs Physical Layer for IEEE 802.11 -WLANs; Radio systems -IR Systems Applications

Module-III: **9 hrs**

Bluetooth: Bluetooth and IEEE 802.15- Bluetooth Specifications - Bluetooth Architectures - Bluetooth Protocols - Bluetooth Service Discovery - Bluetooth MAC - Bluetooth Packet Structure - Bluetooth Audio - Bluetooth Addressing - Bluetooth Limitations – Zigbee

Module-IV: **9 hrs**

WAP: The WAP Forum - WAP Service Model - WAP Protocol Architecture - WAP Programming Model – Mobile applications and Mobile IP - Mobile adhocnetworks(MANET) Wireless Routing Protocol - Cluster Switch Gateway Routing (CSGR) - Ad Hoc On-Demand Distance Vector Routing (AODV). Dynamic Source Routing (DSR) - Zone Routing Protocol (ZRP) - Source Tree Adaptive Routing (STAR).

Module-V: **9 hrs**

Satellite Communication: Overview of Satellite Systems - Orbits and Launching Methods - Geostationary Orbit - Radio Wave propagation - Interference - Satellite Access - Satellites in Networks - Direct Broadcast Satellite (DBS) Television - Satellite Services - INSAT, VSAT, Remote Sensing- Satellite Mobile and Specialized Services.

Text Book(s):

1. *Cory Beard, William Stallings,Wireless Communication Networks and Systems2015, Pearson.*
2. *William Stallings, Wireless communications and Networks, 2 nd Edition, Pearson Education Asia, 2005.*

Reference Book(s):

1. *Jochen Schiller, Mobile Communications, 2nd Edition, Addison-Wesley, 2000.*
2. *Chai-KeongToh, AdHoc Mobile Wireless Networks: Protocols and Systems, Addition Wesley, 2002.*
3. *Dennis Roddy, Satellite Communications,Fourth Edition, McGraw hill 2008*

CSNS 626: NETWORK SECURITY LAB

L	T	P	C
0	0	2	2

Skills to be required:

- *Knowledge on the fundamentals of networking and tools used in networks.*

Lab Software Requirements:

- *Standalone machine with WHOIS client, Wireshark, Ethereal, NMAP tool installed.*

Course Outcome:

- *Will be able to gather information about the networks by using different n/w reconnaissance tools*.
- *Understand the usage of network-based tools for network analysis*
- *Use techniques for Network scanning*
- *Identify network vulnerability*
- *Use tools to simulate intrusion detection system*
- *To understand and install a firewall*

List of Exercises:

1. Download and install nmap. Use it with different options to scan open ports,perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, etc.
2. Detect ARP spoofing using open source tool ARPWATCH.
3. Use the Nessus tool to scan the network for vulnerabilitie.
4. Implement a code to simulate buffer overflow attack.
5. Set up IPSEC under LINUX
6. Install IDS (e.g. SNORT) and study the logs.
7. Use of iptables in linux to create firewalls.

CSNS 627: NETWORK PROTOCOL LAB

L	T	P	C
0	0	2	2

Skills to be required:

- *Knowledge on the protocols used in modern networked systems.*

Lab Software Requirements:

- *Standalone desktop with CentOS/Fedora Linux.*

Course Outcome:

- *Acquire knowledge on various routing protocols in network.*
- *Knowledge on the router configuration using CISCO.*
- *Knowledge on the functioning of various protocols in OSI model.*

List of Exercises:

1. Configuration and logging to a CISCO Router and introduction to the basic user Interfaces and basic commands.
2. Configuration of IP addressing for a given scenario for a given set of topologies.
3. Configure, implement and debug the following: Use open source tools for debugging and diagnostics.
   a. ARP/RARP protocols
   b. RIP routing protocols
   c. BGP routing
   d. OSPF routing protocols
   e. Static routes (check using netstat)
4. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment.
5. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.

M.Tech. (NIS)

Third Semester

CSNS 712: INFORMATION SECURITY MANAGEMENT AND STANDARDS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Familiarity with basic principles of information security.*

Objectives:

- *To understand the management aspects of information security.*
- *To Discuss about Security life cycle and planning.*
- *Demonstrate various security standardizations, for example, ISO/IEC 27002.*

Course Outcome:

- *Knowledge about management aspects of information security.*
- *Should be able to summarize security risk and associated assessment models like COBIT.*
- *Should distinguish proactive security mechanisms, like firewalls, IDS/IPS etc and application audit methodology.*
- *Demonstrate various security standardization and legal issues involving information security.*

Module-I: 9 hrs

Information Security Management: Why Information Security Matters - Information Sensitivity Classification - Information Security Governance - The Computing Environment - Security of Various Components in the Computing Environment - Security Interdependence - CIA Triad - Security Goals versus Business Goals - The Security Star - Parker's View – Defence-In-Depth Security - Security Control – NSA Triad Introduction to Management Concepts: History - Managerial Skills - Mintzberg's Managerial Role - Strategic Management Concepts - IS Security Management Activities - The Information Security Management Cycle - IS Security Management versus Functional Management

Module-II: 9 hrs

Life Cycle and Plan: The Information Security Life Cycle - Security Planning in the SLC - Security Analysis - Security Design - Security Implementation - Security Review - Continual Security - Security Plan - SP Development Guidelines- analysis – methodology – Security Plan : Security Policy, Standards, and Guidelines - Methodologies - on Computing Environment Partition - on Computing Boundaries - Benson's Security Policy Methodology - Business Continuity Planning: Business Disruptions - Business Continuity - Disaster Recovery - Responding to Business Disruptions - Developing a BCP

Module-III: 9 hrs

Security Analysis and Design: Security Risk Management - Various Layers of Risk - The Risk Management Life Cycle - The Preparation Effort for Risk Management- A Sustainable Security - Information Needed to Manage Risks - Factors Affecting Security Risk - The ALE Risk Methodology - Operational, Functional, and Strategic Risks - Operational Risk Management: Naval Safety - The ABLE Methodology - (IFEAR) IFEAR Methodology - Fault Tree Analysis - Event Tree Analysis - FTA-ETA Integration - Risk Management - History - ISO/IEC 27002 - Enhance Security - Measurement and Implementations - Enhance

the ISO/IEC 27002-Based Security Posture - Technical Security Enhancement Based on ISO/IEC 27001- Organizations Interact with the Standards - General ISMS Framework - Model - The Process Approach - Development - Design - Security Inventory Needs - Integration - Self-Assessment for Compliance - Scoping - Security Implementation

Module-IV: **9 hrs**

Security Review and Continual Security: Different Things to Different People - Audit Activities - Definition - Main Features - Application Audit - Relating to Corporate Security Policy - Structure - Security Audit versus IT Auditing - Applicable Security - Related Standards - Security Audit Grades - The Problem of Privacy - The Meaning of Privacy - HIPAA - The Privacy Rule - The HIPAA Security Rule - Administrative Safeguards - NIST on HIPAA - Conducting Effective Risk Analysis - Methods of Doing Business - Background of the Sarbanes–Oxley Act - Sarbanes – Oxley Act of 2002 - Major Provisions of - Management Assessment - IT Compliance - International Responses - Advantages to SOX Compliance - Foreign Whistle blowers and SOX - Reconciling SOX and European Conflicting Standards - EU Corporate Governance Initiatives - E.U.'s Eighth Directive - Planning IT Management for SOX: Delayed SOX Impact.

Module-V: **9 hrs**

Cyberterrorism and Homeland Security: Security Economic Intelligence - Homeland Security - Cyber terrorism in the Literature - Cyber terrorism in the Real World: The FBI Perspective - U.S. Legislative Enactments and Proposed Programs - U.S. Criminal Statutes Affecting the Internet - Statutes and Executive Orders Concerned with Cyber terrorism - International Initiatives - Individual European State Approaches to Security and Counterterrorism.

Text Book(s):

1. *Bel G. Raggad, Information Security Management: Concepts and Practice, CRC Press.*
2. *Nina Godbole, Information Systems Security: Security Management, Metrics, Frameworks and BestPractices, First Edition, Wiley India Pvt Ltd, 2009.*
3. *Michael Whitman and Herbert Mattord, Management of Information Security, Fourth Edition, CengageLearning, 2014.*

Reference Book(s):

1. *Michael Whitman and Herbert Mattord, Principles of Information Security, Fifth Edition, Cengage Learning, 2015.*
2. *Harold F. Tipton, Information Security Management Handbook, Sixth edition, CRC Press, 2012.*
3. *Thomas R. Peltier, Information Security Policies and Procedures, 2nd Edition, Auerbach Publications, 2004.*

M.Tech. (NIS)

Fourth Semester

M.Tech. (NIS)

ELECTIVES
(15 Credits)

CLOUD COMPUTING

CSNS 811: CLOUD COMPUTING ARCHITECTURE

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic concepts of Operating Systems (how they work and operate at a high level): Windows, Linux and a bit of basic concepts about them.*

Objectives:

- *To analyze the components of cloud computing showing how business agility in an organization can be created.*
- *Evaluate the deployment of web services from cloud architecture.*
- *Critique the consistency of services deployed from a cloud architecture.*
- *Critically analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications.*

Course Outcome:

- *Should be able to analyze the components of cloud computing showing how business agility in an organization can be created.*
- *Knowledge on the services deployed from a cloud architecture and how it is deployed.*
- *Compare and contrast the economic benefits delivered by various cloud models based on application requirements, economic constraints and business requirements.*
- *Clear understanding on what model to apply when developing and deploying cloud based applications.*

Module-I: 9 hrs

Cloud Computing Fundamental: Understanding Cloud Computing - Origins and Influences - Basic Concepts and Terminology - Goals and Benefits - Risks and Challenges - Roles and Boundaries - Cloud Characteristics - Cloud Delivery Models - Cloud Deployment Models.

Module-II: 9 hrs

Enabling Technologies and Security: Broadband Networks and Internet Architecture - Data Center Technology - Virtualization Technology - Web Technology - Multitenant Technology - Service Technology –Security: Basics - Threat Agents - Cloud Security Threats.

Module-III: 9 hrs

Cloud Computing Mechanisms: Logical Network Perimeter - Virtual Server - Cloud Storage Device - Cloud Usage Monitor- Resource Replication- Ready-Made Environment - Automated Scaling Listener- Load Balancer- SLA Monitor - Audit Monitor- Failover System – Hypervisor- Resource Cluster- Multi-Device Broker - State Management Database - Remote Administration System - Resource Management System - SLA Management System- Billing Management System

Module-IV: **9 hrs**

Security Mechanisms and Architecture: Encryption - Hashing- Digital Signature -Public Key Infrastructure (PKI) Identity and Access Management - Single Sign-On (SSO) - Cloud-Based Security Groups - Fundamental Cloud Architectures - Advanced Cloud Architectures - Specialized Cloud Architectures

Module-V: **9 hrs**

Working With Clouds: Cloud Delivery Models - The Cloud Provider - The Cloud Consumer - Business Cost Metrics - Cloud Usage Cost Metrics- Cost Management Considerations - Service Quality Metrics

Text Book(s):

1. *Erl, Cloud Computing: Concepts, Technology & Architecture,2013*
2. *Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications, 2010.*
3. *Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, McGraw Hill, 2009.*

Reference Book(s):

1. *Dimitris N. Chorafas, Cloud Computing Strategies, CRC Press, 2010.*

CSNS 812: CLOUD STORAGE INFRASTRUCTURE

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic knowledge on virtualization.*

Objectives:

- *Critically appraise the opportunities and challenges of information management.*
- *Evaluate information storage management design in a cloud environment.*
- *Analyze the role technology plays in the design of a storage solution in a cloud architecture.*
- *Investigate how a global storage solution can be optimized so that it can be delivered successfully from the cloud.*
- *Analyze how best to provide reliable access to information both locally and remotely using storage technologies.*

Course Outcome:

- *Should understand the challenges of information management in complex business environments and to evaluate information storage management design in a cloud environment*
- *Should be able to relate the business objectives of an organization.*
- *Obtain knowledge in the design of a storage solution in a cloud architecture.*

Module-I: 9 hrs

Industry Trends and Perspectives: The Importance of Data and Storage - Business Issues and IT Challenges - Business and IT Opportunities - Opportunity for Cloud, Virtualization, and Data Storage Networking - Common Cloud, Virtualization, and Storage Networking - Cloud, Virtualization, and Storage Networking -Cloud, Virtualization, and Data Storage: Server and Storage I/O Fundamentals - I/O Connectivity and Networking Fundamentals - IT Clouds - Virtualization: Servers, Storage, and Networking - Virtualization and Storage Services - Data and Storage - Infrastructure Resource Management : Managing Data Infrastructures for Cloud and Virtual Environments - Introduction to Infrastructure Resource Management - Understanding IT Resources - Managing IT - Service Offerings, Categories, and Technology Alignment - Gaining Situational Awareness and Control - From SRM to E2E SRA - Search and e-Discovery - Performance and Capacity Planning - Data Movement and Migration.

Module-II: 9 hrs

Security and Data Protection: Being Secure Without Being Scared - Eliminating Blind Spots, Gaps in Coverage, or "Dark Territories" - Security Threat Risks and Challenges - Taking Action to Secure Your Resources - Securing Networks - Securing Storage - Virtual Servers, Physical Servers, and Desktops - Securing Clouds - Disposing of Digital Assets and Technology - Security Checklist - Data Protection: Backup/Restore and Business Continuance/Disaster Recovery - Data Protection Challenges and Opportunities - Protect, Preserve, and Serve Information Services - SLO and SLAs: How Much Availability Do You

Need vs. Want - Common-Sense Data Protection - Virtual, Physical, and Cloud Data Protection - Modernizing Data Protection and Backup - Data Protection Checklist - Common HA-, BC-, and DR-Related Questions

Module-III: **9 hrs**

Measurements and Data Footprint Reduction: Getting Started - Making Sense of Metrics and Measurements - Different Metrics for Different Audiences - Key Performance Indicators - Compound Metrics - Measuring IT Resources and Services Delivery - Where to Get Metrics - Accounting and Chargeback - Benchmarks and Simulation Comparisons - Data Footprint Reduction: Enabling Cost-Effective - Getting Started - The Expanding Scope and Focus of Data Footprint Reduction - DFR Techniques - Metrics and Measurements - What to Look for in a DFR Technology Solution – DFR Techniques - Archiving - Compression and Compaction - Consolidation and Storage Tiering - Data De-duplication - Cloud and Virtual Data Storage Networking - DFR and RAID Configurations - Space-Saving Snapshots - Thin Provisioning - Common DFR Questions

Module-IV: **9 hrs**

Storage Services and Connectivity: Tiered Storage - Storage Reliability, Availability, and Serviceability (RAS) - Aligning Storage Technology and Media to Application Needs - Storage Services and Functionalities - Storage System Architectures - Storage Virtualization and Virtual Storage - Common Storage Questions - Virtual Servers - Inside Virtual Servers and Virtual Machines - Virtual Desktop Infrastructure - Cloud and Virtual Servers - Can and Should All Servers or Desktops Be Virtualized? - Virtualization Beyond Consolidation: Enabling IT Agility - Common Virtualization Questions - Connectivity: Networking with Your Servers and Storage - Networking Challenges - I/O and Networking Bits and Bytes, Decoding Encoding - I/O and Networking Fundamentals - Server (Physical, Virtual and Cloud) Topics - I/O and Networking Devices - Converged and Unified Networking - Local Networking (DAS, SANs, and LANs) - Enabling Distance (MANs and WANs) - Cloud, Virtualization, and Management Topics - Configuring for Reliability, Availability, and Serviceability (RAS) - Common Networking Questions.

Module-V: **9 hrs**

Solution Packages and Management Tools: Clarifying Cloud Confusion - IaaS, PaaS, SaaS, and AaaS - Accessing Clouds - Public Cloud Services - Private Clouds - Stacks and Solutions - PODs and Modular Data Center Components - Vendor Lock-in: The Good, the Bad, and the Ugly - Evaluating Cloud Servers and Solutions - Management and Tools - Software and Management Tools - Management Tool Interfaces - End-to-End Management - Licensing Topics - The Evolving Role of Management Tools - Hard vs. Soft Products - The Other IT Resources: People, Processes, and Policies - Applying What You Have Learned - Don’t Be Afraid, but Look before You Leap - Addressing Issues and Challenges While Enabling Opportunities - What’s Your Vision, Strategy, and Plan? - What to Consider When Evaluating Technologies, Techniques, and Services - Common Cloud, Virtualization and Data Storage - Futures, Trends, Perspectives, and Predictions.

Text Book(s):

1. *Greg Schulz ,, Cloud and Virtual Data Storage Networking, CRC Press, 2011*
2. *Marty Poniatowski, Foundations of Green IT , Pearson, 2009.*
3. *EMC, Information Storage and Management: Storing, Managing, and Protecting , Wiley ,2009*

Reference Book(s):

1. *Volker Herminghaus, Albrecht Scriba,, Storage Management in Data Centers , Springer, 2009.*
2. *Klaus Schmidt, High Availability and Disaster Recovery, Springer, 2006.*

CSNS 813: PRINCIPLES OF SECURITY IN CLOUD COMPUTING

L	T	P	C
3	0	0	3

Pre-requisite:

- *Familiarity with Information security.*

Objectives:

- *Compare modern security concepts as they are applied to cloud computing.*
- *Assess the security of virtual systems.*
- *Evaluate the security issues related to multi-tenancy.*
- *Appraise compliance issues that arise from cloud computing.*

Course Outcome:

- *Should be able to evaluate the security measures in cloud*
- *Should understand the various architectural aspects of cloud.*
- *Should know to analyze data classification and security*
- *Investigate legal and compliance issues in cloud*

Module-I: **9 hrs**

Architectural Concepts: Business Requirements - Cloud Evolution, Vernacular, and Definitions - Roles and Responsibilities - Definitions - Foundational Concepts - Business Requirements Analysis - Boundaries of Cloud Models - Protecting Sensitive Data.

Module-II: **9 hrs**

Data Classification and Security: Data Inventory and Discovery - Jurisdictional Requirements - Data Rights Management - Cloud Data Life Cycle - Cloud Storage - Cloud Data Security Foundational Strategies - Security in the Cloud - Virtualization - Cloud Attack Surface - Disaster Recovery (DR).

Module-III: **9 hrs**

Responsibilities and Application Security: Foundations of Managed Services - Business Requirements - Shared Responsibilities by Service Type - Shared Administration of OS - Share Responsibilities - Lack of Physical Access - Training and Awareness - Common Cloud Application Deployment Pitfalls – Cloud SDLC - 148 ISO/IEC 27034-1 - Cloud Application Architecture - Assurance and Validation.

Module-IV: **9 hrs**

Operations: Physical/Logical - Security Training and Awareness - Basic Operational Application Security - Monitoring, Capacity, and Maintenance - Change and Configuration - Business Continuity and Disaster.

Module-V: **9 hrs**

Legal and Compliance Issues: Legal Requirements and Unique Risks in the Cloud Environment Potential Personal and Data Privacy Issues in the Cloud Environment Audit Processes, Methodologies, and Cloud - The Impact of Diverse Geographical Locations and Legal Jurisdictions - Business Requirements - Cloud Contract Design and Management for Outsourcing.

Text Book(s):

1. *Brian T. O'Hara , Certified Cloud Security Professional, 2nd Edition, 2017.*
2. *Ronald L. Krutz, Russell Dean Vines, Cloud Security , First Edition, Wiley , 2010.*
3. *John Rittinghouse, James Ransome, Cloud Computing , CRC Press, 2010.*
4. *J.R. ("Vic") Winkler, Securing the Cloud, Elsevier, 2011.*

Reference Book(s):

1. *Cloud Security Alliance 2009, Security Guidance for Critical Areas of Focus in Cloud Computing*
2. *VMware Security Hardening Guide*
3. *Cloud Security Alliance 2010, Top Threats to Cloud Computing*
4. *NIST Guidelines on Security and Privacy in Public Cloud Computing*
5. *William Hau, Rudolph Araujo et al How Virtualization Affects PCI DSSwww.mcafee.com/us/resources/.../wp-how-virt-affect-pci-dss-part-1.pdf*

CSNS 814: CONVERGED NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Knowledge of basic networking concepts, routing protocols and IP addressing mechanisms.*

Objectives:

- *To implement applications enabled by a multi-service convergent network.*
- *To understand how real-time traffic is prioritized and carried within a data network.*
- *Engineer networks suitable for voice, multicast traffic and high-speed switched Internet based networks.*

Course Outcome:

- *Should be able to implement applications enabled by a multi-service convergent network.*
- *Clear understanding on how real-time traffic prioritization happens within a data network.*
- *Should be able to design Multicast Networks.*
- *Should be able to gain knowledge on the VOIP techniques.*
- *Gain a clear view on voice, multicast traffic and high-speed switched Internet based networks.*

Module-I: 9 hrs

Introduction: Overview- rationale – Benefits – voice communication network – voice transmission schemes – public switched telephone network – integrated services digital network – call control – advanced intelligent networks – ATM networks –SONET

Module-II: 9 hrs

Data Networking Concepts: Data characteristics – Synchronization – Data communication networks – network architecture – internet architecture – frame relay

Module-III: 9 hrs

Voice Packet and Modulation: Voice packet processing increasing voice – voice by packet – coding techniques and standards - Modulation schemes – impairments with wireless communication and broadband systems – equalization – single carrier – multi carrier

Module-IV: 9 hrs

VOIP Networking: Issues –H.323 – QoS issues - VOIP standards – signalling protocols – PINT – IP QoS – transport architectures – Voice over ATM – VoATM – Circuit Emulation Scheme – comparison of Voice over AAl Schemes – Voice over –Frame Relay Networks – VoFR model – VoRF over switched virtual circuits – Review Of Voice Over Packet Models

Module-V: **9 hrs**

Converged Network Access Technologies: Cable Network Access – DSL Access – Broadband Wireless Access Networks – Corporate Access Networks – Soft switch Model of VoIP - Benefits ofSoftswitch – Architecture Service Creation Environment.

Text Book(s):

1. *Oliver C. Ibe, Converged Network Architectures: Delivering Voice over IP, ATM, and Frame Relay 1st Edition, Wiley*
2. *Connecting Networks v6 Companion Guide, Cisco Networking Academy*
3. *Scott Firestone, ThiyaRamalingam, Steve Fry 2007, Voice and Video Conferencing Fundamentals, 1st Ed. Ed., Cisco Press*
4. *CVOICE 8.0: Implementing Cisco Unified Communications Voice over IP and QoS*
5. *Eric Osborne, Ajay Simha 2003, Traffic engineering with MPLS, Cisco Press*

Reference Book(s):

1. *Amir Ranjbar 2007, CCNP ONT Official Exam Certification Guide, Cisco*
2. *Christina Hattingh, Darryl Sladden, ATM ZakariaSwapan 2010, SIP Trunking, Cisco Press*
3. *Website: Cisco Systems Inc. 2006, Voice/Data Integration Technologies http://www.cisco.com/univercd/cc/td/doc/cisintwk/ito_doc/voicdata.htm*

CSNS 815: ENTERPRISE STORAGE SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Understanding of key concepts related to cloud computing.*

Objectives:

- *Evaluate various storage classifications and technologies.*
- *Analyze storage architectures, processes, components and how they relate to virtualization.*
- *To gain knowledge on the various networking technologies with regards to storage.*

Course Outcome:

- *To be able to evaluate various storage classifications and technologies.*
- *Should be able to understand the storage architectures, processes, components and how they relate to virtualization.*
- *Should understand the basic concept behind storage systems and their level of performance.*
- *Knowledge on virtualization in cloud.*

Module-I: 9 hrs

Storage Systems: Data Classification, Storage Evolution and Data Center infrastructure-Host components, Connectivity, Storage, and Protocols. Components of a disk drive, physical disk and factors affecting disk drive performance - RAID level performance and availability considerations - Components and benefits of an intelligent storage system.

Module-II: 9 hrs

Storage Networking Technologies: Direct-Attached Storage (DAS) architecture, Storage Area Network (SAN) attributes components, topologies, connectivity options and zoning. FC protocol stack, addressing, flow control, and classes of service. Networked Attached Storage (NAS) components, protocols, IP Storage Area Network (IP SAN) iSCSI, FCIP and FCoE architecture. Content Addressed Storage (CAS) elements, storage, and retrieval processes.

Module-III: 9 hrs

Virtualization: Block-level and file-level storage virtualization technology, virtual provisioning and cloud computing.

Module-IV: 9 hrs

Business Continuity: Business Continuity measurement, terminologies, and planning. Backup designs, architecture, topologies, and technologies in SAN and NAS environments - Local and Remote replication using host and array-based replication technologies such as Synchronous and Asynchronous methods.

Module-V: **9 hrs**

Storage Security and Management: Storage security framework and various security domains - Security implementation in SAN, NAS and IP-SAN networking. Monitoring and Storage management activities and challenges

Text Book(s):

1. *Information Storage and Management,EMC*
2. *Richard Barker, Paul Massiglia 2002, Storage area network essentials, Wiley NewYork*
3. *Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, Storage Networks Explained*

Reference Book(s):

1. *W. Curtis Preston 2002, Using SANs and NAS, O'Reilly & Associates Sebastopol, Calif.*
2. *HimanshuDwivedi 2006, Securing storage, Addison-Wesley Upper Saddle River, NJ*

CSNS 816: DATA CENTER VIRTUALIZATION

L	T	P	C
3	0	0	3

Pre-requisite:

- *Familiarity with managing Virtual Environments.*

Objectives:

- *Identify various constraints and challenges in setting up a data center.*
- *Demonstrate Enterprise level virtualization and access control in virtual machines.*
- *Discuss the components needed for end-to-end virtualization.*

***Course Outcome*:**

- *Should be able to overcome the challenges in setting up a data center.*
- *Should be able to give a demo on Enterprise level virtualization and access control in virtual machines.*
- *Clear understanding on the various components available forend to end virtualization.*
- *Should be able to perform Resource monitoring and execute backup and recovery of virtual machines.*

Module-I: 9 hrs

Introduction: Introduction Virtualization History and Definitions - Data Center Essential Definitions -The Origins of Data Center Virtualization Classifying Virtualization Technologies Data Center Network Evolution - Data Center Network Topologies - Network Virtualization Benefits.

Module-II: 9 hrs

Virtualization In Network: Network Partitioning - Defining VLANs - Misconceptions About VLANs - Spanning Tree - Private VLANs - Concepts - Overlapping Addresses - Defining and Configuring - Routing - Management Plane - Application Networking Services -Load Balancer Proliferation - ACE Virtual - Instant Switches: Virtual Device Contexts - Fooling Spanning Tree - Virtualized Chassis with Fabric Extenders.

Module-III: 9 hrs

Virtualization In Storage Technologies: : Data Center Storage Devices - Accessing Data in Rest - Storage Virtualization - Some Fibre Channel Definitions - Fabric Processes - Defining and Exploring VSANs - Fibre Channel over IP - Inter-VSAN Routing - Data Center Bridging - Introducing Fibre Channel over Ethernet - Deploying Unified Server Access - Configuring MultihopFCoE - Unified Fabric Designs - FCoE and SAN Extension.

Module-IV: 9 hrs

Virtualization In Server Technologies: Server Evolution - Server Provisioning Challenges - Unified Computing and Service Profiles - Verifying Stateless Computing - Using Policies -

Firmware Policies - Industrializing Server Provisioning -Transcending the Rack - Moving Targets.

Module-V: 9 hrs

END-TO-END Virtualization: The Virtual Data Center and Cloud Computing - The Virtual Data Center - Automation and Standardization - What Is Cloud Computing - Cloud Implementation - Journey to the Cloud - Networking in the Clouds - Software-Defined Networks - OpenStack - Network Overlays - Cisco Open Network Environment.

Text Book(s):

1. *Gustavo Alessandro , Data Center Virtualization Fundamentals*
2. *Mike Laverick, VMware vSphere 4 Implementation*
3. *Jason W. McCarty, Scott Lowe, Matthew K. Johnson, VMware vSphere Administration Instant Reference*

Reference Book(s):

1. *Brian Perry, Chris Huss, Jeantet Fields, VCP VMware Certified Professional on vSphere 4 Study Guide*
2. *Jason Kappel, Anthony Velte, Toby Velte, Microsoft Virtualization with Hyper-V: Manage Your Datacenter with Hyper-V, Virtual PC, Virtual Server, and Application Virtualization*

CSNS 817: DATA CENTER NETWORKING

L	T	P	C
3	0	0	3

Pre-requisite:

- *Familiarity of Network function Virtualization.*

Objectives:

- *Critically discuss data center networking technologies and protocols.*
- *Evaluate key concepts in modern Layer 2 & Layer 3 data center networks.*
- *Research a topic related to networking technologies in modern data centers.*
- *To design, build and configure complex routed and switched networks.*

Course Outcome:

- *Should be able to understand data center networking technologies and protocols*
- *Obtain knowledge on complex routed and switched networks*
- *Should be able to give a demo on networking technologies in modern data centers*
- *Should have a clear understanding of different layers in networking.*

Module-I: 9 hrs

Evolution of Data Center Design: Data Center Evolution – Computer Networks – Enterprise Vs Cloud Data Center- Movement Into The Cloud – Switch Fabric – Architecture - Topologies – Tradition Enterprise Networks – Datacenter Network Switch Types – Flat Data Center Networks – Rack Scale Architecture- Network Function Virtualization

Module-II: 9 hrs

Data Center Architectures: Network connectivity optimization evolution: Top of rack (TOR), end of rack (EOR), scale up vs scale up, solutions that reduce power and cabling - Data Center standards; TIA/EIA-942 - Structured cabling standards, fiber and copper cabling characteristics, cable management, bandwidth requirements, I/O connectivity.

Module-III: 9 hrs

Server Architectures: Stand-alone, blades, stateless, clustering, scaling, optimization, virtualization - Limitation of traditional server deployments - modern solutions - Applications; database, finance etc - Redundant Layer 2 and Layer 3 designs - Case studies.

Module-IV: 9 hrs

Layer 2 Networks: Ethernet; IEEE 802.3ba; 40 Gbps and 100 Gbps Ethernet. IEEE 802.1D Spanning Tree Protocol (STP), RSTP, PVST, MSTP. TRILL (Transparent Interconnection of Lots of Links), RBridges, IEEE 802.1Qbg Edge Virtual Bridging, 802.1Qbh Bridge Port Extension – Fiber Channel over Ethernet (FCoE) vs Internet Small Computer System Interface (iSCSI). Data Center Bridging (DCB); priority-based flow control, congestion notification, enhanced transmission selection, Data Center Bridging Exchange (DCBX) - Layer 2 Multicasting; Case studies.

Module-V: **9 hrs**

Layer3&Beyond: Layer 3 Data Center technologies, network virtualization. Protocols; IPv4, IPv6, MPLS, OSPF, IS-IS, BGP. OTV, VPLS layer 2 extension protocols. Locator Identifier Separation Protocol (LISP) - Layer 3 Multicasting - Data Center application services - Data center networking use case studies and the enabling technologies and protocols in the modern data center.

Text Book(s):

1. *Gary Lee, Cloud Networking: Understanding Cloud-based Data Center Networks*
2. *SilvanoGai, TommiSalli, Roger Andersson, Cisco Unified Computing System*
3. *Ron Fuller, David Jansen, Matthew McPherson, NX-OS and Cisco Nexus Switching: Next-Generation Data Center Architectures*
4. *SilvanoGai, Claudio DeSanti, I/O Consolidation in the Data Center*
5. *Kevin Corbin, Ron Fuller, David Jansen,, NX-OS and Cisco Nexus Switching: Next Generation Data Center Architectures*
6. *Data Center Virtualization Fundamentals Understanding Techniques And Designs*

Reference Book(s):

1. *Nash Darukhanawalla, Patrice Bellagamba, Interconnecting Data Centers Using VPLS*
2. *Robert W. Kembel, Roger Cummings (Introduction), The Fiber Channel Consultant*
3. *Fiber Channel Switched Fabric*
4. *John L. Hufferd 2003, ISCSI, Addison-Wesley Boston*

CYBER SECURITY

CSNS 821: CYBER FORENSICS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Knowledge on basic Cryptographic Algorithms and Protocols, Computer Networks, Web and Mobile Technology and Security.*

Objectives:

- *Learn the security issues network layer, transport layer and transport layer.*
- *Learn computer forensics.*
- *Be familiar with forensics tools.*
- *Learn to analyze and validate forensics data.*

Course Outcome:

- *Able to analyze security issues in network layer and transport layer.*
- *Should be able to understand computer forensics and its various tools.*
- *Should know to analyze and validate forensics data.*
- *Clear understanding on the various areas of forensics.*

Module-I: 9 hrs

Legal and Ethical Principles : Introduction to Forensics – The Investigative Process – Code of Ethics, Ethics of Investigations, Evidence Management – Collection, Transport, Storage, access control, disposition

Module-II: 9 hrs

Forensic Science: Principles and Methods – Scientific approach to Forensics, Identification and Classification of Evidence, Location of Evidence, Recovering Data, Media File Forensic Steps, Forensic Analysis – Planning, Case Notes and Reports, Quality Control

Module-III: 9 hrs

Digital Forensics: Hardware Forensics – Hidden File and Anti- forensics - Network Forensics – Virtual Systems - Mobile Forensics

Module-IV: 9 hrs

Application Forensics, Tools and Report Writing – Application Forensics, Email and Social Media Investigations, Cloud Forensics, Current Digital Forensic Tools, Report Writing for Investigations

Module-V: 9 hrs

Counter Measures: Defensive Strategies for Governments and Industry Groups, Tactics of the Military, Tactics of Private Companies, Information Warfare Arsenal of the future, and Surveillance Tools for Information Warfare of the Future.

Text Book(s):

1. *Bill Nelson, Christopher Steuart, Amelia Philips, "Computer Forensics and Investigations", Delmar Cengage Learning; 5th edition January 2015.*
2. *Chuck Eastom, "Certified Cyber Forensics Professional Certification:, McGraw Hill, July 2017.*
3. *John R.Vacca, "Computer Forensics: Computer Crime Scene Investigation", Laxmi Publications, 2015.*

Reference Book(s):

1. *MarjieT.Britz, "Computer Forensics and Cyber Crime": An Introduction", 3rd Edition, Prentice Hall, 2013.*

CSNS 822: BLOCK CHAIN TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic knowledge on Private Key Cryptography and P2P Network.*

Objectives:

- *Understand basic crypto currency concepts.*
- *Understand the working and transactions of bit coin.*
- *To analyze the function of Blockchain technique.*

***Course Outcome*:**

- *Understand crypto currency concepts.*
- *Should be able to understand the working and transactions of bit coin.*
- *Should know the different advanced transactions and scripting techniques.*
- *Knowledge on analyzing the function of Blockch*ain

Module-I: 9 hrs

Introduction: Bitcoin - History of Bitcoin - Uses, Users, Choosing a Bitcoin Wallet - Quick Start - Getting Your First Bitcoin - Finding the Current Price of Bitcoin - Sending and Receiving Bitcoin - How it Works, Transactions - Blocks, Mining, and the BlockchainBitcoin Overview.Transaction Inputs and Outputs - Transaction Chains - Making Change - Common Transaction Forms - Constructing a Transaction - Getting the Right Inputs - Creating the Outputs - Adding the Transaction to the Ledger - Bitcoin Mining - Mining Transactions in Blocks - Spending the Transaction

Module-II: 9 hrs

Bitcoin Core: The Reference Implementation - Bitcoin Development Environment - Compiling Bitcoin Core from the Source Code - Selecting a Bitcoin Core Release - Configuring the Bitcoin Core Build - Building the Bitcoin Core Executables - Running a Bitcoin Core Node - Running Bitcoin Core for the First Time - Configuring the Bitcoin Core Node - Bitcoin Core Application Programming Interface (API) - Getting Information on the Bitcoin Core Client Status - Exploring and Decoding Transactions - Exploring Blocks - Using Bitcoin Core

Module-III: 9 hrs

Wallets and Transactions: Wallet Technology - Overview Nondeterministic (Random) Wallets - Deterministic (Seeded) Wallets - HD Wallets (BIP-32/BIP-44) - Seeds and Mnemonic Codes (BIP-39) - Wallet Best Practices - Using a Bitcoin Wallet - Wallet Technology Details - Mnemonic Code Words (BIP-39) - Creating an HD Wallet from the Seed - Using an Extended Public Key on a Web Store Transactions - Transactions in Detail – Transactions Behind the Scenes - Transaction Outputs and Inputs - Transaction Outputs - Transaction Inputs - Transaction Fees - Adding Fees to Transactions Transaction Scripts

and Script Language - Turing Incompleteness - Stateless Verification - Script Construction (Lock + Unlock) - Pay-to-Public-Key-Hash (P2PKH) - Digital Signatures (ECDSA) - How Digital Signatures Work - Verifying the Signature - Signature Hash Types (SIGHASH) - ECDSA Math - The Importance of Randomness in Signatures - Bitcoin Addresses, Balances, and Other Abstractions

Module-IV: **9 hrs**

Advanced Transactions and Scripting: Multisignature -Pay-to-Script-Hash (P2SH) -P2SH Addresses -Benefits of P2SH -Redeem Script and Validation -Data Recording Output (RETURN) -Time locks -Transaction Lock time (nLocktime) -Check Lock Time Verify (CLTV) -Relative time locks -Relative time locks with nSequence -Relative time locks with CSV -Median-Time-Past -Time lock Defense Against Fee Sniping-Scripts with Flow Control (Conditional Clauses) -Conditional Clauses with VERIFY Opcodes -Using Flow Control in Scripts -Complex Script Example The Bitcoin Network -Peer-to-Peer Network Architecture -Node Types and Roles -The Extended Bitcoin Network -Bitcoin Relay Networks -Network Discovery -Full Nodes -Exchanging Inventory - Simplified Payment Verification (SPV) Nodes - Bloom Filters -How Bloom Filters Work -How SPV Nodes Use Bloom Filters -SPV Nodes and Privacy - Encrypted and Authenticated Connections -Tor Transport -Peer-to-Peer Authentication and Encryption -Transaction Pools

Module-V: **9 hrs**

Block chain : The Blockchain Structure of a Block -Block Header -Block Identifiers: Block Header Hash and Block Height -The Genesis Block -Linking Blocks in the Blockchain - Merkle Trees -Merkle Trees and Simplified Payment Verification (SPV) -Bitcoin Test Blockchains - Testing Playground -The Segregated Witness Testnet -The Local Blockchain - Using Test Blockchains for Development,

Text Book(s):

1. *Mastering Bitcoin: Programming the Open Block chain, Andreas M. Antonopoulos, Shroff/O'Reilly; Second edition, 2017.*
2. *Imran Bashir,Mastering Blockchain,Packt Publishing Limited ,2016.*

Reference Book(s):

1. *ArshdeepBahga ,Blockchain Applications: A Hands-On Approach , 2017.*

CSNS 823: PATTERN RECOGNITION TECHNIQUES IN CYBER CRIME

L	T	P	C
3	0	0	3

Pre-requisite:

- *A good foundation of probability and linear algebra and any Machine Learning background will help.*

Objectives:

- *Pattern classification algorithm for a pattern recognition problem and properly implement the algorithm using modern computing tools.*
- *Clustering is an important aspect of supervised learning and has been covered extensively in this course.*
- *Cybercrime techniques and how to apply in pattern recognition.*
- *To solve real-world problems using Pattern Recognition techniques.*

***Course Outcome*:**

- *Should know to implement various pattern recognition problem using computing tools*.
- *Understand and implement Pattern classification algorithm.*
- *Able to gain knowledge on Cybercrime techniques and its application in pattern recognition.*
- *Should be able to solve real-world problems using Pattern Recognition techniques*.

Module-I: 9 hrs

Introduction: Basics of pattern recognition - Design principles of pattern recognition system-Learning and adaptation- Pattern recognition approaches.

Module-II: 9 hrs

Classifiers Based On Bayesian Decision Theory: Introduction-Bayesian Decision Theory-Continuous Features-Minimum error rate- classification- classifiers, discriminant functions, and decision surfaces; The normal density- Discriminant functions for the normal density-Maximum likelihood estimation-Bayesian Estimation- Bayesian parameter estimation-Gaussian Case-general theory-Hidden Markov Models.

Module-III: 9 hrs

Nonparametric Technique and Non-Metric Methods: Density Estimation - Parzen Windows - K-Nearest Neighbor Estimation - Nearest Neighbor Rule- Fuzzy clustering. Non-Metric Methods- Introduction-Decision Trees- CART- Other Tree Methods- Recognition with Strings-Grammatical Methods.

Module-IV: **9 hrs**

Malware Analysisand Network Traffic Analysis: anomaly detection– data driven methods – feature engineering – detection with data and algorithms – challenges using ML- response and mitigation – Malware Analysis: defining – feature generation – classification - Network Traffic Analysis- Theory – ML and network security – building predictive model to classify network attack

Module-V: **9 hrs**

Protecting consumer web and production systems: types of abuse and data that can stop them – learning for abuse problems- large attacks - production systems - ML for system maturity and scalability – data quality – model quality – performance – maintainability – monitoring and alerting – security and reliability – adversarial machine learning.

Text Book(s):

1. *Abhijit S. Theodoridis and K. Koutroumbas, "Pattern Recognition", 4th Ed, Academic Press, 2009.*
2. *Clarence Chio David Freeman "Machine Learning and Security: Protecting Systems with Data and Algorithms","O'Reilly Media, Inc.", 2018*
3. *"Scene of the Cybercrime" 2nd Edition by Debra Littlejohn Shinder, Michael Cross, 2002.*
4. *Earl Gose, Richard Johnsonbaugh, Steve Jost- "Pattern Recognition and Image Analysis" - Pearson Education, 2007.*

Reference Book(s):

1. *Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", 2nd Edition, John Wiley, 2006.*
2. *"A Brief History of Cyber Crime" written by: R. Elizabeth C. Kitchen edited by: M.S. Smith, 2010.*

CSNS 824: CYBER LAWS AND SECURITY POLICIES

L	T	P	C
3	0	0	3

Pre-requisite:

- *Familiarity with Cyber Security and Cyber Crime.*

Objectives:

- *To explain the basic information on cyber security.*
- *To understand the issues those are specific to amendment rights.*
- *To have knowledge on copy right issues of software's.*
- *To understand ethical laws of computer for different countries.*

Course Outcome:

- *Exposure to basic information on cyber security.*
- *Understand the issues those are specific to amendment rights.*
- *Knowledge on copy right issues of software.*
- *Should be able to understand ethical laws of computer for different countries.*

Module-I: 9 hrs

Introduction: Cyber Security and its problem-Intervention Strategies: Redundancy, Diversity and Autarchy.

Module-II: 9 hrs

Private Ordering Solutions: Regulation and Jurisdiction for global Cyber security - Copy Right source of risks – Pirates- Internet Infringement - Fair Use – postings - criminal liability - First Amendments - Data Losing.

Module-III: 9 hrs

Copy Right: Source of risks – Trademarks – Defamation - Privacy-Common Law Privacy - Constitutional law - Federal Statutes – Anonymity - Technology expanding privacy rights

Module-IV: 9 hrs

Duty of Care And Ethics: Criminal Liability - Procedural issues- Electronic Contracts & Digital Signatures- Misappropriation of information - Civil Rights, Tax, Evidence.- Legal Developments, Late 1990 to early 1966, Cyber security in Society, Security in cyber laws case studies, General Law and Cyber Law-a Swift Analysis

Module-V: 9 hrs

Security Policy Case Studies: Indian National Cyber Security Policy-2013 – UK National Cyber Security Strategy 2016 to 2021 – US Cyber Security Policy

Text Book(s):

1. Jonathan Rosenoer,"Cyber Law: The law of the Internet", Springer-Verlag, 1997.
2. Mark F Grady, FransescoParisi, "The Law and Economics of Cyber Security"
http://meity.gov.in/sites/upload_files/dit/files/National%20Cyber%20Security%20Policy%20%281%29.pdf.
3.https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/567242/national_cyber_security_strategy_2016.pdf
4. *https://www.dhs.gov/topic/cybersecurity*

Reference Book(s):

1. *Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives, SunitBelapure Nina Godbole, 2011, Wiley India Pvt Ltd*

CSNS 825: INFORMATION SECURITY AND RISK MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite:

- *A broad knowledge of Information security technologies is assumed: cryptography (public key and symmetric key), firewalls, IDS, viruses/virus detection, access control, etc.*

Objectives:

- *To present a system and management view of information security*
- *To analyze the requirements for information security*
- *How to integrate it into the systems design process, and life cycle security management of information systems.*
- *To understand various levels of risks and control practices.*

Course Outcome:

- *Should be able to understand system and management view of information security*
- *Ability to manage the security life cycleof information systems*
- *Should have a clear view on the system design and life cycle.*

Module-I: 9 hrs

RISK I: Identifying and categorizing risks: Risk Management – Risk Identification – Risk Assessment -Documenting the Results

Module-II: 9 hrs

RISK II: Risk Management: Introduction – Control Strategies – Managing Risk – Feasibility and Cost Benefit Analysis – Risk Control Practices.

Module-III: 9 hrs

Security Policy: Purpose of security policies -Enterprise Information – Issue Specific – System Specific – Guidelines

Module-IV: 9 hrs

Security Management of Deployed Systems: Organizing For Security - Within an Organization – Components – Security Roles- Education – Training and Awareness – Security Management Models: Access Control – Architecture Models – Management Models - Benchmarking – Performance Measures.

Module-V: 9 hrs

Contingency Planning: Fundamentals - Components: Business Impact - Incident Response - Disaster Recovery – Business Continuity - Timing and Sequence - Crisis Management - Business Resumption Planning – Testing Contingency Planning.

Text Book(s):

1. *Management of Information Security by Michael E. Whitman and Herbert J. Mattord, Second edition,*

Reference Book(s):

1. *Security Engineering, Ross Anderson, ISBN 978-0470068526*

CSNS 826: INTRUSION DETECTION SYSTEMS AND FIREWALL

L	T	P	C
3	0	0	3

Pre-requisite:

- *Fundamental knowledge in Operating Systems and Networks*

Objectives:

- *To understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise.*
- *Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems.*
- *Analyze intrusion detection alerts and logs to distinguish attack types from false alarms.*
- *To be able to analyze the basic Firewall mechanism.*

***Course Outcome*:**

- *Acquire knowledge of Intrusion Detection.*
- *Ability to improve the security posture of any enterprise by applying the intrusion mechanism.*
- *Ability to design new Intrusion Detection Systems in the lower level.*
- *Identify attack types from false alarms.*

Module-I: 9 hrs

History of Intrusion Detection: Audit, Concept and definition, Internal and external threats to data, attacks, Need and types of IDS, Information sources Host based information sources, Network based information sources.

Module-II: 9 hrs

Intrusion Prevention System and Snort: Network IDs protocol based IDs, Hybrid IDs, Analysis schemes, thinking about intrusion. A model for intrusion analysis- Incident Responses – Incident Response Process – IDS ad IPS response Phases Forensics –Corporate Issues - Snort Installation Scenarios, Installing Snort, Running Snort on Multiple Network Interfaces, Snort Command Line Options. Step-By-Step Procedure to Compile and Install Snort Location of Snort Files, Snort Modes Snort Alert Modes

Module-III: 9 hrs

Snort Rules and ACID: Rule Headers, Rule Options, the Snort Configuration File etc. Plugins, Preprocessors and Output Modules, Using Snort with MySQL - Using ACID and Snort Snarf with Snort -Agent development for intrusion detection - Architecture models of IDs and IPs

Module-IV: **9 hrs**

Firewall Introduction and Technologies: Why Internet Firewalls - Internet Services - Security Strategies - Building Firewalls - Packets and Protocols - What Does a Packet Look Like? - IP - Protocols Above IP - Protocols Below IP - Application Layer Protocols - IP Version - Non-IP Protocols - Attacks Based on Low-Level Protocol Details - Firewall Technologies - Some Firewall Definitions - Packet Filtering - Proxy Services - Network Address Translation - Virtual Private Networks

Module-V: **9 hrs**

Building Firewalls: Firewall Architectures - Firewall Design - Packet Filtering - Proxy Systems - Bastion Hosts - UNIX and Linux Bastion Hosts 176 - Windows NT and Windows 2000 Bastion Hosts

Text Book(s):

1. *RafeeqRehman , " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall , 2003.*
2. *Carl Endorf, Eugene Schultz and Jim Mellander"Intrusion Detection & Prevention", 1st Edition, Tata McGraw-Hill, 2004.*
3. *Elizabeth D. Zwicky, Simon Cooper & D. Brent Chapman , "Building Internet Firewalls" O'Reilly*

Reference Book(s):

1. *Christopher Kruegel,FredrikValeur, Giovanni Vigna: "Intrusion Detection and Correlation Challenges and Solutions", 1st Edition, Springer, 2005.*
2. *Stephen Northcutt, Judy Novak : "Network Intrusion Detection", 3rd Edition, New Riders Publishing, 2002.*
3. *T. Fahringer, R. Prodan, "A Text book on Grid Application Development and Computing Environment". 6th Edition,KhannaPublihsers, 2012.*

CSNS 827: MULTIMEDIA SECURITY & FORENSICS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic knowledge of analysis, authentication, hiding and recovery of data.*

Objectives:

- *To introduce digital era of communication and watermarking.*
- *To provide knowledge on various watermarking techniques.*
- *To help understand the concept of securing forensics methods.*
- *To throw insight on Cryptography techniques in Forensics*.

Course Outcome:

- *Understand digital watermarking and communication process.*
- *Ability to analyze all models in digital watermarking.*
- *Knowledge about security in forensic field.*
- *Capable of finding all forgery ways in digital era and overcome techniques*.

Module-I: **9 hrs**

Digital Watermarking Basics: Models of Watermarking - Basic Message Coding - Error Correction Coding.

Module-II: **9 hrs**

Digital Watermarking and Digital Communications: Information Theory: Mutual Information and Channel Capacity - Watermarking with Side Information - Using PerceptualModels - Robust Watermarking -Affine-Resistant Watermarking.

Module-III: **9 hrs**

Media Specific Digital Watermarking: Image Watermarking, Video Watermarking, Audio Watermarking, Watermarking for CG-models, Watermarking for Binary Images, Watermarking for 3D Contents, Data Hiding through watermarking techniques.

Module-IV: **9 hrs**

Digital Watermarking Protocols: A Buyer-Seller Watermarking Protocol, an Efficient and Anonymous Buyer-Seller Watermarking Protocol, Extensions of Watermarking Protocols, Protocols for Secure Computation.

Module-V: **9 hrs**

Cryptography and Multimedia Encryption: Introduction to Cryptography, Multimedia Processing in the Encryption Domain, Privacy preserving Information Processing, Information Theory and Digital Forensics, Forgeries Detection, New ways for making Forgeries.

Text Book(s):

1. *Michael Digital Watermarking and Steganography, 2nd Edition, by Cox, Miller, Bloom, Fridrich, and Kalker, 2008*

Reference Book(s):

1. *Multimedia Security Handbook, BorkoFurht, DarkoKirovski, CRC Press, 2004*
2. *Multimedia Security Technologies for Digital Rights Management, WenjunZeng, Heather Yu, Ching-Yung Lin, Elsevier, 2006*
3. *Advanced Techniques in Multimedia Watermarking: Image, Video and Audio Applications: Image, Video and Audio Applications, Al-Haj, Ali Mohammad*
4. Chin-Laung Lei, Pei-Ling Yu, Pan-Lung Tsai, and Ming-Hwa Chan. 2004. An efficient and anonymous buyer-seller watermarking protocol. Trans. Img. Proc. 13, 12 (December 2004)

Software Defined Networking

CSNS 831: SOFTWARE DEFINED NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Knowledge on computer networks.*

Objectives:

- *To comprehend the differences between traditional networks and software defined networks.*
- *Understand advanced and emerging networking technologies.*
- *Obtain skills to do advance networking research and programming.*
- *Learn how to use software programs to perform varying and complex networking tasks.*
- *Expand upon the knowledge learned and apply it to solve real world problems.*

Course Outcome:

- *Identify the difference between traditional networks and software defined networks.*
- *Clear understanding on the advanced and emerging networking technologies.*
- *Ability to carry out advance networking research and programming.*
- *Ability to use software programs to perform varying and complex networking tasks.*

Module-I: **9 hrs**

Introducing SDN: SDN Origins and Evolution – Introduction – Why SDN? - Centralized and Distributed Controller and Data Planes - The Genesis of SDN

Module-II: **9 hrs**

SDN Abstractions: How SDN Works - The Openflow Protocol - SDN Controllers: Introduction - General Concepts VMware - Nicira - VMware/Nicira - OpenFlow-Related - Mininet - NOX/POX - Trema - Ryu - Big Switch Networks/Floodlight - Layer 3 Centric - Plexxi - Cisco OnePK

Module-III: **9 hrs**

Programming SDN: Network Programmability - Network Function Virtualization - NetApp Development, Network Slicing

Module-IV: **9 hrs**

Sdn Applications and Use Cases: SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System 3

Module-V: **9 hrs**

SDN'S Future and Perspectives: SDN Open Source - SDN Futures - Final Thoughts and Conclusions.

Text Book(s):

1. *Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black,Morgan Kaufmann Publications, 2nd edition, 2014.*
2. *SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly, 2013.*
3. *Software Defined Networking with OpenFlow By SiamakAzodolmolky, Packt Publishing, 2013.*

Reference Book(s):

1. *Feamster, Nick, Jennifer Rexford, and Ellen Zegura. "The road to SDN: an intellectual history of programmable networks." ACM SIGCOMM Computer Communication Review 44.2 (2014): 87-98.*
2. *Kreutz, Diego, et al. "Software-defined networking: A comprehensive survey." Proceedings of the IEEE 103.1 (2015): 14-76.*
3. *Nunes, Bruno AA, et al. "A survey of software-defined networking: Past, present, and future of programmable networks." Communications Surveys & Tutorials, IEEE 16.3 (2014): 1617- 1634.*
4. *Lantz, Bob, Brandon Heller, and Nick McKeown. "A network in a laptop: rapid prototyping for software-defined networks." Proceedings of the 9th ACM SIGCOMM Workshop on Hot Topics in Networks. ACM, 2010.*
5. *Monsanto, Christopher, et al. "Composing software defined networks." Presented as part of the 10th USENIX Symposium on Networked Systems Design and Implementation (NSDI 13). 2013.*

CSNS 832: CLOUD ORCHESTRATION AND NFV

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic understanding of cloud-based services and virtualization.*

Objectives:

- *To learn about advanced OS technologies*
- *To learn virtualization techniques and Cloud orchestration*
- *To design next generation cloud applications*
- *To understand the concept of NFV*

Course Outcome:

- *Understanding about advanced OS technologies*
- *knowledge on virtualization techniques and Cloud orchestration*
- *Ability to design next generation cloud applications*
- *Knowledge about NFV techniques and to deploy it in cloud.*

Module-I: 9 hrs

Overview and Designing: OpenStack Cloud architectural Consideration- Logical architecture, Nova-Compute service, Neutron-Networking Services, Architecture setup Deploying OpenStack, Cloud Controller and service.Case Studies - OpenStack – Amazon-Google – Microsoft

Module-II: 9 hrs

Advanced OS Technologies: Introduction to virtualization - Xen , Hyper-V , KVM, Hardware support for virtualization - Memory virtualization (IOMMU) - Network virtualization - SR-IOV –VMQ – Advance Networking(SDN and NFV)

Module-III: 9 hrs

Operating the Cloud Infrastructure: HA and Failover - Monitoring and troubleshooting - Performance tuning Maintaining Cloud Performance. Cloud Protocols - Representational state transfer REST - Web Server Gateway Interface (WSGI)

Module-IV: 9 hrs

Network Function Virtualization(NFV): Virtualization Concepts - NFV Architecture framework - benefits of NFV - Virtualization of network functions -CAP theory - Replication Vs. Erasure coding - Consistent hashing - Case Studies - Swift - Hadoop Distributed File System (HDFS) Vs. Amazon's Simple Storage Service (S3)

Module-V: 9 hrs

NFV deployment in the Cloud-Orchestrating- Deploying and Managing NFV Infrastructure - Network services - Software Defined Networking (SDN).

Text Book(s):

1. *Mastering OpenStack, ChandanDuttanChawdhury, PACKT Publishing, 2nd Edition, 2017*
2. *Adnan Ahmed Siddiqui - OpenStack Orchestration, PACKT Publishing 2015*
3. *Network Functions Virtualization (NFV) with a Touch of SDN Paperback, RajendraChayapathi , Syed F.Hassan , Paresh Shah, Addison Wesley , First Edition, November 2016.*

Reference Book(s):

1. *QiangDuan , Mehmet Toy, "Virtualized Software-Defined Networks and Services" , Artech House, 2016.*

CSNS 833: SOFTWARE DEFINED OPTICAL NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic understanding of SDN.*

Objectives:

- *To acquire knowledge of Optical networks and its basic principles*
- *To acquire knowledge of SDN and its application areas*
- *To learn the use of SDN in Optical network environments and its applications*
- *To gain knowledge on various optical network technologies.*

Course Outcome:

- *Knowledge of Optical networks and its basic principles*
- *Knowledge of SDN and its application areas*
- *Capability of using SDN in Optical network environments*
- *Clear understanding on how SDN works in optical network.*

Module-I: **9 hrs**

Fundamentals of SDN: SDN Operation - SDN Devices - SDN Controller - The OpenFlow Specification -OpenFlow Overview -OpenFlow 1.0 and OpenFlow Basics -OpenFlow .1 Additions -OpenFlow 1.2 Additions -OpenFlow 1.3 Additions -OpenFlow Limitations - Alternative Definitions of SDN - Potential Drawbacks of Open SDN - SDN via APIs - SDN via Hypervisor-Based Overlays - SDN via Opening Up the Device - Network Functions Virtualization - Alternatives Overlap and Ranking

Module-II: **9 hrs**

Optical Networks Technology: Propagation of Signals in Optical Fiber - Components - Modulation and Demodulation - Transmission System Engineering - Evolution from Wavelength-Switched to Flex-Grid Optical Networks - Taking Advantage of Elastic Optical Networks - Routing and Spectrum Allocation - Transmission in Elastic Optical networks

Module-III: **9 hrs**

SDN in Other Environments: Wide Area Networks - Service Provider and Carrier Networks - Campus Networks - Hospitality Networks - Mobile Networks - In-Line Network Functions - Optical Networks - SDN vs. P2P/Overlay Networks

Module-IV: **9 hrs**

SDN in Optical Networks and Management: Client Layers of the Optical Layer - WDM Network Elements - WDM Network Design - Control and Management - Access Networks - Photonic Packet Switching - Node Architectures for Elastic and Flexible optical networks - Sliceable bandwidth variable transponders - GMPLS Control Plane - SDN in Optical networks - Application based network operations - In-Operation network Planning.

Module-V: **9 hrs**

Case Studies in Software Defined Optical Networks: Review the latest development like A Software-Defined optical Network emulation platform(SONEP) - S-BVT Based HYDRA-SDN Space Division Multiplexing (SDM) in optical networks- ROLEX version with centralized SDN- OpenFlow enabled restoration in EONs

Text Book(s):

1. *Paul Goransson Chuck Black, "Software Defined Networks", 1st Edition, A Comprehensive Approach, Morgan Kaufmann, 2014.*
2. *Victor Lopez, Luis Velasco, "Elastic Optical Networks: Architectures, Technologies and Control". Optical Network series, Springer International Publications, 2016.*

Journal / Paper(s):

1. *https://www.osapublishing.org/jocn/home.cfm*
2. *https://www.researchgate.net/publication/283986398_Software_Defined_Optical_Networks_SDONs_A_Comprehensive_Survey*

Reference Book(s):

1. *Rajiv Ramaswami, Kumar Sivarajan, Galen Sasaki, "Optical Networks, A Practical Perspective, 3rd Edition", Morgan Kaufmann, 2009.*
2. *Wei Wei, Jianjun Yu, "Software-defined Optical Communications and Networking: Principles and Applications", Taylor and Francis,CRC Press, 2017.*
3. *Paul Goransson Chuck Black Timothy Culver, Software Defined Networks , 2nd Edition, A Comprehensive Approach , eBook ISBN: 9780128045794*

CSNS 834: SDN FOR REAL NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic understanding of SDN and familiarity with modern networking technologies.*

Objectives:

- *To learn techniques to migrate legacy networks towards SDN*
- *To apply SDN techniques for converging wired and wireless networks*
- *To gain knowledge of SDN in Cloud, IOT, AI and 5G networks.*
- *Understand the architecture of SDN in various fields.*

Course Outcome:

- *Understand techniques to migrate legacy networks towards SDN*
- *Evaluate SDN techniques for converging wired and wireless networks*
- *Knowledge about SDN designed for cloud, IOT, AI and 5G networks*
- *Insights about the architecture of SDN network.*

Module-I: 9 hrs

Software-Defined Networking: Software Defined Networking– The Basics-SDN Controllers-A Little History about SDN Controller Platforms-Open Daylight SDN Controllers-What is Open SDN?- SDN in the data center: Sustainable support for tomorrow's applications-Benefits that SDN offers in the data center.

Module-II: 9 hrs

Software Defined Networking For Cloud Computing: Applying Software-defined Networks to Cloud Computing Cloud Computing and Network Virtualization-. Software-defined Networks (SDNs)- Cloud Network Virtualization using SDN Case Study with Open Daylight and Open Stack- Final Considerations, Challenges and Perspectives

Module-III: 9 hrs

Software Defined Networking For Internet-Of-Things: Why SDN for the IoT? -SDN—Simplicity for the IoT-SDN architecture for IoT - SDN—Scalability for the IoT-SDN—Traffic Flow Optimization for the IoT-Security and Connectivity- The Telco Role

Module-IV: 9 hrs

SDN For Artificial Intelligence: What is Artificial Intelligence?-Artificial Intelligence in SDN- Load Balance and Flow Routing Network Security- Intelligent Network Applications.

Module-V: 9 hrs

SDN For The 5G Networks: Introduction- Evolution of the Wireless Communication towards the 5G- Network Function Virtualization- Information-Centric Networking- Mobile and Wireless Networks- Ubiquitous Connectivity- Mobile Clouds- Cooperative Cellular Networks- Unification of the control plane-Supporting automatic QoS provisioning-Cognitive Network Management and Operation- Role of Satellites in the 5G networks

Text Book(s):

1. *SDN and NFV Simplified: A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization 1st Edition by Jim Doherty , 2014*
2. *Software-Defined Networking (SDN) with OpenStack By Sriram Subramanian, SreenivasVoruganti, Packt 2016*
3. *Network Function Virtualization: Concepts and Applicability in 5G Networks By Ying Zhang, john wiley and sons 2018*
4. *Building the Network of the Future: Getting Smarter, Faster, and More ... edited by John Donovan, Krish Prabhu, 2017*
5. *Internet of Things for Architects: Architecting IoT solutions by By Perry Lea, Packt publishing 2018*
6. *"Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" William Stallings Publisher: Addison-Wesley 2015 ISBN: 9780134175393*

Reference Book(s):

1. *https://www.sdxcentral.com/sdn/definitions/software-defined-networking-tutorial/*
2. *http://sbrc2015.ufes.br/wp-content/uploads/Ch1.pdf.*
3. *Cloud Services, Networking, and Management By Nelson Fonseca, Raouf Boutaba IEEE Press , Wiley 2015.*
4. *IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the IoT By David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry CISCO Press*

CSNS 835: SOFTWARE DEFINED RADIOS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Advanced Networks And Communication Systems*

Objectives:

- *Understand the principles behind the Software Defined Radios over the conventional Cognitive Radios.*
- *Ability to analyze Software Defined Networking protocols and cognitive radio techniques*
- *Understand the data traversal over SDN*
- *Design algorithms for Software Defined Radio and cognitive radio environments*

Course Outcome:

- *Should be able to distinguish between Software Defined Radios over the conventional Cognitive Radios.*
- *Able to analyze Software Defined Networking protocols and cognitive radio techniques*
- *Clear view on the data traversal over SDN*
- *Should be able to design algorithms for Software Defined Radio and cognitive radio environments*

Module-I: **9 hrs**

Software Defined Radio Concepts: Need for Software Radios - Characteristics and Benefits of a Software Radio - Design Principles of a Software Radio - RF Receiver Front-End Topologies - Importance of the Components to Overall Performance - Transmitter Architectures and Their Issues - Noise and Distortion in the RF Chain ADC and DAC Distortion - Flexible RF Systems

Module-II: **9 hrs**

SDN As A Platform For Cognitive Radio: Hardware Architecture: Baseband Processors - Hardware Architecture: Multi-Core Systems - Software Architecture: Design Philosophies - GNU Radio - Software Communications Architecture - Application Software - Component Development - Waveform Development – Cognitive Waveform Development

Module-III: **9 hrs**

Cognitive Radio- Technologies Required: Software Capable Radios - Software Programmable Radios - SDR Examples - Aware Adaptive and CRs - Radio Capabilities and Properties Comparison - Spectrum Awareness and Frequency Occupancy - Software Technology - Funding and Researches in CRs - Directions and Standards

Module-IV: **9 hrs**

Object Oriented Representation Of Radios: Introduction to Network Resources - Network Resources - Object Oriented Programming – Object Request Broker Architecture - Object Brokers and Software Radios - Mobile Application Environments - Security in Software Radios - Joint Tactical Radio Systems - SCA Architectures

Module-V: **9 hrs**

Case Studies In Software Radio Designs: Intrinsic Architectural Characteristics to Software Radios - Important Architectural Characteristics to Software Radios - Practical Software Radios - CA Architectural Details - Wireless Information Transfer Systems - SDR Digital Transceiver Sub Systems - Spectrum ware Systems - Layered Radio Architecture - Case Study on Trending Software-Defined Radio Architecture.

Text Book(s):

1. *Software Radio: A Modern Approach to Radio Engineering By Jeffrey*
2. *Cognitive Radio Technology", Bruce A Fette, Academic Press, 2009*

Reference Book(s):

1. *Cognitive Radio Networks by Wyglinski, Alexander M. Nekovee, Maziar, Hou, Y. Thomas, 2010 Elsevier.*

Internet of Things

CSNS 841: INTERNET - of -THINGS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Understanding of computer networks and Cloud computing.*

Objectives:

- *Understand basics of IOT*
- *Discuss IoT Enablers And Solutions*
- *To Understand the Reliability, Security, And Privacy Of IoT*
- *Have a brief study on the IoT Applications*

Course Outcome:

- *Understanding of underlying concepts of IoT*
- *Insights about programming IoT*
- *Ability to design security solutions to IoT*
- *Knowledge about Real world IoT applications*

Module-I: 9 hrs

Background: An Overview – evolution – architectures – resource management - data management and analytics – communication – security – identity management – Privacy - Standardization and Regulatory Limitations - Open Source Semantic Web Infrastructure for Managing IoT Resources in the Cloud - OpenIoT Architecture for IoT/Cloud Convergence - Scheduling Process and IoT Services Lifecycle- Scheduling and Resource Management - Validating Applications and Use Cases- Future Research Directions - Device/Cloud Collaboration Framework- Applications of Device/Cloud Collaboration

Module-II: 9 hrs

IoTEnablers and Solutions: Programming Frameworks for Internet of Things - Embedded Device Programming Languages -Message Passing in Devices - Coordination Languages - Polyglot Programming - IoT Programming Approaches - Existing IoT Frameworks - Future Research Directions -Virtualization on Embedded Boards as Enabling Technology for the Cloud of Things - ARM Virtualization Extensions - XEN ARM Virtualization - KVM ARM Virtualization- Container-Based Virtualization - Virtualization and Real-Time - Micro Virtual Machines (MicroVMs) for Cloud-Assisted Cyber-Physical Systems (CPS) -Virtual Machines and Micro Virtual Machines - Other Architectures - Architecture for Deploying CPS in the Cloud and the Expansion of the IoT - Extending the Possibilities of the IoT by Cloud Computing - Micro Virtual Machines with the Sensor Observation Service - the Path Between Smart Objects and CPS - Virtual Machines and Sensor Observation Service – Implementation - IoT Architecture for Selected Use Cases

Module-III: **9 hrs**

IoTData and Knowledge Management: Stream Processing in IoT, Foundations, State-of-the-Art and Future Directions -The Foundations of Stream Processing in IoT - Continuous Logic Processing System - Challenges and Future Directions - A Framework for Distributed Data Analysis for IoT

Module-IV: **9 hrs**

IoTReliability, Security, and Privacy: Security and Privacy in the Internet of Things - IoT Security Overview - Security Frameworks for IoT - Internet of Things—Robustness and Reliability – Introduction- IoT Characteristics and Reliability Issues - Addressing Reliability - Governing Internet of Things: Issues, Approaches, and New Paradigms - Background and Related Work - IoT Governance - Future Research Directions - TinyTO: Two-Way Authentication for Constrained - Devices in the Internet of Things – Introduction - Security Aspects and Solutions - Design Decisions - TinyTO Protocol - Possible Handshake Protocol Candidates – Evaluation - Obfuscation and Diversification for Securing - the Internet of Things (IoT) – Introduction - Distinguishing Characteristics of IoT - Obfuscation and Diversification Techniques - Enhancing the Security in IoT Using Obfuscation - and Diversification Techniques

Module-V: **9 hrs**

IoTApplications: Applied Internet of Things – Scenario - Architecture Overview -Sensor to Gateway Communication – Sensors - The Gateway Hardware - Gateway Software - Data Transmission- Internet of Vehicles and Applications - Background and Concept - Network Architecture - Characteristics and Challenges - Enabling Technologies –Applications - Summary and Future Directions - Cloud-Based Smart-Facilities Management - Background and Related Work - Middleware ServicesResource Management Techniques for Wireless Sensor Networks - Sensor Allocation - Request Scheduling -Resource Management Techniques for Supporting Data Analytics.

Text Book(s):

1. *RajkumarBuyya, Amir VahidDastjerdi, "Internet of Things: Principles and Paradigms", Elsevier 2016*

Reference Book(s):

1. *Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco Press, 2017*

CSNS 842: IoT ARCHITECTURE AND PROTOCOLS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Networking Basics: TCP, UDP, TCP/IP and OSI Model.*

Objectives:

- *To Understand the Architectural Overview of IoT*
- *To Understand the IoT Reference Architecture and RealWorld Design Constraints*
- *To gain knowledge about the protocols in various layers and their security features.*
- *To Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service)*

Course Outcome:

- *Should know the Architectural Overview of IoT*
- *Understand the IoT Reference Architecture and RealWorld Design Constraints*
- *Clear understanding on the various IoT Protocols (Datalink, Network, Transport, Session, Service)*
- *Exposure to the security levels in each layer of network along with the protocol used.*

Module-I: 9 hrs

Overview: IoT-An Architectural Overview– Building An Architecture - Main Design Principles And Needed Capabilities - An Iot Architecture Outline - Standards Considerations. M2M and IoT Technology Fundamentals- Devices And Gateways - Local And Wide Area Networking - Data Management - Business Processes in IoT - Everything as a Service(XaaS) - M2M and IoT Analytics - Knowledge Management

Module-II: 9 hrs

Reference Architecture: IoT Architecture-State of the Art – Introduction - State of the art - Reference Model and architecture -IoT reference Model - IoT Reference Architecture-Introduction - Functional View - Information View - Deployment and Operational View - Other Relevant Architectural Views. Real-World Design Constraints- Introduction - Technical Design Constraints-Hardware Is Popular Again - Data Representation And Visualization - Interaction And Remote Control.

Module-III: 9 hrs

IOT Data Link Layer & Network Layer Protocols: PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), WirelessHART -Z-Wave - Bluetooth Low Energy -Zigbee Smart Energy - DASH7 - Network Layer-IPv4 - IPv6 - 6LoWPAN - 6TiSCH -ND - DHCP - ICMP - RPL - CORPL - CARP

Module-IV: 9 hrs

Transport & Session Layer Protocols: Transport Layer (TCP - MPTCP - UDP - DCCP - SCTP)-(TLS - DTLS) –Session Layer-HTTP -CoAP - XMPP - AMQP - MQTT

Module-V: **9 hrs**

Service Layer Protocols & Security: Service Layer - oneM2M - ETSI M2M - OMA - BBF – Security in IoT Protocols – MAC 802.15.4 - 6LoWPAN - RPL - Application Layer

Text Book(s):

1. *Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.*

Reference Book(s):

1. *Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI*
2. *Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things",*
3. *Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications",*
4. *Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 2014.*

CSNS 843: EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Good understanding of the concepts of basic electronics such as circuits, logic gates.*

Objectives:

- *To understand the architecture and functions of 8085 processor*
- *To Learn Assembly language programming*
- *To understand the Basic concepts of Embedded systems and 8051 microcontroller*
- *To gain knowledge about how the I/O devices are interfaced with 8051 microcontroller*
- *To understand the basics of RTOS and to learn the method of designing a real time systems*

Course Outcome:

- *Should be able to program using assembly language.*
- *Clear view on the basic concepts in embedded system and how they function.*
- *Basic idea about 8085 processor and 8051 microcontroller, their I/O devices interaction.*
- *Understand and implement smart systems*

Module-I: 9 hrs

Introduction To Microprocessors: Evolution Of Microprocessors - 8-Bit Processor - 8085 Architecture – Register Organization - Instruction Set – Timing Diagram- Addressing Modes – Interrupts- Interrupt Service Routines- Assembly Language Programming Using 8085

Module-II: 9 hrs

Introduction To Embedded Systems: Embedded Systems- Processor Embedded Into A System-Embedded Hardware And Software Units- Applications-Design Process – Intel 8051 Architecture- Processor And Memory Organization - Interrupts Of 8051 - Assembly Language Programming Using 8051

Module-III: 9 hrs

Interfacing With 8051: Input-Output Interfacing – Bus Standards – PCI – ISA – Timing And Control – Input Output Devices – Serial and Parallel Communication – Motor Control-Programming Display Devices – ARM

Module-IV: 9 hrs

Real – Time Operating System: Inter Process Communication – Signal Functions – Socket Programming – Mailbox - Pipes – RTOS – OS Services – Process Management - Timer Function –Event Function – Memory Management – Device, Files And I/O Subsystem – Basic Design Of RTOS.

Module-V: **9 hrs**

RTOS Programming: Basic Functions – Types of RTOS – RTOS mCOS – RTLinux – Real Time Linux Functions- Programming with RTLinux – Case Study

Text Book(s):

1. *Rajkamal, "Embedded System: Architecture, Programming and Design" Tata Mcgraw-Hill Education, Second Edition, 2008.*
2. *B.KanthRao, "Embedded Systems" PHI Learning Private Limited, 2011.*
3. *Mohamed Rafiquzzaman, "Microprocessors and Microcomputer-based system design", CRC Press, Second Edition, 2013*

Reference Book(s):

1. *Marilyn Wolf, "Computers as a Component" Third Edition, Morgan Kaufmann Series 2012.*
2. *A.P.Godse, A.O.Mulani, "Embedded Systems" Third Edition, Technical publications 2009.*

CSNS 844: PRIVACY AND SECURITY IN IoT

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic understanding of IoT Architecture and Protocols.*

Objectives:

- *Ability to understand the Security requirements in IoT and to understand the cryptographic fundamentals for IoT.*
- *Ability to understand the authentication credentials and access control.*
- *Understand the various types Trust models and Cloud Security.*

Course Outcome:

- *Knowledge about Security requirements in IoT and to understand the cryptographic fundamentals for IoT.*
- *Clear view about the authentication credentials and access control.*
- *Ability to distinguish various types of Trust models and Cloud Security.*
- *Basic idea about IOT cloud security.*

Module-I: 9 hrs

Introduction: Securing The Internet Of Things: IoT- Industry collaboration – Uses – IoT in the Enterprise – IoT Future and Need of Security – Vulnerabilities, Attacks and Countermeasures – Security Engineering for IoT Development – Security Life cycle.

Module-II: 9 hrs

Cryptographic Fundamentals For Iot: Cryptographic primitives and its role in IoT – Encryption and Decryption – Hashes – Digital Signatures – Random number generation – Cipher suites – key management fundamentals – cryptographic controls built into IoT messaging and communication protocols – IoT Node Authentication.

Module-III: 9 hrs

Identity & Access Management Solutions For Iot: Identity lifecycle – Authentication credentials – IoT IAM infrastructure – Authorization with Publish / Subscribe schemes – access control.

Module-IV: 9 hrs

Privacy Preservation And Trust Models For Iot: Privacy Challenges – IoT PIA – PbD principles – Privacy Engineering recommendation.

Module-V: 9 hrs

Cloud Security For Iot: Cloud services and IoT – offerings related to IoT from cloud service providers – Cloud IoT security controls – An enterpriseIoT cloud security architecture – New directions in cloud enabled IoT computing.

Text Book(s):

1. *Brian Russell, Drew Van Duren, "Practical Internet of Things Security (Kindle Edition)", 2016.*
2. *Fei Hu, "Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations", 2016.*

CSNS 845: BIG DATA ANALYTICS FOR IoT

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic understanding of big data and IoT.*

Objectives:

- *To learn the concepts of big data analytics*
- *To learn the concepts about Internet of things*
- *To understand and implement smart systems*

Course Outcome:

- *Would understand the use of big data for IOT.*
- *Basic idea about RFID.*
- *Ability to analyze and implement smart systems.*
- *Clear view on sustainable data analytic in cloud.*

Module-I: **9 hrs**

Big Data Platforms For The Internet Of Things: Big Data Platforms for the Internet of Things: network protocol- data dissemination –current state of art- Improving Data and Service Interoperability with Structure, Compliance, Conformance and Context Awareness: interoperability problem in the IoT context- Big Data Management Systems for the Exploitation of Pervasive Environments – Big Data challenges and requirements coming from different Smart City applications

Module-II: **9 hrs**

RFID False Authentications: On RFID False Authentications: YA TRAP – Necessary and sufficient condition for false authentication prevention - Adaptive Pipelined Neural Network Structure in Self-aware Internet of Things: self-healing systems, Role of adaptive neural network- Spatial Dimensions of Big Data: Application of Geographical Concepts and Spatial Technology to the Internet of Things- Applying spatial relationships, functions, and models

Module-III: **9 hrs**

Big Data Management: A Platform for Internet of Things and Analytics: a massively distributed number of sources - Big Data Metadata Management in Smart Grids: semantic inconsistencies – role of metadata

Module-IV: **9 hrs**

Web Enhanced Building: Toward Web Enhanced Building Automation Systems: heterogeneity between existing installations and native IP devices - loosely-coupled Web protocol stack –energy saving in smart building- Intelligent Transportation Systems and Wireless Access in Vehicular Environment Technology for Developing Smart Cities: advantages and achievements- Emerging Technologies in Health Information Systems: Genomics Driven Wellness Tracking and Management System (GO-WELL) – predictive care – personalized medicine

Module-V: **9 hrs**

Sustainability Data and Analytics: Sustainability Data and Analytics in Cloud-Based M2M Systems – potential stakeholders and their complex relationships to data and analytics applications - Social Networking Analysis - Building a useful understanding of a social network - Leveraging Social Media and IoT to Bootstrap Smart Environments : lightweight Cyber Physical Social Systems – citizen actuation.

Text Book(s):

1. *NikBessis, CiprianDobre, Big Data and Internet of Things: A Roadmap for SmartEnvironments*
2. *Stackowiak, R., Licht, A., Mantha, V., Nagode, L.," Big Data and the Internet of Things Enterprise Information Architecture for A New Age", Apress, 2015.*

Reference Book(s):

1. *John Bates, "Thing analytics - Smart Big Data Analytics for the Internet of Things", John Bates, Software AG; 1 edition 2015.*

CSNS 846: FOG COMPUTING

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic understanding of cloud computing*

Objectives:

- *Become familiar with the concepts of Fog*
- *Understand the architecture and its components and working of components and its performance*
- *Explore Fog on security, multimedia and smart data*
- *Model the fog computing scenario*

Course Outcome:

- *Understand the architecture and its components and working of components and its performance*
- *Clear understanding with Fog computing concepts.*
- *Knowledge about the various services in Fog layer.*
- *Understand Fog on security, multimedia and smart data*
- *Should be able to model the fog computing scenario*

Module-I: 9 hrs

Introduction To Fog Computing: Characteristics of the Fog Layer - Design and Organization – Services - Computing Services- Storage Services- Communication Services.

Module-II: 9 hrs

Management At The Fog Layer: IoT Resource Estimation Challenges and Modelling in Fog: Fog Computing - Resource Estimation and Its Challenges - Customer's Reliability-Based Dynamic Resource Estimation in Fog - Fog Computing in Support of Hierarchical Emergent Behaviours - Fog Computing - Hierarchical Emergent Behaviours - Autonomous Vehicles Primitives

Module-III: 9 hrs

Services Of The Fog Layer: Privacy-Preserving Computation in Fog Computing – Blockchain - Multi-Party Computation - Multi-Party Computation and Blockchain

Module-IV: 9 hrs

Self-Aware Fog: Cloud, Fog, and Mist Computing Networks - Self-Aware Data Processing – Case Studies I,II,III and IV - Requirements and Architecture for a Smart Gateway Based on Hierarchical Temporal Memory - Urban IoT Edge Analytics - Design Challenges - Edge-Assisted Architecture

Module-V: **9 hrs**

Control-As-A-Service and Case Study: Power Grid and Energy Management - Cyber-Physical Energy Systems - Internet-of-Things and Fog Computing - Control-as-a-Service - Residential Cyber-Physical Energy System - Healthcare Services in the Fog Layer - System Architecture of Healthcare IoT - Case Study, Experiments, and Evaluation -Edge Architectures - Edge ComputingApplications.

Text Book(s):

1 *Amir M. Rahmani , Fog Computing in the Internet of Things Intelligence at the Edge*
2 *Fog Computing: Helping the Internet of Things Realize its Potential Amir VahidDastjerdi and RajkumarBuyya, University of Melbourne*
3 *Multi-Dimensional payment Plan in Fog Computing with Moral Hazar,YanruZhang,Nguyen H. Tran,DusitNiyato, and Zhu Han,IEEE,2016*

Reference Book(s):

1 *FarhoudHosseinpour,JuhaPlosila,HannuTenhunen,"An Approach for Smart management of Big Data in the Fog ComputingContext",IEEE 8th International Conference on Cloud Computing Technology and Science,2016*
2 *Hua-Jun Hong, Jo-Chi Chuang and Cheng-HsinHsu,"Animation Rendering on Multimedia Fog computing Platforms", IEEE 8th International Conference on Cloud Computing Technology and Science,2016*
3 *Dongyoung Koo, Youngjoo Shin, Joobeom Yun, junbeomHur,"A Hybrid deduplicaton for secure and Efficiet data Outsourcing n Fog Computing", IEEE 8th International Conference on Cloud Computing Technology and Science,2016*
4 *Fog Computing: A Platform for Internet of Things and Analytics, FlavioBonomi, Rodolfo Milito, PreethiNatarajan and Jiang Zhu, Big Data and Internet of Things: A Roadmap for Smart Environments, Studies in Computational Intelligence 546, DOI: 10.1007/978-3-319- 05029-4_7,©Springer International Publishing Switzerland 2014*
5 *CloudPath: A Multi-Tier Cloud Computing Framework*
6 *Cloud4Home -- Enhancing Data Services with @Home Clouds*
7 *Femto Clouds: Leveraging Mobile Devices to Provide Cloud Service at the Edge*
8 *Fast, Scalable and Secure Onloading of Edge Functions Using AirBox*

CSNS 847: WIRELESS SENSOR PROTOCOLS AND PROGRAMMING

L	T	P	C
3	0	0	3

Pre-requisite:

- *Understanding of OSI model.*

Objectives:

- *Understand basic sensor network concepts*
- *To understand physical layer issues, understand and analyze Medium Access Control Protocols*
- *Comprehend network and transport layer characteristics and protocols and implement conventional protocols*
- *Understand the network management and Middleware services*

Course Outcome:

- *Clear understanding on the basic sensor network concepts*
- *Knowledge about physical layer issues, understand and analyze Medium Access Control Protocols*
- *Ability to implement conventional protocols in basic system level.*
- *Ability to differentiate network and transport layer characteristics and their protocols.*
- *Understand the network management and Middleware services*

Module-I: 9 hrs

Background Of Sensor Network Technology: Basic Overview of the Technology- Basic Sensor Network Architectural Elements - Applications of Wireless Sensor Networks: Range of Applications- Examples of Category 2 WSN - Examples of Category - Another Taxonomy of WSN Technology- Basic Wireless Sensor Technology - Sensor Node Technology- Hardware and Software - Sensor Taxonomy- WN Operating Environment- WN Trends

.Module-II: 9 hrs

Wireless Transmission Technology and Systems: Radio Technology Primer -Medium Access Control Protocols for Wireless Sensor Networks- Background - MAC Protocols for WSNs- Sensor-MAC Case Study- Routing Protocols for Wireless

Module-III: 9 hrs

Sensor Networks: Data Dissemination and Gathering- Routing Challenges and Design Issues in Wireless Sensor Networks- Routing Strategies in Wireless Sensor Networks- Transport Control Protocols for Wireless Sensor Networks- Traditional Transport Control Protocols- Transport Protocol Design Issues - Examples of Existing Transport Control Protocols- Performance of Transport Control Protocols

Module-IV: **9 hrs**

Middleware For Wireless Sensor Networks: WSN Middleware Principles - Middleware Architecture- Data-Related Functions –Architectures - Existing Middleware- MiLAN(Middleware Linking Applications and Networks - Network Management for Wireless Sensor Networks - Network Management Requirements - Network Management Design Issues - Example of Management Architecture: MANNA - Other Issues Related to Network Management

Module-V: **9 hrs**

OS For Wireless Sensor Networks: Introduction - Operating System Design Issues - Examples of Operating Systems- Performance and Traffic Management – Background - WSN Design Issues - Performance Modeling of WSNs - Case Study: Simple Computation of the System Life Span.

Text Book(s):

1. *KazemSohraby, Daniel manoli , "Wireless Sensor networks- Technology,Protocols and Applications", Wiley InterScience Publications 2010*
2. *WaltenegusDargie, Christian Poellabauer , "Fundamentals of Wireless Sensor Networks, Theory and Practice", Wiley Series on wireless Communication and Mobile Computing, 2011*

Reference Book(s):

1. *BhaskarKrishnamachari , " Networking Wireless Sensors", Cambridge University Press, 2005*
2. *C.S Raghavendra, Krishna M.Sivalingam, Taiebznati , "Wireless Sensor Networks", Springer Science 2004*

Wireless Computing

CSNS 851: RADIO NETWORK PLANNING AND OPTIMIZATION

L	T	P	C
3	0	0	3

Pre-requisite:

- *Understanding of Multiple Radio Access Techniques for Wireless Communication.*

Objectives:

- *To understand Radio Network Planning &Optimization.*
- *To provide detailed descriptions of the radio network planning and optimization of UMTS networks based on Frequency Division Duplex (FDD) WCDMA technology.*
- *To know radio resource utilization.*
- *To understand issues in radio networks and to overcome them.*

Course Outcome:

- *Ability to plan and optimize the Radio Network.*
- *Knowledge on detailed descriptions of the radio network planning and optimization of UMTS networks based on Frequency Division Duplex (FDD) WCDMA technology.*
- *Knowledge on how radio resources are utilized.*
- *Ability to solve the basic issues in radio networking.*

Module-I: 9 hrs

Introduction: Introduction to Radio Network Planning and Optimization - Future Trends - Towards a Service driven Network Management - Wireless Local Area Networks (WLANs) - Next-generation Mobile Communication

Module-II: 9 hrs

WCDMA Radio Network Planning: Dimensioning - Detailed Planning - Verification of Dimensioning with Static Simulations - Verification of Static Simulator with Dynamic Simulations - Optimization of the Radio Network Plan

Module-III: 9 hrs

Steganalysis WCDMA–GSM Co-planning Issues: Radio Frequency Issues - Radio Network Planning Issues; Coverage and Capacity Enhancement Methods - Techniques for Improving Coverage - Techniques for Improving Capacity

Module-IV: 9 hrs

Radio Resource Utilization: Introduction to Radio Resource Management - Power Control - Handover Control - Congestion Control - Resource Management; RRU for High-speed-Downlink Packet Access (HSDPA) - Impact of Radio Resource Utilization on Network Performance.

Module-V: **9 hrs**

Radio Network Optimization Process: Introduction to Radio Network Optimization Requirements - Introduction to the Telecom Management Network Model - Tools in Optimization - Advanced Analysis Methods and Radio Access Network Auto tuning – Advanced Analysis Methods for Cellular Networks - Automatic Optimization.

Text Book(s):

1. *"Radio Network Planning and Optimization", Edited by JaanaLaiho, AchimWacker& Tomas Novosad, John Wiley, 2006.*
2. *Morten Tolstrup, "Indoor Radio Planning: A Practical Guide for GSM, DCS, UMTS and HSPA", John Wiley, 2nd Edition,2014.*

Reference Book(s):

1. *IanaSiomina, "Radio Network Planning and Resource Optimization", Printed by LiUTryck, Link¨oping, Sweden, 2007.*

CSNS 852: ADVANCED WIRELESS NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Good knowledge of fundamentals of computer networks is required.*

Objectives:

- *To build an understanding of the fundamental concepts of wireless networking.*
- *To familiarize with the basic taxonomy and terminology of the various channel modeling and layers of the network.*
- *To get introduced to resource management and security issues in wireless networks.*
- *To gain expertise in some specific areas of networking such as Ad Hoc networks, sensors networks, and active networks.*

Course Outcome:

- *Understanding of the fundamental concepts of wireless networking.*
- *Familiarity in the basic taxonomy and terminology of the various channel modeling and layers of the network.*
- *Understand some specific areas of networking such as Ad Hoc networks, sensors networks, and active networks.*
- *Clear understanding on the resource management and security issues in wireless networks.*

Module-I: 9 hrs

Adaptive and Reconfigurable Link Layer: Link Layer Capacity of Adaptive Air Interfaces - Adaptive Transmission in Ad Hoc Networks - Adaptive Hybrid ARQ Schemes for Wireless Links - Stochastic Learning Link Layer Protocol - Adaptive Medium Access Control

Module-II: 9 hrs

Adaptive Network and TCP Layer: Graphs and Routing Protocols - Graph Theory - Routing with Topology Aggregation - Network and Aggregation Models - Effective Capacity - TCP Operation and Performance - TCP for Mobile Cellular Networks - Random Early Detection Gateways for Congestion Avoidance TCP for Mobile Ad Hoc Networks.

Module-III: 9 hrs

Mobility and Resource Management: Prioritized Handoff - Cell Residing Time Distribution - Mobility Prediction in Pico- and Micro-Cellular Networks - Channel Assignment Schemes - Resource Management in 4G.

Module-IV: 9 hrs

Security: Authentication - Security Architecture - Security Management in GSM Networks - Security Management in UMTS - Security Architecture for UMTS/WLAN Interworking - Security in Ad Hoc Networks - Security in Sensor Networks.

Module-V: **9 hrs**

Ad Hoc and Sensor Networks: Routing Protocols - Hybrid Routing Protocol - Scalable Routing Strategies - Multipath Routing - Clustering Protocols. Cashing Schemes for Routing - Distributed QoS Routing - Sensor Networks Parameters - Sensor Networks Architecture - Mobile Sensor Networks Deployment - Directed Diffusion

Text Book(s):

1. *Glisic, Savo G., Advanced Wireless Networks, John Wiley and Sons, 2006.*
2. *Chen, Hsiao-Hwa and Guizani, Mohsen, Next Generation Wireless Systems and Networks, John Wiley and Sons ,2006.*

Reference Book(s):

1. *Glisic, Savo G., Advanced Wireless Networks, John Wiley and Sons, 2006.*
2. *Rappaport, T.S., Wireless Communications: Principles and Practice, 2e, 2010.*

CSNS 853: MOBILE COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic understanding of wireless transmissions and computer networks.*

Objectives:

- *To understand the issues involved in mobile communication system design and analysis.*
- *To understand the concept of frequency reuse. To understand the characteristics of wireless channels.*
- *To acquire knowledge in different modulation schemes and its error probability in wireless system.*
- *To know the fundamental limits on the capacity of wireless channels.*
- *To understand the diversity concepts.*

Course Outcome:

- *Understand the issues involved in mobile communication system design and analysis.*
- *Understand the characteristics of wireless channels and the concept of frequency reuse.*
- *Knowledge in different modulation schemes and its error probability in wireless system.*

Module-I: 9 hrs

The Wireless Channel: Overview of wireless systems – Physical modeling for wireless channels – Time and Frequency coherence – Statistical channel models – Capacity of wireless Channel- Capacity of Flat Fading Channel — Channel Distribution Information known – Channel Side Information at Receiver – Channel Side Information at Transmitter and Receiver – Capacity with Receiver diversity – Capacity comparisons – Capacity of Frequency Selective Fading channels

Module-II: 9 hrs

Digital Modulation: Digital Modulation and Detection-Fading– Outage Probability– Average Probability of Error — Combined Outage and Average Error Probability – Doppler Spread – Inter symbol Interference

Module-III: 9 hrs

Multi antenna Communication: Realization of Independent Fading Paths – Receiver Diversity – Selection Combing – Threshold Combing – Maximal-Ratio Combing – Equal - Gain Combing – Transmitter Diversity – Channel known at Transmitter – Channel unknown at Transmitter – The Alamouti Scheme– Transmit & Receive Diversity-MIMO Systems

Module-IV: **9 hrs**

Multicarrier Modulation: Data Transmission using Multiple Carriers – Multicarrier Modulation with Overlapping Sub channels – Mitigation of Subcarrier Fading – Discrete Implementation of Multicarrier Modulation – Peak to average Power Ratio- Frequency and Timing offset – Case study IEEE 802.11a.

Module-V: **9 hrs**

Cellular Concepts: Frequency Reuse – Channel Assignment Strategies – Hand off Strategies – Interference and system capacity- Co-Channel Interference- Adjacent Channel Interference – Trunking and Grade of service – Improving coverage & capacity in cellular systems-Cell Splitting- Sectoring-Repeaters for Range Extension-Microcell Zone Concept.

Text Book(s):

1. *David Tse and PramodViswanath, "Fundamentals of Wireless Communication", Wiley Series in Telecommunications, Cambridge University Press, 2005.*
2. *Theodore.S. Rappaport, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, India, 2009.*
3. *Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.*
4. *ArogyaswamiPaulraj, RokitNabar, Dhananjay Gore, "Introduction to Space-Time Wireless Communication", 1st Edition, Cambridge University Press, 2008.*

Reference Book(s):

1. *W.C.Y.Lee, "Mobile Cellular Telecommunications - Analog and Digital Systems", 2nd Edition. Tata McGraw Hill, 2006.*

CSNS 854: AD-HOC MOBILE NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Basic Knowledge on wireless networks and understanding of OSI model.*

Objectives:

- *To introduce the characteristic features of Ad-hoc wireless networks and their applications to the students.*
- *To enable the student to understand the functioning of different access and routing protocols that can be.*
- *To enable the student to understand the Mobility in MANETs*
- *To understand QoS feature in Adhoc networks.*

Course Outcome:

- *Understand the characteristic features of Ad-hoc wireless networks and their applications to the students.*
- *Understand the functioning of different access and routing protocols that can be.*
- *Knowledge on Mobility in MANETs*
- *Acquire basic idea about QoS and energy management in Adhoc network.*

Module-I: 9 hrs

Introduction To MANETS and Mac Layer Protocols: Fundamentals of Wireless Networks– IP Limitations-Mobile Internet Protocol (IP)- Issues in Mobile IP- Differences between Cellular and Ad Hoc Wireless Networks- Issues in Ad Hoc Wireless Networks- Classification of Ad-hoc Networks-MANET applications- Important Issues and the Need for Medium Access Control (MAC) Protocols.- Classification of MAC Protocols- Multiple-Channel MAC Protocols.

Module-II: 9 hrs

Routing Protocols For Ad Hoc Wireless Networks: Design Issues of Routing Protocols for Ad Hoc Networks- Classification of Routing Protocols- Proactive Routing- WRP, DSDV, OLSR Protocol - Reactive Routing - AODV, DSR, TORA, CBRP Protocol - Hybrid Routing. - ZRP, ZHLS

Module-III: 9 hrs

Quality Of Service (Qos) In Ad Hoc Networks: Introduction to QoS -Issues and Challenges Involved in Providing QoS -Classification of QoS Solutions - Medium Access Control (MAC) -Layer QoS Solutions - Network -Layer QoS Solutions -QoS Model -QoS Frameworks - INSIGNIA Protocol Commands - INSIGNIA Protocol Operations - Reservation Establishment -QoS Reporting - Flow Restoration -Flow Adaptation -Intelligent Optimization Self -Regulated adjustment(INORA) - Coarse -Feedback Scheme -Class -Based Fine Feedback

Module-IV: **9 hrs**

Energy Management Systems In Ad Hoc Wireless Networks: Classification of Energy Management Schemes - Overview of Battery Technologies - Principles of Battery Discharge - Impact of Discharge Characteristics on Battery Capacity - Battery Modeling - Battery - Driven System Design - Energy -Efficient Routing Protocol - Transmission Power Management Schemes - Transmission Power Control

Module-V: **9 hrs**

Mobility Models For MANET: Mobility Model Classifications -Formulation of Mobility Models - Mobility Metrics -Impact of Mobility Models on MANET -Random Walk Mobility -Notation, Characteristics of Random Walk Mobility, Stationary Distribution of Random Walk Mobility, Limitations of Random Walk Mobility Model -Random Waypoint Mobility - Notation - Random Waypoint Stochastic Process - Transition Length and Duration - Limitations -Smooth Random Mobility -Notation - Characteristics of Smooth Random Mobility Model - Speed Control–DirectionControl - Correlation Between Direction and Speed Change

Text Book(s):

1. *Subir Kumar Sarkar, T.G. Basavaraju, C. Puttamadappa," Ad Hoc Mobile Wireless Networks: Principles, Protocols, andApplications",Secondedition,AUERBACH PUBLICATIONS,,2013.*
2. *RadhikaRanjanRoy,"Handbook of Mobile AdHocNetworks for MobilityModels", Springer Science+Business Media, LLC 2011 .*

Reference Book(s):

1. *Jonathan Loo, Jaime LloretMauri, Jesús Hamilton Ortiz"Mobile Ad Hoc Networks: Current Status and Future Trends"CRC Press, 2012.*
2. *B. V. V. S. PRASAD,"ROUTING ISSUES IN MANETs",Educreation Publishing - 2016*

CSNS 855: ADVANCED MOBILE COMPUTING

L	T	P	C
3	0	0	3

Pre-requisite:

- *Understanding of OSI model and wireless channel transmissions.*

Objectives:

- *To learn mobile computing techniques*
- *To be familiar with mobile computing trends and wireless application protocol.*
- *To learn about the mobile Internet*
- *To study about various application languages and mobile application development platforms*

Course Outcome:

- *Get introduced to various mobile computing techniques*
- *Knowledge about the mobile Internet*
- *Familiarize with various mobile computing trends and wireless protocols.*
- *Knowledge about various application languages and mobile application development platforms*

Module-I: 9 hrs

Mobile Communications: An Overview: Mobile communication-Mobile computing-Mobile Computing Architecture-Mobile devices-Mobile System Networks – Data dissemination – Mobile management- security. MOBILE DEVICES AND SYSTEMS-Mobile phones – digital Music players – Handheld Pocket computers – Handheld devices – Smart systems – Limitations of mobile devices – Automotive systems.

Module-II: 9 hrs

GSM and Similar Architectures: GSM – services and architectures – Radio interfaces – Protocols – Localization – Calling – Handover – Security – New data services – General packet radio service- High speed circuit switched data – DECT. WIRELESS MEDIUM ACCESS CONTROL BASED COMMUNICATION-Medium Access Control – Introduction to CDMA –based Systems – Spread spectrum in CDMA Systems – coding methods in CDMA – IS-95 cdmOne System – IMT – 2000 – i-mode – OFDM

Module-III: 9 hrs

Mobile IP Network Layer and Mobile Transport Layer: IP and mobile Network layers – Packet Delivery and Handover Management – Location management – Registration – Tunneling and Encapsulation - Route Optimization - Dynamic Host Configuration Protocol. Conventional TCP/IP Transport Layer Protocols – Indirect TCP – Snooping TCP – Mobile TCP – Other methods of mobile TCP – layer transmission – TCP over 2.5G/3G Mobile networks.

Module-IV: **9 hrs**

Mobile Devices: Server and Management: Mobile agent – Application server – Gateways – Portals -Service Discovery – Device management – Mobile file systems-Security.MOBILE AD HOC AND WIRELESS SENSOR NETWORKS-Introduction to mobile Ad hoc network – MANET –Wireless Sensor Networks –Applications

Module-V: **9 hrs**

Wireless LAN, Mobile Internet Connectivity and Personal Area Network: WirelessLAN (Wi-Fi) Architecture and Protocol layers- WAP 1.1 and WAP 2.0 Architecture – XHTML-MP (Extensible Hypertext Markup Language Mobile Profile) - Bluetooth enabled devices network – layers in Bluetooth protocol- security in Bluetooth protocol- IrDA – ZigBees - Mobile application languages and mobile application development platforms

Text Book(s):

1. *Raj Kamal, "Mobile Computing",Oxford Higher education, Second Edition, 2007*
2. *J.Schiller, "Mobile Communication", Addison Wesley, 2000. William Stallings, "Wireless Communication and Networks", Pearson Education,2003.*
3. *LotherMerk, Martin.S.Nicklaus and Thomas Stober, "Principle of Mobile Computing",Second Edition, Springer, 2003.*

Reference Book(s):

1. *Singhal, "WAP-Wireless Application Protocol", Pearson Education, 2003.*
2. *William C.Y.Lee, "Mobile Communication Design Fundamentals", John Wiley,1993*

CSNS 856: HIGH SPEED NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite:

- *Familiarity with types of computer network, network architecture and network topologies.*

Objectives:

- *Introduce to ATM and Frame relay.*
- *Up-to-date survey of developments in High Speed Networks.*
- *To know techniques involved to support real-time traffic and congestion control.*
- *Analyze the different levels of quality of service (QoS) to different applications.*

Course Outcome:

- *Clear understanding of ATM functioning.*
- *Knowledge on techniques involved to support real-time traffic and congestion control.*
- *Ability to analyze the different levels of quality of service (QoS) to different applications*.
- *Understanding of the routing, congestion and traffic management* with respect to high speed networks

Module-I: 9 hrs

High Speed Networks: Introduction to Computer Networks –Protocols and the TCP/IP Suite- TCP and IP -Frame Relay - High Speed LAN

Module-II: 9 hrs

ATM: Introduction: ATM cell Layered organization Connection admission control ATM cell switching routing and addressing - IP over ATM - Segmentation and reassembly SVC establishment - Circuit emulation Performance management Multicast optical

Module-III: 9 hrs

Congestion and Traffic Management: Congestion Control in Data Networks and Internet – Link Level Flow and Error Control – Traffic and Congestion Control in ATM networks

Module-IV: 9 hrs

Routing: Overview of graph – interior routing protocol – exterior routing protocol – integrated and differentiated Services – Protocols for Qos Support

Module-V: **9 hrs**

Optical Networks: Introduction to Optical networks Wavelength division multiplexing (WDM) Introduction to broadcast-and-select networks - Switch architectures - channel accessing Wavelength routed networks Switch architectures - Routing and wavelength assignment virtual topology design IP over SONET over ATM over WDM IP over ATM over WDM IP over WDM.

Text Book(s):

1. *William Stallings, High Speed Networks and Internet, Pearson Education, Fourth Edition, 2005.*
2. *Behrouz A. Forouzan, Data Communications and Networking, 4th edition, Tata McGraw-Hill, 2005.*
3. *Warland&PravinVaraiya, High Performance Communication Networks, Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.*

Reference Book(s):

1. *IrvanPepelnjk, Jim Guichard and Jeff Apcar, MPLS and VPN architecture, Cisco Press, Volume 1 and 2, 2003.*
2. *Rajiv Ramaswami and Kumar N. Sivarajan, Optical Networks: A Practical Perspective, 1st Edition, Morgan Kaufmann, USA, 2001.*
3. *C. Siva Ram Murthy and Mohan Gurusamy, WDM Optical Networks: Concepts, Design, and Algorithms, Prentice Hall, USA, 2002.*
4. *Stamatios V. Kartalopoulos, Understanding SONET/SDH and ATM: Communications Networks for Next Millennium, Prentice-Hall of India, 2001.*

PONDICHERRY UNIVERSITY

SCHOOL OF PERFORMING ARTS
DEPARTMENT OF PERFORMING ARTS

4 YEAR B.P.A COURSE STRUCTURE

DEGREE PROGRAMME

SEMESTER PATTERN

NEP BASED

MJD 1: INTRODUCTION TO THEATRE

Course Number	:	MJD 1
Course title	:	**Introduction to Theatre**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Major
General Information	:	Theory
Semester & Year	:	I Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	No
Seminars	:	Yes
Assignment	:	Yes
Test	:	Yes

Course Objective:

- To familiarize the concept of Indian theatre and western theatre.
- To Understand modern playwrights

Course Outcomes:

After successful completion of the course, the student will be able to:

- relate the Indian theatre in the context of contemporary and its development
- analyze and compare with Western and Eastern Theatre and define the origin and development of those theatre forms

Content and concept of the course:

Unit – 1: **Introduction to Indian Theatre** Origin; Development; introduction to Contemporary Indian Theatre; Playwrights
Unit – 2: **Western Theatre** Greek theatre; Origin; Development; Playwrights; Roman Theatre**;** Origin; Development; Playwrights
Unit -3: **Medieval and Elizabethan Theatre** Origin; Development; Types of Plays
Unit- 4: **Japanese and Chinese Theatre** Introduction to Kabuki; Noh; Bunraku; Bugaku; Peeking Opera

Text Books and References:

1. Nandi Bhatia, Modern Indian Theatre: A Reader, Oxford University Press, 2009
2. AcllardyceNicoll, World Drama, George G Harrap& Co Publication1966
3. Robert Cohen, Theatre, McGraw-Hill Humanities Social Publication, 2007, United States
4. Yasmine Maria Jahanmir, Lillian Campana, Western Theatre In Global Contexts, Routledge Publication, 2020

MID 1 (A): ACTING BASICS

Course Number	:	MID 1 (A)
Course title	:	**Acting Basics**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Minor
General Information	:	Practical
Semester & Year	:	I Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Seminars	:	Yes
Assignment	:	Yes

Course Objective:

- To analyze and appraise the importance of acting which is useful for theatre practice and performance.
- To understand basics of acting on stage based on characters

Course Outcomes:

After successful completion of the course, the student will be able to:

- familiarize the different types of acting in theater
- arrange and assemble the acting techniques

Course Content:

Unit 1: Warming up exercises; Mastering one's own tool: body & voice
Unit 2: Activities versus Action and Psycho- physical activities (gesture, posture, movement, etc.,)
Unit 3: Building a character through observation and Absorption from real example
Unit 4: Assignment in relation with play script

Text Books and Reference Books:-

1) Elizabeth Reynolds Hapgood, Constantin Stanislavski **"An Actor Prepares",** Methuen, Great Britain, 1980
2) Elizabeth Reynolds Hapgood, Constantin Stanislavski " **Building a Character**" Eyre Methuen, London, 1979
3) Elizabeth Reynolds Hapgood, Constantin Stanislavski," **Creating a role**", Eyre Methuen, London, 1981
4) Lawrence Olivier¸ **"Actor "** Holiday House, U.K, 1986

5) Hardie Albright, **"Acting is a creative process"**, Dickenson Publishing Company Inc., California, 1974.
6) Sunith Dhir, " Styles of Acting" Gian Publishing House , New Delhi-2
7) Tyrone Guthrieon, **"Acting"** Studio Vista, London, 1971
8) Uta Hagen**, "Respect for Acting"** Wily Publishing 1973

MID 1 (B): DIRECTION BASICS

Course Number	:	MID 1 (B)
Course title	:	**Direction Basics**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Minor
General Information	:	Practical
Semester & Year	:	I Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Seminars	:	Yes
Test	:	Yes
Assignment	:	Yes

Course Objectives and outcome of the Course:

The art and technical aspect of direction is covered in this course. The evolution of direction and his role in making performance are studied in detail.

Content and concept of the course:

Unit 1– Introduction to Direction
Unit 2 – Role of a Director
Unit 3- Analysing a play
Unit 4- Interpretation and Basics of Direction skills

Text Books and References:

:

1. Ahart, John**. The Director's Eye**. Colorado Springs: Meriwether Pub. Ltd., 2001.
2. **The Director's Voice,** by Arthur Bartow.
3. **On Directing**, by Harold Clurman
4. **Makers of Modern Theatre,** Rama Rao
5. **Directorial approach of Theru -K-Koothu**, R. Raju 2006

6. **Scenic design and stage lighting,** The Columbia Encyclopedia, Sixth Edition. 2001. at www.riscoptright.com
7. **Theatrical Design and Production: An Introduction to Scene Design and Construction, Lighting, Sound, Costume, and Makeup** (4th edition) by J. Michael Gillette. (Mountain View, CA: Mayfield Publishing Company. 2000).
8. **The Staging Hand Book** by Francis Reid, A&C, Black ,London, second edition-1995
9. **Stage Craft and Scene Design** by Herbert Phillippi, Houghton Mifflin Company, Boston, First Edition-1953.
10. **Technical Theatre Hand Book** by Stephen Scott Richardson, WPI, Great Britain, 1996
11. **The Director and the Stage** by Bran Edward ,Methuen Drama,London-1987

MID -1 (C): DESIGNING BASICS

Course Number	:	MID 1 (C)
Course title	:	**Designing Basics**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course	:	Minor
General Information	:	Practical
Semester & Year	:	I Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Seminars	:	Yes
Assignment	:	Yes

Course Objective:

- To analyze and appraise the importance of Voice and Speech useful for theatre practice and performance.
- To understand basic Voice and speech techniques on stage based on characters

Course Outcomes:

After successful completion of the course, the student will be able to:

- familiarize the different Voice and Speech exercises in theater
- arrange and assemble the Voice and Speech Techniques

Content and concept of the course:

Unit 1: Introduction to voice and speech -Building voice : Projection and Resonance Elements of Speech- Building Speech: Exercises and using Elements of speech-
Unit 2: Vibration and Articulation-All aspects- Exercises in Enunciation- Respiration -Words containing classified -Pure Tone- Elements of Expression
Unit 3: Villupattu: Song & Speech Bharatha Pirasangi
Unit 4: Dubbing artist for Cartoons-Dubbing voice for Film-News reading and Radio Jacky Practices

Text Books and References:

5. Nandi Bhatia, Modern Indian Theatre: A Reader, Oxford University Press, 2009
6. AcllardyceNicoll, World Drama, George G Harrap& Co Publication1966
7. Robert Cohen, Theatre, McGraw-Hill Humanities Social Publication, 2007, United States
8. Yasmine Maria Jahanmir, Lillian Campana, Western Theatre In Global Contexts, Routledge Publication, 2020
9. Sunith Dhir, "Styles of Acting" Gian Publishing House, New Delhi
10. Lawrence Olivier¸ "Actor" Holiday House, U.K, 1986
11. Hardie Albright, "Acting is a creative process", Dickenson Publishing Company Inc., California, 1974.
12. Sunith Dhir, "Styles of Acting" Gian Publishing House, New Delhi-2
13. Tyrone Guthrieon, "Acting" Studio Vista, London, 1971
14. Uta Hagen, "Respect for Acting" Wily Publishing 1973
15. Artaud, Antonin; The Theatre and Its Double, Grove Press, 1994.
16. Barba, Eugenio; Beyond the Floating Islands, PAJ Publications, 1986 ISBN 978-0933826984
17. Grotowski, Jerzy; Towards a Poor Theatre, Theatre Arts Books, 2002.
18. Hodge, Alison (ed.); Twentieth Century Actor Training, Routledge, 2000. ISBN 978-0415194525
19. Leabhart, Thomas; Modern and Post-Modern Mime, Palgrave, 1989.
20. Marshall, Lorna; The Body Speaks: Performance and Expression, St. Martin's Griffin, 2002. ISBN 9781403960283
21. Meyerhold, Vsevolod and Braun, Edward; Meyerhold on Theatre, Bloomsbury Methuen Drama, 1978. ISBN 978-0413387905
22. Oida, Yoshi; The Invisible Actor, Bloomsbury Methuen Drama, 2002. ISBN 978-0413696106
23. Potter, Nicole (ed.) et al. "'Movement for Actors, Allworth Press, 2002. ISBN 978-1581152333

MLD -1: THEATRE EXERCISES

Course Number	:	MLD 1
Course title	:	**Theatre Exercises**
Credits Hours	:	3 Credits
No. of contact hours (per week)	:	4 Hours
Type of the Course	:	Multi-disciplinary
General Information	:	Practical
Semester & Year	:	I Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Seminars	:	Yes
Assignment	:	Yes

Course Objectives and outcome of the Course:

Daily morning exercise class focuses on eastern and western method of exercise. All this methods covered in this course to give basic training, introducing various methods of physical exercise and Theatre games to nurture the body, mind and voice of performing artist.

Content and concept of the course:

Unit-1 Body Conditioning Exercises- Relaxation, Concentration, Warming up, Isolation, Trust Exercises, Breathing Exercises Selected Postures and Gestures based on Hatha Yoga and Indian Martial Arts Kalari Payat
Unit – 2 Eye and Face Exercises – Different Exercises for Eye and Face Muscles selected from Natya Sastra
Unit – 3 Rhythm, Balance, impulse, flow, intuition, feeling: abstract and purpose in movements Exercises for Body Joints and Limbs(Neck, Head, Chest, Hands, Trunk and legs)
Unit-4 Exercises for senses: Touch, smell, sight, hearing and taste Navarasas: eyes, Full Body Co-ordination Exercises with Music (Aerobics)face and whole body

Text Books and References:

1. **Theatre Games** by Clive Barker, A&C Black; Reprint edition (September 1, 2003)
2. **Theatre Games** for the Classroom: A Teacher's Handbook, by Viola Spolin , North-western University Press (1986)
3. **Acting Games: Improvisations and Exercises: A Textbook of Theatre Games and Improvisations** by Marsh Gary Cassady, Meriwether Publishing (1993)
4. **Games for Actors and Non-Actors** 2nd Edition, by Augusto Boal, Rout ledge (2002)
5. Ragu Ananthanarayanan**, "Leaving through Yoga Madiram"** Chennai -28, 2002

6. John Pery, **"Encyclopaedia of acting techniques"** Cassell , London, 1997
7. John Martin , "**Intercultural Performances**"
8. Eugenio Barba & Nicola Savarase, "**The Secret Art of the Performer**" Rout ledge, London and New York, 1991.

SEC 1 (A): INDIAN MARTIAL ARTS AND CONTEMPORARY THEATRE

Course Number	:	SEC 1(A)
Course title	:	**Indian Martial Arts and Contemporary Theatre**
Credits Hours	:	3 Credits
No. of contact hours (per week)	:	4 Hours
Type of the Course (hard/soft core)	:	Skill Enhancement Course
General Information	:	Practical
Semester & Year	:	I Semester
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Assignment	:	Yes

Course Objective:

- To analyze and appraise the importance of Martial Arts useful for theatre practice and performance.
- To understand basic Indian Martial Arts and Contemporary Theatre techniques on stage based on characters and practice

Course Outcomes:

After successful completion of the course, the student will be able to:

- familiarize the Martial Arts exercises in theater
- arrange and assemble the Martial Arts techniques to contemporary theatre

Content and concept of the course:

Unit 1: Kalari Payattu & Basic Movements-Kalari Payattu & Silambam combination Movements
Unit 2: Presenting a open air performance-Introduction of stick movements in Kalari- Stick movements& small stick movements in Kalari
Unit 3: Introduction of Tai-Chi Movements-Gymnastic movements related to theatre
Unit 4: Designing a movement choreography using Music & Percussion- Practicing and performing in front of audience

Text Books and References:

1. **Actors on Guard: A Practical Guide for the Use of the Rapier and Dagger for Stage and Screen**, by Dale Ant Girard, Theatre Arts Book (1996)
2. **Stage Combat: Fisticuffs, Stunts, and Swordplay for Theatre and Film**, by Jenn Boughn, Allworth Press (2006)
3. **Combat Mime: A Non-Violent Approach to Stage Violence**, by Martinez J. D., Rowman & Littlefield Publishers, Inc. (1982)
4. **Fight Direction for Stage and Screen**, by William Hobbs, Heinemann (1995)
5. **Swashbuckling: A Step-by-Step Guide to the Art of Stage Combat and Theatrical**, by Richard Lane, Limelight Editions; 1st Limelight Ed edition (August 1, 2004)

SEC 1 (B): STAGE MANAGEMENT

Course Number	:	SEC 1(B)
Course title	:	**Stage Management**
Credits Hours	:	3 Credits
No. of contact hours (per week)	:	4 Hours
Type of the Course (hard/soft core)	:	Skill Enhancement Course
General Information	:	Practical
Semester & Year	:	I Semester
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Assignment	:	Yes

Course Objective:

- To analyze and appraise the importance of Stage Management for theatre performance.
- To understand basic Stage Management techniques for stage.

Course Outcomes:

After successful completion of the course, the student will be able to:

- familiarize the concept odf Stage Management in theater
- arrange and assemble the techniques of Stage Management in theatre

Content and concept of the course:

Unit 1: Objectives and Functions of Stage and Production Management; Roles and Responsibilities of Stage Manager and Production Manager
Unit 2: Principles of stage management from audition; General Theatre Organization and Management/ Organizing a theatre group

Unit 3: Office procedure/Preparing a budget/Publicity and Printing; Scheduling/Pre-Production/Rehearsals/Technical Rehearsals/Costume Rehearsal/Grand Rehearsal
Unit 4: Performance/Prompt Script

Text Books and References:

1. The Stage Management Handbook, Daniel A. Ionazzi
2. The Backstage Guide to Stage Management, Thomas A. Kelly
3. Stage Management by Hal D. Stewart, Pitman, 1957
4. Stage Management by Daniel Bond
5. Stage Management and Theatre Administration by Paul Me near and Hawkins , editor :David Mayer, Phi don Press Limited, 1988

SEC 1 (C): MASK MAKING

Course Number	:	SEC 1(C)
Course title	:	**Mask Making**
Credits Hours	:	3 Credits
No. of contact hours (per week)	:	4 Hours
Type of the Course (hard/soft core)	:	Skill Enhancement Course
General Information	:	Practical
Semester & Year	:	I Semester
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Assignment	:	Yes

Course Objectives and outcome of the Course:

Mask and stage properties play their part in relation to a theatrical production as a whole by enhancing the effects of words, Action, and scene. They perform their work by embroidering the illusion evoked on the stage. Skillfully used, they have the power to transform a beggar into prince, to make a forest rise from the boards, and even star falls from heavens. The making of the stage properties might be called an almost magical craft, for although its influence is felt, it is rarely observed except by the people who know the skilled work behind the paper and paste, the wood and wire.

The objective of the course is to introduce the outline follows the natural order of the construction process that is frame work, covering, and painting. Detail and decoration are founded upon these basic techniques and the care with which they are applied will determine the durability quality, the cost of a given prop.

Content and concept of the course:

Unit 1: Introduction to Mask Making; Property and its need, Mask according to play and interpretation. Types of masks
Unit 2: 3 practical applications of simple mask, wired masks, papa ire Mache, clay master modeled, mold preparation, POP surgical bandage. Sponge, Latex, Cloth etc.,
Unit 3: Preparing a record book with designs of masks.
Unit 4: Hands on experience and preparing different types of Masks with references to plays

Text books and/or Recommended or Required Readings:

1. Technical Theatre Hand Book by Stephen Scott Richardson, WPI,Great Britain, 1996
2. An Introduction to Scenic Design and Construction by Michael Gillette, 5th edition, 2005
3. Designing and Drawing for the Theatre; Lynn Pecktal
4. Designer Drafting for the Entertainment World; Patricia Woodbridge
5. Scenic Art for the Theatre: History, Tools, and Techniques, Crabtree & Beudert
6. Perspective Rendering for the Theatre; William H. Pinnell
7. Theory and Craft of the Scenographic Model; Darwin Reid Payne
8. Nadakath Thozil Nunukkam – Katchi Amaippu, R.Raju
9. Stage Craft and Scene Design by Herbert Phillippi, Houghton Mifflin Company, Boston, First Edition-1953.
10. Designing for the Theatre, by Francis Reid, A&C Black – London, 1989

B.P.A.Theatre Arts
SEMESTER II

MJD 2: FOLK THEATRE PERFORMANCES

Course Number	:	MJD 2
Course title	:	**Folk Theatre Performances**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Major
General Information	:	Theory
Semester & Year	:	II Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	No
Seminars	:	Yes
Assignment	:	Yes
Test	:	Yes

Course Objective:

- To familiarize the concept of Ethnicity and Nativity of Indian Folk Theatre
- To Understand Traditions, Customs, Beliefs and Rituals and the Performing Space

Course Outcomes:

After successful completion of the course, the student will be able to:

- relate to the Indian folk theatre and its outline history
  analyze and compare with traditional and regional performances

Content and concept of the course:

Unit – 1: Introduction of Folklore; Folk Literature; 2 Folk Traditions, Customs, Beliefs, Rituals beyond with the Performances
Unit – 2: Introduction of Folk Theatre Performances of India- Theru-k-koothu, Kaniyan koothu, Theyyam, Yakshagana, Thamasa, Bayalatta, Raaja raani Aattam, Puli Aattam, Navatanki, Jatra, Villuppattu, Leather Shadow Puppet Theatre, Naarthevangudikaadu Therukkoothu
Unit -3: Analyse : Ritual to Performance, Performance to Ritual (Kaniyan Koothu, Naarthevan kudikaadu Therukkoothu, Villuppattu)
Unit- 4: Study about the Regional Cultural Essence in Folk Theatre Forms

Text books and/or Recommended or Required Readings:

1. **Folk Theatre of India,** by Balwant Gargi, 1991, Rupa & Co Calcutta, ISBN 81 - 7167 - 278 - 0
2. **Indian Theatre Traditions of Performance**, Ed.Farley F.Richmond et al. University of Hawaii Press (1990)
3. **Vilimbunilai Makkal Vazhakkarugal,** Dr. A.Dhananjayan,Vallinam Publications, Pondicherry, 2006
4. **Indian Theatre: Tradition, Continuity and Change**, by Nemichand Jain, 1992, Vikas Publishing.

5. **Thamil Chamoogathil Naattar Kalaignargal ,** Dr. A. Dhananjayan,2011, FRRC Publications, Tirunelveli
6. **Traditions of Indian Theatre**, M.L. Varadpande, Abhinav Publication
7. **Ritual To Theatre – Victor Turnor**
8. **Leather Shadow Puppet Theatre** – M.Ramasamy
9. **Naattuppuraviyal** – D. Lourdhu, Frrc Publications, Palayamkottai

MID 2 (A): ACTING FOR STAGE

Course Number	:	MID 2 (A)
Course title	:	**Acting for Stage**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Minor
General Information	:	Practical
Semester & Year	:	II Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Seminars	:	Yes
Assignment	:	Yes

Course Objective:

- To analyze and appraise the importance of acting which is useful for theatre practice and performance.
- To understand basics of acting on stage based on characters

Course Outcomes:

After successful completion of the course, the student will be able to:

- familiarize the different types of acting in theater
- arrange and assemble the acting techniques

Content and concept of the course

Unit 1: Eyes , face, gestures and body movements practices based on a classical form and folk theatre form
Unit 2: Mime and movements
Unit 3: Some Indian contemporary Theatre director's method and approaches
Unit 4: Thematic choreography; Dramatizing a song

Text Books and References:

1. **A Practical Handbook for the Actor** by Bruder, Melissa et al. Random House, 1986.
2. **A Practical Handbook for the Actor** by Bruder, Cohn, Olnek…McGaw, Charles and Larry D. Clark. Acting is Believing, Wadsworth, 2004.
3. Bates, Brian**. The Way of the Actor**, Shambhala, 1987.
4. Boal, Augusto. **Games for Actors and Non-actors**, Routledge, 1992.
5. Bogart, Anne and Tina Landau. **The Viewpoints Book**, Smith and Kraus, 2005.
6. Brook, Peter. **The Empty Space**. Atheneum, 1968,
7. Brook, Peter. **The Open Door**. Pantheon, 1993.
8. Cameron, Julia, **The Artist's Way**, Tarcher/Putnam, 1992.
9. Chaikin, Joseph. **The Presence of the Actor**, Atheneum 1972.
10. Chekhov, Michael. **Lessons for the Professional Actor**, Performing Arts Journal, 1985,
11. Chekhov, Michael. **On The Technique of Acting**, Harper-Collins, 1991.
12. Chekhov, Michael. **To the Actor**, Routledge, 2002.
13. Goffman, Erving. **The Presentation of Self in Everyday Life**, Doubleday, 1959.
14. Grotowski, Jerzy. **Towards a Poor Theatre**. Simon and Shuster, 1968.
15. Harrop, John and Sabin Epstein. **Acting with Style**. Allyn and Bacon, 2000.
16. O'Neill, Rosary. **The Actor's Checklist: Building a Character**, Wadsworth Publishing, 2003.
17. Rodenburg, Patsy. **The Actor Speaks**, St. Martin's, 2000.

MID 2 (B): DIRECTION PROCESS I

Course Number	:	MID 2 (B)
Course title	:	**Direction Process I**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Minor
General Information	:	Practical
Semester & Year	:	II Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Seminars	:	Yes
Test	:	Yes
Assignment	:	Yes

Course Objectives and outcome of the Course:

The art and technical aspect of direction is covered in this course. The evolution of direction and his role in making performance are studied in detail.

Content and concept of the course:

Unit 1– Introduction to Director
Unit 2 – Direction Process, Steps and Advancements
Unit 3- Play Analysis and Playwriting
Unit 4- Interpretation of selected scenes and Assignments

Text Books and References:

1. Ahart, John**. The Director's Eye**. Colorado Springs: Meriwether Pub. Ltd., 2001.
2. **The Director's Voice,** by Arthur Bartow.
3. **On Directing**, by Harold Clurman
4. **Makers of Modern Theatre,** Rama Rao
5. **Directorial approach of Theru -K-Koothu**, R. Raju 2006
6. **Scenic design and stage lighting,** The Columbia Encyclopedia, Sixth Edition. 2001. at www.riscoptright.com
7. **Theatrical Design and Production: An Introduction to Scene Design and Construction, Lighting, Sound, Costume, and Makeup** (4th edition) by J. Michael Gillette. (Mountain View, CA: Mayfield Publishing Company. 2000).
8. **The Staging Hand Book** by Francis Reid, A&C, Black ,London, second edition-1995
9. **Stage Craft and Scene Design** by Herbert Phillippi, Houghton Mifflin Company, Boston, First Edition-1953.
10. **Technical Theatre Hand Book** by Stephen Scott Richardson, WPI, Great Britain, 1996
11. **The Director and the Stage** by Bran Edward ,Methuen Drama,London-1987

MID 2 (C): DESIGNING ASPECTS
COSTUME DESIGN

Course Number	:	MID 2 (C)
Course title	:	**Designing Aspects: Costume Design**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Minor
General Information	:	Practical
Semester & Year	:	II Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Seminars	:	Yes
Assignment	:	Yes

Course Objective:

- To develop costume design ability through study of elements and principles of design and research techniques, as well as developing visual and verbal communication skills the importance of acting which is useful for theatre practice and performance.
- To gain an understanding of costume design as an applied art and essential part of the collaborative theatre production process.

Course Outcomes:

After successful completion of the course, the student will be able to:

- plan and design of performance costumes, including skills such as drawing, painting, production and play analysis
- Write, draw, paint, research, read and discuss of Costume production

Content and concept of the course:

Unit 1: The role of Costume in a Play Performance; Functions and Principles of Costume Design; Study of Textiles
Unit 2: Preparing a Textile Chart; Mode of Wearing through different periods (Culture, Region and Religion); Costume and Costume Properties
Unit 3: Model Making ; Analyzing the play in terms of a costume designer
Unit 4: Costume Designing for a Play (Classical, Periodical and Stylized)

Text Books and References:

1. **Folk Theatre of India,** by Balwant Gargi, 1991, Rupa & Co Calcutta, ISBN 81 - 7167 - 278 - 0
2. **Indian Theatre Traditions of Performance**, Ed.Farley F.Richmond et al. University of Hawaii Press (1990)
3. **Vilimbunilai Makkal Vazhakkarugal,** Dr. A.Dhananjayan,Vallinam Publications, Pondicherry, 2006

4. **Indian Theatre: Tradition, Continuity and Change**, by Nemichand Jain, 1992, Vikas Publishing.
5. **Thamil Chamoogathil Naattar Kalaignargal ,** Dr. A. Dhananjayan,2011, FRRC Publications, Tirunelveli
6. **Traditions of Indian Theatre**, M.L. Varadpande, Abhinav Publication
7. **Ritual To Theatre – Victor Turnor**
8. **Leather Shadow Puppet Theatre** – M.Ramasamy
9. **Naattuppuraviyal** – D. Lourdhu, Frrc Publications, Palayamkottai
10. **My Life in Art *by* Constantin Stanislavsky**, Taylor & Francis, Inc. 2008
11. **An Actor Prepares, Creating a role and Building a Character**, *by* Constantine Stanislavski, Taylor & Francis, Inc. 1989
12. **Building a Character *by*** Constantine Stanislavski, Taylor & Francis, Inc. 1989
13. **Mayer hold on Theatre Meyer hold: A Revolution in Theatre** *by* Edward Braun, Publisher: University of Iowa Press, 1998
14. **Brecht on Theatre : The Development of an Aesthetic** *by* John Willett *(Translator)*, Hill and Wang, 1964
15. **Actors on Acting : The Theories, Techniques and Practices of the Great Actors of all Times as Told in Their Own Words**, by Toby & Helen Krich Chinoy, Eds. Cole, Crown (1949)

MLD-2 THEATRE GAMES

Course Number	:	MLD- 2
Course title	:	**Theatre Games**
Credits Hours	:	3 Credits
No. of contact hours (per week)	:	4 Hours
Type of the Course	:	Multi-Disciplinary
General Information	:	Practical
Semester & Year	:	III Semester
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Assignment	:	Yes
Practical Record	:	Yes

Course Objectives and outcome of the Course:

Theatre Games is a tool for theatre person to deal with actor, group of people, social sectors, Theatre production, children, for bringing understanding in a better and easy way. The students of Drama and theatre Arts learn this skill in order to face new environment and situations effectively.

Objective and Output of the course

- Problem solving
- Self-management and group understanding
- Ability to Face new environment

Content and concept of the course:

Unit 1: : Games for Warming up (Ice break)-Removing inhibitions; Games related with developing five senses
Unit 2: Games for developing Actor and theatre Performance; Games for Developing leadership; Games for personality Development and group understandings
Unit 3: Team building games; Creating Games in a context
Unit 4: Assignment, Improvising new games

Text Books and References:

1. **Agusto Boal, Games for Actors and Non Actors**
2. **Clive Parker, Theatre Games**
3. **Creative Drama for Intermediate children**

SEC 2 (A): BASICS OF DRAWING AND PAINTING

Course Number	:	SEC 2 (A)
Course title	:	**Basics of Drawing and Painting**
Credits Hours	:	3 Credits
No. of contact hours (per week)	:	4 Hours
Type of the Course (hard/soft core)	:	Skill Enhancement Course
General Information	:	Practical
Semester & Year	:	II Semester
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Assignment	:	Yes

Course Objective:

- To analyze and appraise the importance of Drawing and Painting Skills
- To understand basic techniques in drawing and painting

Course Outcomes:

After successful completion of the course, the student will be able to:

- familiarize the concept drawing and painting
- Arrange and assemble the techniques of drawing and painting.

Content and concept of the course:

Unit 1: Introduction, Understand the basics, Colors, Proportions, Compositions
Unit 2: 5 fundamentals of Drawing and Painting, Edges, Spaces, Light and Shadow, Relationships, The Whole, or Gestalt.
Unit 3: Basic Scene drawings and sketches practices, Reviewing sketches
Unit 4: Preparing Scenes Story Boards and presentations

Text Books and References:

1. Edwards, Betty. *The New Drawing on the Right Side of the Brain*, HarperCollins Publishers Ltd; 3Rev Ed edition, 2001, ISBN 978-0-00-711645-4
2. Brommer, Gerald F. Exploring Drawing. Worcester, Massachusetts: Davis Publications. 1988.
3. Bodley Gallery, New York, Modern master drawings, 1971, OCLC 37498294.
4. Holcomb, M. (2009). Pen and Parchment : Drawing in the Middle Ages. New York: The Metropolitan Museum of Art.
5. Hillberry, J.D. Drawing Realistic Textures in Pencil, North Light Books, 1999, ISBN 0-89134-868-9.
6. Landa, Robin. Take a line for a walk: A Creativity Journal. Boston: Wadsworth, 2011. ISBN 978-1-111-83922-2
7. Lohan, Frank. Pen & Ink Techniques, Contemporary Books, 1978, ISBN 0-8092-7438-8.
8. Ruskin, J. (1857). The Elements of Drawing. Mineola, NY: Dover Publications Inc. ISBN 978-1-4538-4264-5
9. Spears, Heather. The Creative Eye. London: Arcturus. 2007. ISBN 978-0-572-03315-6.
10. World Book, Inc. The World Book Encyclopedia Volume 5, 1988, ISBN 0-7166-0089-7.
11. Drawing/Thinking: Confronting an Electronic Age, edited by Marc Treib, 2008, ISBN 0-415-77560-4
12. Gurney, James. "James Gurney Interview". Retrieved 28 November 2012.
13. Adams, Steven (1994). The Barbizon School & the Origins of Impressionism. London: Phaidon Press. pp. 31-32, 103. ISBN 0-7148-2919-6.
14. Dingfelder, Sadie (February 2010). "How artists see". www.apa.org. Retrieved 2021-09-10.

SEC 2 (B): MIME

Course Number	:	SEC 2 (B)
Course title	:	**Mime**
Credits Hours	:	3 Credits
No. of contact hours (per week)	:	4 Hours
Type of the Course (hard/soft core)	:	Skill Enhancement Course
General Information	:	Practical
Semester & Year	:	II Semester
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Assignment	:	Yes

Course Objective:

- To analyze and appraise the importance of Mime.
- To understand basic Mime techniques.

Course Outcomes:

After successful completion of the course, the student will be able to:

- familiarize the concept of Mime
- arrange and assemble the techniques of Mime

Content and concept of the course:

Unit 1: Introduction, Understand the basics of body movement in Mime
Unit 2: Types of Mime, Procedure, practice
Unit 3: Solo and Group Mime activities, Discussion on Costumes and Makeup for Mime
Unit 4: Assignments and Performances

Text Books and References:

1. World Mime Index
2. International mime theatre information
3. MOVEO, international school of corporeal mime and physical theatre in Barcelona
4. International Theatre School Jacques Lecoq Archived 31 May 2020 at the Wayback Machine
5. London International School of Performing Arts
6. Innovo Conservatory of Physical Theatre
7. Henry George Liddell, Robert Scott, A Greek-English Lexicon, on Perseus Digital Library
8. Callery, Dympha (2001). Through the Body: A Practical Guide to Physical Theatre. London: Nick Hern Books. ISBN 1-85459-630-6.
9. "Patrimoine-culturel-immateriel". www.culture.gouv.fr. Retrieved 26 September 2021.

10. Lust, Annette. "The Origins and Development of the Art of Mime". From the Greek Mimes to Marcel Marceau and Beyond: Mimes, Actors, Pierrots and Clowns: A Chronicle of the Many Visages of Mime in the Theatre. 9 March 2000. Retrieved 14 February 2010.
11. "Mime and pantomime | visual art". Encyclopedia Britannica. Retrieved 15 November 2019.
12. H Nettleship ed., A Dictionary of Classical Antiquities (London 1894) p. 393
13. H J Rose, A Handbook of Latin Literature (London 1967) p. 152
14. Broadbent, R. J. (1901) A History of Pantomime, Chapter VI. London. Retrieved 14 February 2010.
15. H J Rose, A Handbook of Latin Literature (London 1967) p. 150
16. G Highet, Juvenal the Satirist (Oxford 1962) p. 274

SEC 2 (C): YOGA AND THEATRICAL MOVEMENTS

Course Number	:	SEC 2 (C)
Course title	:	**Yoga And Theatrical Movements**
Credits Hours	:	3 Credits
No. of contact hours (per week)	:	4 Hours
Type of the Course (hard/soft core)	:	Skill Enhancement Course
General Information	:	Practical
Semester & Year	:	II Semester
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Assignment	:	Yes

Course Objective:

- To analyze and appraise the importance of Yoga in theatre
- To understand basic Yoga techniques.

Course Outcomes:

After successful completion of the course, the student will be able to:

- familiarize the concept of Yoga and Theatre Movement
- arrange and assemble the techniques of Yoga in Thetre performance

Content and concept of the course:

Unit 1: Surynamaskar, Pranayama, Different asana
Unit 2: Meditation Breathing exercise, Head to toe exercise Stretching. Musical movements
Unit 3: Relaxation technique. Body awareness and balancing
Unit 4: Improvised movements based on dance, music and text. Different types of movement like - straight, curved, sidewise etc. Eastern and western method of exercise.

Text books and References:

1. Asanas & Pranayam by Swami Kuvalayanand
2. Sahaj Raj Yoga by Swami Vivekanand
3. Light on Yoga by B. K. S. Tyengar
4. Theatre Games by Clive Barker
5. Theatre Games for the Classroom : A Teacher's Handbook by Viola Spolin
6. Leaving through Yoga Madiram by Ragu Ananthanarayanam
7. Games for Actors and Non-Actors by Augusto Boal
8. Acting Games : Improvisations and Exercises : A Textbook of Theatre Games and Improvisations by Marsh Gary Cassady

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SEMESTER III

MJD-3: THEATRE ARCHITECTURE

Course Number	:	MJD 3
Course title	:	**Theatre Architecture**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Major
General Information	:	Theory
Semester & Year	:	III Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	No
Seminars	:	Yes
Assignment	:	Yes
Test	:	Yes

Course Objective:

- To familiarize the concept of Theatre Architecture
- To Understand Space, technicalities of different types of theatre Architecture

Course Outcomes:

After successful completion of the course, the student will be able to:

identify different kinds of performing art spaces and Theatrical architecture will enhance the spatial aspect of theatre practice of western and eastern designs

Content and concept of the course:

Unit – 1: Indian Classical Theatre in Natyasastra: Ancient Indian Concepts of Theatre and Theatre Buildings; Theatre Space of Indian Ritualistic Performances
Unit – 2: Theatrical Elements in Silapathikaram (Arangketru Kathai)/Spatial aspects in the Traditional Theatre of Tamilnadu
Unit -3: Theatre Architecture - Greek, Roman, Globe, Proscenium
Unit- 4: Theatre Structure of NOH, Kabuki of Japan, Chinese Opera

Texts Books and References:

1) **The Cambridge Guide to Asian Theatre**, Brandon, James R., Cambridge University Press, 1993.
2) **History of the World Theatre** – Oscar G. Brechet
3) **The Theatre of the Middle Ages** – Tyoleman William
4) **Silapathikaram** (portions on theatre only) – Translated by Dr.R.S. Pillai, Tamil University, Tanjore, 1989.

5) **Performing Architecture: Opera Houses, Theatres and Concert Halls for the Twenty-first Century**, by Michael Hammond, Merrell; 1st edition (November 30, 2006)
6) **Koothambalam and Kudiattam**, by Goverdhan Panchal, Published by Sangeet Natak Akedemy 1984
7) **Noh** by Daiji Maruoka, Tatsuo Yoshikoshi, Published by Hoikusha, 1982
8) **Bharatha's Natyasastra** by Dr. Manmohan Ghosh, Volume-ii The Asiatic Society, Calcutta-16, 1961.
9) **Sanskrit Play Production in Ancient India** by Tarla Mehta, Published by Moltilal Banarsidass Publishers Private Limited, New Delhi-1995.
10) **Theatre in the South-East Asia** by J.R.Brandon Harvard University Press, Cambridge, Massachusets-1974
11) **The Chinese Theatre** by Chen Jack Dennis Dobson Ltd., London.

MJD-4: CLASSICAL ANCIENT THEATRE

Course Number	:	MJD 4
Course title	:	**Classical Ancient Theatre**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Major
General Information	:	Theory
Semester & Year	:	III Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	No
Seminars	:	Yes
Assignment	:	Yes
Test	:	Yes

Course Objective:

- To familiarize the concept of Theatre Architecture
- To Understand Space, technicalities of different types of theatre Architecture

Course Outcomes:

After successful completion of the course, the student will be able to:

Identify different kinds of performing art spaces and Theatrical architecture will enhance the spatial aspect of theatre practice of western and eastern designs

Content and concept of the course:

Unit – 1: Introduction to Natya Sastra – Bharata /Origin of Drama
Unit – 2: Natya dharmi and Lokdharmi, Nirupana and Natyasastra-Tolkappiayam / Dasarupahas Vidhana
Unit -3: Bhava: Anubhava, vibava, styi Bhava and Sanchari Bhava, Concept of Rasas: Natyasastra-Thollkappiyam
Unit- 4: Abhinaya- Angika, Vaachika, Haaharya and Saathvika

Text Books and References:

1) **Natya sastra –** Manmohan Ghosh, Appa Rao and Adirangacharya
2) **Ancient drama in Tamil Society** – Dr.K. Sivathambi, NCBH, Madras
3) **Tamil Nataka Varalaru** – K.S. Krishnamurthy
4) **Early Sanskrit Literary theories and Tholkappium** – Dr.K.Sundaramoorthy
5) **Tholkappium Meippattial** (Uraikalam) – K. Vallaivaaranar, Madurai
6) **Sanskrit Drama in Performance**, Ed. Rachel Baumer, Dr. James Brandon, 1981
7) **Traditions of Indian Theatre** – M.L. Varadpande, Abinav Publications,1979
8) **Sources of Indian Tradition Vol. I**, Ed. Stephen Hay, Penguin, ISBN - 0 - 14 - 015462 – 0
9) **Abhinaya Dharbanam**-Abhiyagupta

MID-3 (A): ACTING II: STYLIZED ACTING

Course Number	:	MID-3 (A)
Course title	:	**Acting II: Stylized Acting**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Minor
General Information	:	Practical
Semester & Year	:	III Semester
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Assignment	:	Yes
Practical Record	:	Yes

Course Objective:

- familiarize with the different styles of acting
- To Understand Space, technicalities with "hands-on" experience on Stylization of realistic and nonrealistic movements

Course Outcomes:

After successful completion of the course, the student will be able to:

- learn to analyze a script from a scenic design perspective.

- develop research skills in scenic design.
- develop a scenic design process. Develop skills in representing initial design decisions through thumb-nail sketches and floor plans.

Content of Theory Course

Unit – 1: Improvisations: Exercises for recalling senses, exercise of creating situations, Individual and group exercises using imaginary objects as well as handling real objects and then substituted
Unit – 2: Mime – Traditional and Modern Mime/Pantomime /Choreography
Unit -3: Michel Choekhov Acting techniques. (Basic and Advanced), Acting Techniques of Mayerhold (Theory and Practical), Brechtian Acting Techniques (Approach and Application), *Jerzy* Grotowski's para theatrical training process
Unit- 4: Designing Choreography for Performance, emotional expressions through body, working on stylized movements / Practical Record/

Text books and/or Recommended or Required Readings:

1) Gelb, Michael J. Body Learning: An Introduction to the Alexander Technique.
2) Schneer, Georgette. Movement Improvisation: In the Words of A Teacher and Her Students.
3) Kaltenbrunner, Thomas. Contact Improvisation: Moving, Dancing, Interaction: With an Introduction to New Dance.
4) Novack, Cynthia Jean. Sharing the Dance: Contact Improvisation and American Culture.
5) Albright, Ann Cooper and Geri, David, eds. Taken By Surprise: A Dance Improvisation Reader.
6) Richards, Thomas. At Work With Gortowsky On Physical Actions.
7) John stone, Keith. Impro, Rout ledge, 1979.
8) Spolin, Viola. Improvisation for the Theatre, Cemrel, 1975.
9) Zinder, David, Body Voice Imagination, Routledge, 2002.

1. Technical Theatre Hand Book by Stephen Scott Richardson, WPI, Great Britain, 1996
2. The Director and the Stage by Bran Edward ,Methuen Drama,London-1987

MID 3 (B): DIRECTION PROCESS II: FORMALISTIC

Course Number	:	MID 3 (B)
Course title	:	**Direction Process II: Formalistic**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Minor
General Information	:	Practical
Semester & Year	:	III Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Seminars	:	Yes
Test	:	Yes
Assignment	:	Yes

Course Objectives and outcome of the Course:

The art and technical aspect of direction is covered in this course. The evolution of direction and his role in making performance are studied in detail.

Content and concept of the course:

Unit 1– Introduction to Formalistic Theatre, Direction
Unit 2 – Principles of Direction
Unit 3- Play Analysis and Editing
Unit 4- Interpretation and introduction to Directors Script and Assignments

Text Books and References:

12. Ahart, John**. The Director's Eye**. Colorado Springs: Meriwether Pub. Ltd., 2001.
13. **The Director's Voice,** by Arthur Bartow.
14. **On Directing**, by Harold Clurman
15. **Makers of Modern Theatre,** Rama Rao
16. **Directorial approach of Theru -K-Koothu**, R. Raju 2006
17. **Scenic design and stage lighting,** The Columbia Encyclopedia, Sixth Edition. 2001. at www.riscoptright.com
18. **Theatrical Design and Production: An Introduction to Scene Design and Construction, Lighting, Sound, Costume, and Makeup** (4th edition) by J. Michael Gillette. (Mountain View, CA: Mayfield Publishing Company. 2000).
19. **The Staging Hand Book** by Francis Reid, A&C, Black ,London, second edition-1995
20. **Stage Craft and Scene Design** by Herbert Phillippi, Houghton Mifflin Company, Boston, First Edition-1953.

21. **Technical Theatre Hand Book** by Stephen Scott Richardson, WPI, Great Britain, 1996
22. **The Director and the Stage** by Bran Edward ,Methuen Drama,London-1987

MID-3 (C): DESIGNING TECHNIQUES: MAKE-UP

Course Number	:	MID-3 (C)
Course title	:	**Designing Techniques: Make-Up**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Minor
General Information	:	Practical
Semester & Year	:	III Semester
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Assignment	:	Yes
Practical Record	:	Yes

Course Objective:

- familiarize with the concept of Make Up
- understand different types of makeup in thetare
- "hands-on" experience on Makeup and technicalities

Course Outcomes:

After successful completion of the course, the student will be able to:

- learn concept of Make Up.
- develop a design process. Develop skills in makeup.

Content of Theory Course

Unit – 1: The Role of Make- up in Play Performance, Functions and Principles of Make-up
Unit – 2: Introduction of Make-up materials, Types of Make Up- Straight, Character, Sculpture and Mosaic Make Up,
Unit -3: Applications of Base/Highlighting Place/Shading Places, Changing the eye brows, lips, Moustaches, Beards, Use of Crepe Hair
Unit- 4: Analysing a play in the point of view of Make-up Designing Prepare a Make –up plate for all the characters in a play , All the practical works should be compiled and maintained as a record book.

Materials, Supplies, Text books and/or Recommended or Required Readings:

1. Stage makeup, by Richard Corson, Printice-Hall, Inc., 1970
2. Theatrical Design and Production: An Introduction to Scene Design and Construction, Lighting, Sound, Costume, and Makeup (4th edition) by J. Michael Gillette. (Mountain View, CA: Mayfield Publishing Company. 2000).
3. Stage Make-up, by Richard Corson, Appleton –Century –Crofts, New york1967
4. Cosmetics Science and Technology Editor by Edward Sagarin, Inter -science Publishers Ltd., London-1957
5. Arangam Athan Kurugal by Jeeva, Pondicherry-1998

MLD-3: FOLK PERFORMANCES

Course Number	:	MLD-3
Course title	:	**Folk Performances**
Credits Hours	:	3 Credits
No. of contact hours (per week)	:	4 Hours
Type of the Course (hard/soft core)	:	Multi-Disciplinary
General Information	:	Practical
Semester & Year	:	III Semester
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Assignment	:	Yes
Practical Record	:	Yes

Course Objectives and outcome of the Course:

Introduction to Folk Performing Arts with their Socio and Ritual values and their customs and beliefs. The value of our traditional art form and their entertainment value in society are the main concern.

Content and concept of the course:

Unit – 1: Introduction to Folk Performance (Regional – seasonal – period etc) / Elements of Tamil Folk Performances – variations
Unit – 2: Karagaattam, Periya Melam, Erudhu kattu Melam, Chauu, Kathakali, Koodiyattam, Mayilattam, Poikkal Kudhirai Attam, Muscruth Attam, Folk Songs and its Social Values, Kavadi Aattam, Folk Music and Musical Instruments (Urumi, Parai, Chentai,Udukku, Kattaikulal, Oodhu Kombu, etc) and other regional Folk art forms of india

Unit -3: Practice and Performance
Unit- 4: Assignments and Presentations

Text Books and Referebnces:

1. **Aesthetics of Indian Folk Dance** – Brejesh Banerji (Casmi Publications, Delhi)
2. **Traditions of Indian Folk Dance** – Kapila Vatsyanan (Clarion Books
3. **Folk theatres of India**, Balwant Gargi, Rupa
4. **Folk Music and Folk Lore and Anthology Memangobis** (Chief Editor), 1967.
5. **The Character of Folk dances** – Mary Tamielli off print from Folk Lore Volume LXIV – June, 1956.
6. **European Folk dance** – Joan Camson – Pitman Publishing, Britain, 1972.
7. **Folk Lore and Folk Lore** – Richard Dorshon – The University of Chicago Press, London, 1972.
8. **Studies in Tamil Folk Literature** – N. Vanamamalai, NCBH, Madras, 1969.

Reference Books in Tamil:

1. **Nattapura Nigazh Kalaigal** – Dr.K.A. Gunasekaran, NCBH, Madras, 1993.
2. **Nattupura Nadanangulam Padalkalum**, Dr.K.A. Gunasekaran, NCBH, Madras.
3. **Naattuuppura Paadal Kazhanchiyam- Thogudhi – 5,** Dr.A.Dhananjayan, Meyyappan Aaivagam, Chidambaram, 2001
4. **Kulakkuriyalum meenavar vazhakkarugalum –** Dr. A.Dhanajayan, NCBH Publications, Chennai, 2011
5. **Tamizhakathil Therukkoothu** – Dr.A. Arivunambi.
6. **Thorpavai Nizhalkoothu** – Dr.M. Ramasamy
7. **Nattupura Padalkal Kattum, , Thamizar Vazhviyal**, R. Ramanathan ,Manivasagam Printers. Chidambaram
8. **Tamilaga Kalaiselvangal** – Dr. Tulasi Ramasamy, International Tamil Studies.Chennai.
9. **Tamizhar Koothukkal** – International Tamil Studies
10. **Tamilnattu makkalum Panpadum** – Somale, National Book Trust, Delhi
11. **Tamil Nadakamum Sankaradass Swamigalum** – Annam Printers, Siva Gangai.
12. **Nattar Vazhakkatrial Aaivugal** – D. Lourde.
13. **Nattupura Iyal** – Dr.S. Shanmuga Sundaran – Manivasagam Publications.
14. Gopalakrishna Bharathiyar – **Thirumalaipovar enum Nandanar Sarithira**
15. **Keerthana,** Rata Nayakkar and Sons, Chennai, 1960.
16. **Indraiya Tamilnadaka Choozhal** – Dr.K.A. Gunasekaran, Thannane Publishers, Pondicherry, 1999.

SEC 3 (A): PUBLIC SPEAKING

Course Number	:	SEC 3 (A)
Course title	:	**Public Speaking**
Credits Hours	:	3 Credits
No. of contact hours (per week)	:	4 Hours
Type of the Course (hard/soft core)	:	Skill Enhancement Course
General Information	:	Practical
Semester & Year	:	III Semester
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Assignment	:	Yes

Course Objective:

- To analyze and appraise the importance of Public Speaking Skill
- To understand basic speaking techniques.

Course Outcomes:

After successful completion of the course, the student will be able to:

- familiarize the concept of Public Speaking
- arrange and assemble the techniques of Public Speaking

Content and concept of the course:

Unit 1: Introduction to Public Speaking, Types of Public Speaking
Unit 2: Public Speaking Skills Communication, Clear articulation, Presentation style, Confidence, Passion, Ability to connect with the audience, Practise speaking, Focus on your body language.
Unit 3: Practicing the 7 P's-pronunciation, pace, pause, punch, power, passion, and posture
Unit 4: Choosing topics and Speaking, Assignments and Experiments

Text Books and References:

1. Collins, Philip. "The Art of Speeches and Presentations" (John Wiley & Sons, 2012).
2. Fairlie, Henry. "Oratory in Political Life," History Today (Jan 1960) 10#1 pp. 3–13. A survey of political oratory in Great Britain from 1730 to 1960.
3. Flintoff, John-Paul. "A Modest Book About How To Make An Adequate Speech" (Short Books, 2021). excerpt
4. Gold, David, and Catherine L. Hobbs, eds. Rhetoric, History, and Women's Oratorical Education: American Women Learn to Speak (Routledge, 2013).
5. Heinrichs, Jay. "Thank You For Arguing" (Penguin, 2008).
6. Lucas, Stephen E. The Art of Public Speaking (13th ed. McGraw Hill, 2019).
7. Noonan, Peggy. "Simply Speaking" (Regan Books, 1998).

8. Parry-Giles, Shawn J., and J. Michael Hogan, eds. The Handbook of Rhetoric and Public Address (2010) excerpt
9. Sproule, J. Michael. "Inventing public speaking: Rhetoric and the speech book, 1730–1930." Rhetoric & Public Affairs 15.4 (2012): 563–608. excerpt
10. Turner, Kathleen J., Randall Osborn, et al. Public speaking (11th ed. Houghton Mifflin, 2017). excerpt
11. Dale Carnegie· Arthur R. Pell. Public Speaking for Success. 2006
12. Dale Carnegie. Public Speaking and Influencing Men in Business. 2003
13. Dale Carnegie. How to Develop Self-Confidence & Influence People by Public Speaking. New York: Pocket Books,1926
14. Chris Anderson. The Official TED Guide to Public Speaking. Houghton Mifflin Harcourt, Boston, 2016.

SEC 3 (B): DIGITAL DESIGN

Course Number	:	SEC 3 (B)
Course title	:	**Digital Design**
Credits Hours	:	3 Credits
No. of contact hours (per week)	:	4 Hours
Type of the Course (hard/soft core)	:	Skill Enhancement Course
General Information	:	Practical
Semester & Year	:	III Semester
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Assignment	:	Yes

Course Objective:

- To analyze and appraise the importance of Digital Designing
- To understand basic designing techniques techniques.

Course Outcomes:

After successful completion of the course, the student will be able to:

- familiarize the concept of Digital Designing
- arrange and assemble the techniques of Digital Designing

Content and concept of the course:

Unit 1: Introduction to Digital Design- immersive class in the digital tools of design
Unit 2: Photography, Photoshop ,After Effects, QLab and Projection
Unit 3: 3D Drafting (Vector works and Sketch up) and 3D Printing.
Unit 4: Preparing Digital Posters, Prints, Publicity

Text Books and References:

1. Berry, D. M. and Dieter (2015) Postdigital Aesthetics: Art, Computation and Design, London: Palgrave. ISBN 978-1137437198
2. Paul, Christiane (2016). "Introduction From Digital to Post-Digital—Evolutions of an Art Form". In Paul, Christiane (ed.). A Companion to Digital Art. Malden, MA: Wiley. pp. 1–2. ISBN 978-1-118-47520-1.
3. Reichardt, Jasia (1974). "Twenty years of symbiosis between art and science". Art and Science. **XXIV** (1): 41–53.
4. Christiane Paul (2006). Digital Art, pp. 7–8. Thames & Hudson.
5. Lieser, Wolf. Digital Art. Langenscheidt: h.f. ullmann. 2009, pp. 13–15
6. Grierson, Mick. "Creative Coding for Audiovisual Art: The CodeCircle Platform" (PDF).
7. "Sketchpad | computer program | Britannica". www.britannica.com. Retrieved 2022-12-01.
8. Free Press wins its 9th Pulitzer; Reporting led to downfall of mayor". (April 21, 2009). Detroit Free Press, p.1A.
9. "The 2009 Pulitzer Prize Winners: Local Reporting". The Pulitzer Prizes. Retrieved 2013-10-26.
10. Cohn, Gabe (2018-10-25). "AI Art at Christie's Sells for $432,500". The New York Times. ISSN 0362-4331. Retrieved 2022-10-04.
11. "Not the Only One". Creative Capital. Retrieved 2023-02-26.
12. "Sougwen Chung". The Lumen Prize. Retrieved 2023-02-26.
13. "2022 Fine Arts Placings of the Colorado State Fair" (PDF).
14. "Refik Anadol: Unsupervised | MoMA". The Museum of Modern Art. Retrieved 2023-02-26.

SEC 3 (C): MODEL MAKING

Course Number	:	SEC 3 (C)
Course title	:	**Model Making**
Credits Hours	:	3 Credits
No. of contact hours (per week)	:	4 Hours
Type of the Course (hard/soft core)	:	Skill Enhancement Course
General Information	:	Practical
Semester & Year	:	III Semester
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Assignment	:	Yes

Course Objective:

- To analyze and appraise the importance of Making Models
- To understand basic Model Making techniques

Course Outcomes:

After successful completion of the course, the student will be able to:

- familiarize the concept of Models
- arrange and assemble the techniques of Model Making

Content and concept of the course:

Unit 1: Introduction to Model Making
Unit 2: Designs of Groung Plan and Elevation plans
Unit 3: Different types of materials used in making models, Selection of type of Theatre- Natyamantapa, Amphi Theater, Globe, Procenium, Noh and Kabuli Theatre
Unit 4: Preparing and presenting a Model for exam

Text Books and References:

1. Brockett, Oscar G., Margaret Mitchell, and Linda Hardberger. *Making the Scene: A History of Stage Design and Technology in Europe and the United States*, Tobin Theatre Arts Fund, distributed by University of Texas Press, 2010. Traces the history of scene design since the ancient Greeks.
2. Pecktal, Lynn. *Designing and Painting for the Theater*, McGraw-Hill, 1995. Details production design processes for theater, opera, and ballet. The foundational text provides a professional picture and comprehensive references to the design process. Well-illustrated with detailed lined drawings and photographs to convey the beauty and craft of scenic and production design.
3. "Set Designer | Berklee". Berklee. Retrieved 2023-11-05.
4. LuPone, Robert (2008), Erlhoff, Michael; Marshall, Tim (eds.), "Set Design", Design Dictionary, Board of International Research in Design, Birkhäuser Basel, pp. 357–359, doi:10.1007/978-3-7643-8140-0_245, ISBN 978-3-7643-8140-0, retrieved 2023-11-08
5. Pincus-Roth, Zachary (2008-01-31). "ASK PLAYBILL.COM: Sets". Playbill. Retrieved 2019-10-31.
6. "Training as a Theatre Designer". Central School of Speech and Drama, University of London article. Archived from the original on 2016-09-03. Retrieved 2011-04-02.
7. "Scenography, MA/MFA". The Royal Central School of Speech and Drama. Retrieved 2023-11-08.
8. "Scenic Designer". Yale Undergraduate Production. Retrieved 2021-12-22.

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SEMESTER IV

MJD-5: DRAMATIC LITERATURE – CLASSICAL INDIAN

Course Number	:	MJD 5
Course title	:	**Dramatic Literature- Classical Indian**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Major
General Information	:	Theory
Semester & Year	:	IV Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	No
Seminars	:	Yes
Assignment	:	Yes
Test	:	Yes

Course Objective:

- familiarize with classical literature
- to analyse the dramatic literature intensely related to classical Indian Theatre

Course Outcomes:

After successful completion of the course, the student will be able to:

- learn to analyse a Dramatic Literature
- develop knowledge in Classical Indian literature
- summarise the dramatics of ancient classical theatre.

Unit – 1: Ancient Indian Drama – An Introduction; Sanskrit Theatre and Dramatists
Unit – 2: Indian Philosophical systems an Introduction; Textual Analysis- Plot, Structure and Theme
Unit -3: Kalidasa- Abhijana Sakunthalam, Sudraka – Mirchakatikam, Mahendravarma Pallavan – Bagavathajeevigiyam, Sankaradoss Swamigal – Valli Thirumanam
Unit- 4: Assignment and Classroom Seminars on Classical Playwrights/ Final Exam

Text books and/or Recommended or Required Readings:

1) Brandon, James R. The Cambridge Guide to Asian Theatre. Cambridge: Cambridge University Press, 1993.
2) Wilson and Goldfarb, Living Theater: A History, 4th edition.
3) Dasarupaka
4) Vadamozhi Nataka Ilakkiya Varalaru
5) **Natya sastra –** Manmohan Ghosh, Appa Rao and Adirangacharya
6) **Ancient drama in Tamil Society** – Dr.K. Sivathambi, NCBH, Madras
7) **Tamil Nataka Varalaru** – K.S. Krishnamurthy

8) **Early Sanskrit Literary theories and Tholkappium** – Dr.K.Sundaramoorthy

9) **Tholkappium Meippattial** (Uraikalam) – K. Vallaivaaranar, Madurai

10) **Sanskrit Drama in Performance**, Ed. Rachel Baumer, Dr. James Brandon, 1981

11) **Traditions of Indian Theatre** – M.L. Varadpande, Abinav Publications,1979

12) **Sources of Indian Tradition Vol. I**, Ed. Stephen Hay, Penguin
13) ISBN - 0 - 14 - 015462 – 0
14) **Abhinaya Dharbanam**-Abhiyagupta

MJD-6: CONTEMPORARY INDIAN THEATRE

Course Number	:	MJD 6
Course title	:	**Contemporary Indian Theatre**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Major
General Information	:	Theory
Semester & Year	:	IV Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	No
Seminars	:	Yes
Assignment	:	Yes
Test	:	Yes

Course Objective:

- familiarize with the Indian Theatre post classicalism
- To Understand and analyse thew contemporary Indian theatre and playwrights

Course Outcomes:

After successful completion of the course, the student will be able to:

- learn to analyse and contemporize Indian Theatre
- Summarise and interpret the plays

Unit – 1: Modernity in India: Impact on Art; Modernism in Indian Drama some trends ; extual Analysis- Plot, Structure and Theme.
Unit – 2: Street Theatre- Introduction, development and street plays analysis
Unit -3: Play Analysis: Andayuk by Taramveer Bharathi- Evam Indrajit by Badal Sircar; Silence the court is in session by Vijay Tendulkar-Naga mandala by Girish Karnard, Aurungazeb by Indira Parthasarathy-Narkalikaran by Muthusami
Unit- 4: Assignments and Seminar and Exam

Materials, Supplies, Text books and/or Recommended or Required Readings:

1) Brandon, James R. The Cambridge Guide to Asian Theatre. Cambridge: Cambridge University Press, 1993.
2) Wilson and Goldfarb, Living Theater: A History, 4th edition.
3) Pavallakkodi Allathu Kuduppa Vazhakku --Dr.K.A.Gunasekaran
4) Indian Drama in English by Ananda Lal, IWE Online, 13 May 2022.
5) The Indian theatre, by Mulk Raj Bansal, Published by D. Dobson, 1950.
6) Theatre in India, by Balwant Gargi. Published by Theatre Arts Books, 1962.
7) A panorama of theatre in India, by Som Benegal. Published by Popular Prakashan [for] Indian Council for Cultural Relations (ICCR), 1968.
8) Roy, Pinaki. "Bratya Basu's Boma: Bombing the Coloniser-supervised Chronicle". Postcolonial Indian Drama in English and English Translation: Reading Themes and Techniques (ISBN 978-93-5207-560-7). Eds. Sarkar, J., and U. De. New Delhi: Authors Press, 2017. pp. 287–300.
9) Roy, Pinaki. "Bratya Basu's Boma: Bombing the Coloniser-supervised Chronicle". Postcolonial Indian Drama in English and English Translation: Reading Themes and Techniques (ISBN 978-93-5207-560-7). Eds. Sarkar, J., and U. De. New Delhi: Authors Press, 2017. pp. 287–300.
10) Indian Theatre: Traditions of Performance, by Farley P. Richmond, Darius L. Swann, Phillip B. Zarrilli. Motilal Banarsidass Publ., 1993. ISBN 81-208-0981-5.
11) Indian theatre: theatre of origin, theatre of freedom, by Ralph Yarrow. Routledge, 2001. ISBN 0-7007-1412-X.
12) The Oxford companion to Indian theatre, by Ananda Lal. Oxford University Press, 2004. ISBN 0-19-564446-8.
13) jagrancityplus
14) A History of the Jana Natya Manch: Plays for the People" by Arjun Ghosh; Published by SAGE Publications India, New Delhi; 2012

MJD-7: NEW TRENDS IN WORLD THEATRE

Course Number	:	MJD 7
Course title	:	**New Trends in World Theatre**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Major
General Information	:	Theory
Semester & Year	:	IV Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	No
Seminars	:	Yes
Assignment	:	Yes
Test	:	Yes

Course Objective:

- familiarize with the new trends in theatre
- To Understand and analyse different trends in world theatre

Course Outcomes:

After successful completion of the course, the student will be able to:

- learn to analyse trends in theatre
- Summarise and interpret the new trends in world theatre

Unit – 1: Introduction to theatre techniques; development of new trends in theatre
Unit – 2: Theatre Movements, concepts and Ideas: Theatre of Cruelty, Black theatre, Feminist theatre, Theatre of Oppressed, Theatre of the Protested, Third theatre, Forum theatre, Ethnic theatre and Dalith theatre, Avant-garde theatre, Neo-classicism, Post-modern theatre, Theatre Therapy
Unit -3: Contemporary Trends in Indian Theatre and Western Theatre; Comparative study
Unit- 4: Assignments and Seminar and Exam

Text Books and References:

1) The Oxford illustrated History of Theatre, John Russell Brown, Oxford University Press, 1995.
2) Gelb, Michael J. Body Learning: An Introduction to the Alexander Technique.
3) Schneer, Georgette. Movement Improvisation: In the Words of A Teacher and Her Students.
4) Kaltenbrunner, Thomas. Contact Improvisation: Moving, Dancing, Interaction: With an Introduction to New Dance.
5) Novack, Cynthia Jean. Sharing the Dance: Contact Improvisation and American Culture.

MID-4 (A) ACTING FOR DIFFERENT MEDIA

Course Number	:	MID-4 (A)
Course title	:	**Acting for Different Media**
Credits Hours	:	4 Credits
No. of contact hours (per week)	:	5 Hours
Type of the Course (hard/soft core)	:	Minor
General Information	:	Practical
Semester & Year	:	IV Semester
Prerequisite	:	NIL
Regular Teaching	:	Yes
Practical if applicable	:	Yes
Seminars	:	Yes
Assignment	:	Yes
Test	:	Yes

Course Objectives and outcome of the Course:

- Provides fundamental concepts and techniques of performance, an essential foundation for anyone wanting to act for the camera.
- Involves acting exercises, scene work, monologues, acting games, reading, text analysis, and processes for creating character and creating a role.
- Essential for that need to know how to work with actors, directors, and producers of film, and

television.

Content and concept of the course:

Unit –1: Lecture: Theatre performance vs. On-camera, Radio Plays, News Reading
Unit – 2: On Camera: Presenting Yourself / Getting to Know You And Your Type. Read Film Form Handout and Become Familiar with Framing and Camera Direction Handouts
Unit -3: The Creation of a Commercial. The Importance of the Storyboard. Film Form/Shot Breakdown and Framing.
Unit- 4: Rehearse Monologues/Radio Commercial and prep for it / View and Discuss. Rehearse Scenes, Shoot Monologues / Headshot session with photographer, Shoot Final Scenes and Monologues / View Final Scenes

Text Books and References:

1. Barr, Tony. Acting for the Camera, Harper Perennial, 1997.
2. Caine, Michael. Acting in Film, Applause, 1997.
3. Henry, Mari Lyn and Lynne Rogers. How to be a Working Actor, Watson-Guptill, 2000.
4. Merlin, Joanna. Auditioning, Vintage, 2001.
   Students will also be required to obtain film scripts
5. Acker, Iris. The Secrets to Auditioning for Commercials, Distinctive Publishing, 1991.
   Ball, William. A Sense of Direction, Drama Publishers, 1984.
   Barnes, Michael J. and George Contini. Theatre and Film on the Net,
6. Allyn and Bacon, 2001.
7. Bruder, Melissa et al. A Practical Handbook for the Actor, Random House, 1986.
8. Cohen, Robert. Acting Professionally, Mayfield Publishing, 1998.
9. Field, Syd. Screenplay, Dell Publishing, 1994.
10. Garrison, Larry. Breaking into Acting for Dummies, For Dummies, 2002.
11. Gillespie, Bonnie. Casting Q's, Cricket Feet Publishing, 2003.
12. Hurtes, Hettie Lynne. Agents on Actors, Backstage Books, 2000.
13. Katz, Stephen. Shot by Shot, Michael Wiese Productions, 1991.
14. Kerr, Judy. Acting is Everything; An Actor's Guidebook for a Successful Career in Los Angeles, September Publishing, 2003.
15. Lemack, Brad. **The Business of Acting**, Ingenuity Press, 2002.
16. Tucker, Patrick. **Secrets of Screen Acting**, Routledge, 1994.

ANNEXURE – I

REVISED GUIDELINES, REGULATIONS, AND SYLLABI

2019-20

M. A. Mass Communication
2-Year Masters Programme

DEPARTMENT OF ELECTRONIC MEDIA & MASS COMMUNICATION
PONDICHERRY UNIVERSITY
PUDUCHERRY – 605 014

FIRST SEMESTER

Course Code : **MASC 411**
Course Title : **COMMUNICATION PHILOSOPHIES AND THEORIES**

Theory**: 3 Credits / Hardcore**

Course Overview:

In this course, students will learn various theories that describe and explain human communication behaviour and interpersonal communication dynamics in face-to-face and mediated setting. Students will study theories in the contexts of the communication field: interpersonal, small group, pubic, organizational, mass media, intercultural and gender. Students will also be introduced to different schools of communication, their orientations, the development of theoretical inquiry in the field of communication, including Frankfurt School, CCCS, Marxism etc. to understand all forms of media, mediated events, cultures among others. Further, students will be encouraged, through structured assignments, to apply the theories to their own lives. Theories are taught using prescribed reading materials as well as through the use of films and other visual materials.

Learning Outcomes:

Upon completion of this course, students will be able to:

1. To be knowledgeable about theories that explain a wide range of communication phenomena
2. To enhance communication competence as a result of studying theories
3. To distinguish similarities and differences among theories
4. To understand the ways in which communication inquiry occurs
5. To develop competencies in using theories to analyze actual events
6. To appreciate the current conduct of communication research

COURSE CONTENTS

Unit 1: Communication: Origins and Types
Communication Theory: Scope and definitions Schools of Communication - Types of Communication - Communication Theories: Indian, Eastern and Western philosophies Human Communication / Interpersonal communication and Cross-cultural Communication

Unit 2: Critical Theory of Communication
Robert Craig's "Communication Theory as a Field" Raymond Williams: high and low cultures – Stuart Hall: Representation, Identity / Encoding and Decoding Rhetoric and Persuasion – Overview of models of communication: Shannon & Weaver, David Berlo, Osgood-Schramm, Transmission, Ritual and Publicity models

Unit 3: Media and Culture Studies
Understanding Media and culture: Base and Superstructure
Louis Althusser's Ideology and Antonio Gramsci's Hegemony
Theodor Adorno and Max Horkheimer: Culture as Industry
Political economy of media
Social Constructionism / Technology determinism vs. social determinism
Information/ Knowledge / Networked Societies

Unit 4: Positivist theories of Communication

Lasswell's Magic Bullet Theory
Symbolic Interactionism/Selective perception, retention / Cognitive dissonance
Cultivation Theory/Spiral of Silence Theory
Agenda-setting /Framing/Priming Theories Two-step Flow Model
Uses and gratifications Theory
McLuhan: The Medium is the Message/Medium Theory Diffusion of Information

Unit 5: Applied Communication projects

The last unit will be an Applied Theory programme wherein students can draw on any of the theories learnt and prepare any one of the following though the options are not limited to whatever is specified here
Communication plan for media industry/Communication plan for an NGO
Communication plan for digital media/Communication plan to study a phenomenon Reviewing a film using theories learnt/Preparing a research agenda – Preparing an outline for documentary on a topic using one of the theories as a lens Interpersonal communication plan for any organisation
Cross-cultural communication plan for MNCs

Text Books:

1. Floyd, K., Schrodt, P., Erbert, L. & Angela. (2017). Exploring communication theory: Making sense of us. NY: Routledge.
2. Mattelart, A., Mattelart, M. (1995). Theories of communication: A short introduction. London: Sage. McQuail, D. (2010).
3. McQuail's mass communication theory (6th Edition). London: Sage.Prysthon, A. (2016).
4. Stuart Hall, film studies and the cinema. MATRIZes Journal, 10 (3). 77-88. Rosenberry, J. &Vicker, L. A. (2009).
5. Applied mass communication theory: A guide for media practitioners. NY: Routledge.
6. Wayne, M. (2003).
7. Marxism and media studies: Key concepts and contemporary trends. NY: Pluto Press.

Web resources:

https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/library_and_information_science/knowledge_society/05._theories_and_models_of_communication/et/4305_et_et.pdf.

http://people.unica.it/ernestinagiudici/files/2014/03/CRAIG-COMMUNICATION-THEORY-AS-A-FIELD.pdf

http://dmcodyssey.org/wp-content/uploads/2013/09/INTRODUCTION-TO-HUMAN-COMMUNICATION.pdf

http://catalogue.pearsoned.co.uk/samplechapter/0205353908.pdf

https://faculty.georgetown.edu/irvinem/theory/SH-Encoding-Decoding.pdf

http://www.revistas.usp.br/matrizes/issue/view/9256

Course Code : **MASC 412**
Course Title : **NEWS WRITING AND REPORTING: THEORY AND PRACTICE**

Theory**: 3 Credits / Hardcore**

Course Overview:

This course aims to introduce students to reporting different types of news in various settings and scenarios. Writing techniques of the reported stories will also form the part of the course where students will undergo both theoretical and practical sessions on writing. Apart from these the course also focuses on editing news and the principles involved in it. Layout designing using page designing softwares also forms a part of the course whereby students edit and design the story written by them.

Learning Outcomes:

Upon completion of this course, students will be able to:

1. Elaborate on ethics of reporting.
2. Do outdoor field reporting on various issues.
3. Write news for different news platforms.
3. Give headlines to news stories.
4. Write captions for images.
5. Edit news and design newspaper pages using layout design software.

COURSE CONTENTS

Unit 1: **News Types & Principles of Reporting**

News Types and Principles of Reporting - Types of news - News elements Attribution - Responsibilities - Precautions

Unit 2: **Types & Tools of Reporting**

Types and tools of reporting Field reporting - Using data for reporting courts and communities Reporting hunger and poverty - Research Use of RTI, search engines and AI

Unit 3: **Writing News**

Writing news Headlines and Captions Leads - Features and Opinions Writing for TV - Writing for online media

Unit 4: **News Editing and Functions**

News editing and functions Editing principles - Editing Desks Copy editing - Style sheets Fonts, columns

Unit 5: **News Platforms**

News Platforms News in print media News in Television News in Social media News Websites - Case study

Text Books:

1. Writing and Editing News: KV Krishnaswamy, Orient Blackswan Private Limited, 2015
2. Headline Writing: Sunil Saxena, Sage, 2006.
3. News Reporting and Writing: Alfred Lawrence Lorenz and; John Vivian, Pearson Education, 2006.
4. The Journalist's Handbook: M. V. Kamath, Vikas, 2007.
5. The Elements of Style: Strunk, William and; White, E.B. Longman, 1999
6. Convergent Journalism: The Fundamentals of Multimedia Reporting. Stephen Quinn, Lang Publishing, 2005.

Additional Readings (Suggested)

1. The Newswriter's Handbook– An Introduction to Journalism: M.L. Stein & Susan F. Paterno, Blackwell, 2005.
2. The Editor's Toolbox– A Reference Guide for Beginners and Professionals: Buck Ryan & Michael O'Donnell, Iowa State Press, 2001

Assignments

Students will have to bring out newspapers (4 pages) consisting of stories reported, written and edited individually. Students will also have to make a presentation on an assigned topic.

General Course Policies

Two continuous assessments or formative exams will be conducted during each semester and students will be informed beforehand about the exam schedule. In case, if on any valid reason, a student fails to appear for the exam, s/he may be allowed to request the faculty for a third Internal Test. Students have to put in a minimum of 70 % attendance to be able to write the end semester exams.

Course Code : **MASC 413**
Course Title : **THE FUTURE OF JOURNALISM**

Theory**: 3 Credits;** Practical: **1 Credit - 4 Credits / Hardcore**

Course Overview:

This course will introduce you to the basic principles of journalism important to journalistic practice. It will engage you in a critical inquiry and discussion through which you will learn the building blocks for modern journalism practice. Also, through collaborative theatre activities, you will explore experientially what waits for you as a future journalist. The key issues in society that journalists must pay attention to will be raised to enable reflection and peer group learning.

Learning Outcomes:

1. Understand the concepts of truth and information accuracy, verification – evidence, fact- checking and corroboration; fairness and balance, moral judgments, news sources- accurate attribution and confidentiality of anonymous sources.
2. Know the importance of allegiance to citizens and the larger public interest above any other to provide the news without fear or favour; fairly represent the varied viewpoints and interests in society, and to place them in context rather than highlight only the conflicting fringes of debate; to serve as a watchdog over those whose power and position most affect citizens.
3. Nurture independence by encouraging individuals to speak their minds and stimulating the intellectual diversity necessary to understand and accurately cover an increasingly diverse society.
4. Introduce 'Journalism- storytelling with a purpose' and the necessity of keeping news comprehensive and in proportion, and not inflating events for sensation, neglecting others, stereotyping or being disproportionately negative.
5. Encourage practice of principles of critical thinking and decision making; Integrity and accountability; Exercising a personal sense of ethics and responsibility and mastering an increasingly complex body of knowledge and specialized skills including a balance of conceptual, philosophical and skills-based content.

COURSE CONTENTS

Unit 1: Seeking the truth and information accuracy

News elements and values - Notion of truth – Verification – Evidence, fact- checking and corroboration–Plagiarism.
Transparency and accountability vs. 'Fake News'
Right to Information: Using RTI as a tool for journalism
Separation between news and opinion -- Moral judgments
Working with sources – accurate attribution and protection of sources
Accuracy as the foundation upon which everything else is built – Speed versus accuracy - Case Studies and Collaborative Theatre: Investigations and struggles faced in uncovering the truth.

Unit 2: Allegiance to citizens and the larger public interest above any other

To provide the news without fear or favour – Fairly represent the varied viewpoints and interests in society, and to place them in context rather than highlight only the conflicting fringes of debate - Representation of marginalized and the subaltern: Grassroot journalism - Taste and representation of issues in the media including- the printed word, the still photograph, the moving image, traditional media and new media - Gender and sexual orientation – Stereotyping - Portrayal of women, children, differently abled - how does the media represent them?
Victims or survivors? Working with survivors of trauma
Case Studies and Collaborative Theatre: Public-interest journalism

Unit 3: Independence of spirit and mind, rather than neutrality

Personal integrity – Ethics and Accountability. Who is the media accountable towards? Corporatization of media houses.
Nurturing independence by encouraging individuals to speak their minds and stimulating the intellectual diversity necessary to understand and accurately cover an increasingly diverse society. Point-of-view journalism
Fairness and objectivity. The age of freelance journalism. Resisting and Surviving.
Libel and Defamation: Also as means for intimidation and silencing the media
Sexual Harassment at the workplace: #MeToo Movement in India and Abroad
Safety and protection of journalists: Perils of regional and local journalists
Case Studies and Collaborative Theatre: Independent journalism

Unit 4: Making the significant interesting and relevant

Journalism – 'storytelling with a purpose'. Entertainment, infotainment, edutainment - Continually asking what information has most value to citizens and in what form - Avoiding trivia and false significance that engenders a trivial society
Keeping news comprehensive and in proportion, and not inflating events for sensation, neglecting others, stereotyping or being disproportionately negative.
Media bias, sensationalism and propaganda: In the context of corporates and politicians owning media houses - Case Studies and Collaborative Theatre: 'Storytelling with a purpose'

Unit 5: Principles of critical thinking and decision making

Exercising a personal sense of ethics and responsibility – a moral compass
Mastering an increasingly complex body of knowledge and specialized skills including a balance of conceptual, philosophical and skills-based content
As framers of public discussion, not to neglect the points of common ground where problem solving occurs - To serve as a watchdog over those whose power and position most affect citizens - Ethical concerns in investigative journalism.
Trial by media - Context, interpretation, comment, criticism, analysis, debate and trolling Social Media: New roles for journalism and mobilizing public opinion
The new trend of Mobile Journalism (MoJo).
Case Studies and Collaborative Theatre: Our changing journalism world

Pedagogical Approach:

Lectures will be supplemented with discussions and critiquing of journalistic content in various media. Theatre activities including role playing, hot seating, simulations and street theatre will be facilitated for students to develop the ability to think critically and practice journalistic principles. Students will engage with writing assignments reflecting their understanding.

General Course Policies:

Written tests, assignments and theatre activities will form the basis of evaluation for a maximum of 40% marks. The remaining 60% marks will be assessed through a written end semester examination. Outstanding works submitted by students will be published on The Inquirer website: http://puinquirer.edu.in/

Textbooks:

1. 21st Century Journalism in India: ed. Nalini Rajan, Sage, 2007.
2. An Introduction to Journalism: Carole Fleming et al., Vistaar, 2006.
3. Journalistic Ethics - Moral responsibility in the media: Dale Jacquette, Pearson Education, 2007.
4. Journalism Principles & Practice: Tony Harcup, Vistaar, 2006.
5. Journalism through RTI - Information Investigation Impact: Shyamlal Yadav, 2017.
6. Key Concepts in Journalism Studies: Bob Franklin et al., Vistaar, 2006.
7. Poverty Matters - Covering Deprivation in India: K. Nagaraj, Orient BlackSwan, 2017.
8. Practising Journalism - Values, Constraints, Implications: ed. Nalini Rajan, Sage, 2006.
9. Public Interest Journalism - A Guide for Students: Arvind Sivaramakrishnan, Orient BlackSwan, 2014.
10. The Journalists Handbook: M. V. Kamath, Vikas, 2007.
11. The Professional Journalist: John Hohenberg, Blackwell, reprinted in India by Surjeet, 2007.
12. The RTI Story - Power to the People: Aruna Roy, MKSS Collective, 2018.
13. Understanding Journalism: Lynette Sheridan Burns, Vistaar, 2004.
14. Whose News? The Media and Women's Issues: eds. Ammu Joseph & Kalpana Sharma, Sage, 2006.

Articles:

1. Defining the principles of ethical journalism by N. Ram in Practising Journalism - Values, Constraints, Implications: ed. Nalini Rajan, Sage, 2006.
2. 'Murdochization' of news an article by Daya Kishan Thussu in Media, Culture & Society.
3. 'Murdochisation' of the Indian media by Paranjoy Guha Thakurta & Alice Seabright.

Web Resources:

http://cij.co.in/RTI.php
RTI for Journalists: an article by the Centre for Investigative Journalism, New Delhi.

Course Code : **MASC 414**
Course Title : **PHOTOJOURNALISM**

Theory**: 1 Credit;** Practical: **2 Credits - 3 Credits / Hardcore**

Course Overview:

This course introduces you to the basics of digital photography through the use of your Smart phones, DSLR, Mirrorless, Point & Shoot and Compact cameras. Through practical exercises, you will explore the entire process of photojournalistic principles and practice. You will see, read and do a critical appreciation of the work of eminent photographers and photojournalists. This along with responding to the work of your peers, will enable you to identify and develop your creative expression, style and voice.

Learning Outcomes:

1. Introduce photography – Hands-on training in operation of digital camera (dependent on the model in use) – Experiments with Speed, Aperture and Depth of Field – Experiments with understanding light (under and over exposure).
2. Introduce photojournalism – Research stories – Spot news, local news, single picture story, human interest stories – Do documentary photography, portraits and photo essay. Give appropriate captions for images – Meet deadlines with the help of technology – Understand the legal and ethical issues involved in photojournalism.
3. Learn to take photographs - using elements of design, colour and composition to create visually stimulating and storytelling frames – Create your own style and identity - experiment with numerous styles and genres. Practice taking pictures with an individual focus, drawing from our personal and emotional lives. Do candid photography & street photography (Skills required for working with people - explaining your objective, convincing, developing trust, putting your subject at ease, appropriate dressing so that you attract minimum attention, etc.)
4. Develop the skills needed for editing pictures - examine print quality, format, size, layout, and title, as well as whether words or other visuals are needed – Practice editorial process to develop a concise group of images from a large number of photographs – Learn to be your own critic, stand back, evaluate, and reflect to communicate the intent and content of your photographs.
5. Critical appreciation of photographs – Studying the works and processes of worldwide eminent photographers and photojournalists. Selected work of students will be exhibited in digital format on The Inquirer website.

COURSE CONTENTS

Unit 1: Photography: Elements and Principles
Shutter speed; Aperture; Depth of field; Lens – Experiments with shutter speed, aperture and DOF (the exposure triangle) – Experiments with understanding light (under and over exposure), ISO – File types (RAW, JPG, TIFF, etc.) Digital workflow - download, organise and back-up files for easy retrieval

Unit 2: Introduction to photojournalism
Seeing through photographs, reporting & addressing the course of events Reflecting on objectivity/subjectivity, privacy/public interest, reality/fabrication Selecting and researching different aspects of a story: topic/news story/long term project, the unusual and newsworthy by reading, observing, scouting

an area of town or a particular subject and talking to sources.
Mind mapping. Covering spot news, local news, features, human interest stories – Exploring photo-montage, documentary photography, portrait, single picture story and photo essay/picture story Ethics.
Questions of misrepresentation and digital manipulation
Women photojournalists: Breaking the glass ceiling

Unit 3: Doing photography

Composition: Making a picture with visual elements of design, colour, texture, tone, line, shape, symmetry, asymmetry, perspective, negative space, pattern and visual weight to create visually stimulating and storytelling frames – Understanding the relationship between form and content – Shooting with output in mind – Horizontal and vertical formats/frames – Understanding styles of "Masters of Photography" and identifying your own style – Creating your own style and identity - experimenting with numerous styles and genres, identifying what you are most interested in. Taking pictures with an individual focus, drawing from our personal and emotional lives. Taking pictures that connect to life, revealing our ways of seeing, communicating perspectives and awareness of our surroundings. Getting closer to subject. Developing photo stories.
Candid photography & street photography - learning how to work rapidly and unobtrusively in busy environments with minimal equipment and maximum adaptability

Unit 4: Becoming a photojournalist

Qualities and skills needed to be a photojournalist. Building rapport and trust. Editing pictures. Picture selection and sequencing. Examine print quality, format, size, layout, and title, as well as whether words or other visuals are needed. Curating photographs. Applying editorial process to develop a concise group of images from a large number of photographs – Giving appropriate captions for images and using text, audio and video. Writing human interest stories for your photo essay. Professionalism and meeting deadlines with the help of technology. Showcasing your work on the web, in exhibitions/galleries. Career paths. Photo books.
Being your own critic and participating in peer review. Learn to stand back, evaluate, and reflect to continuously improve upon the practice of photojournalism.

Unit 5: Understanding & appreciating photographs

Studying the works and processes of eminent photographers and photojournalists. Writing briefly about those who inspire you.

Homi Vyarawalla, Sunil Janah, Raghu Rai, Raghubir Singh, S. Paul, Kishore Parekh, Ashwin Mehta, T.S. Satyan, Prashant Panjiar, Dorothea Lange, Margaret Bourke-White, Ruth Gruber, Diane Arbus, Mary Ellen Mark, Alfred Stieglitz, Edward Jean Steichen, Edward Weston, Paul Strand, Alfred Eisenstaedt, Joel Meyerowitz, Brassaï, Walker Evans, Bill Brandt, Henri Cartier-Bresson, Robert Capa, David Douglas Duncan, Irving Penn, W. Eugene Smith, Helmut Newton, Marc Riboud, Robert Frank, Larry Burrows, Bruce Davidson, Lee Friedlander, Don McCullin, Josef Koudelka, Sebastiao Salgado, James Nachtwey, Steve McCurry

Pedagogical Approach:

The curriculum provides space to train students in academic/ critical analysis of media. The ultimate aim is not to produce technically competent workers but thinking professionals. The course includes lectures, slide shows, assignments, critiques, in-class discussions, brainstorming, individual / group presentations; and practical exercises for learning photography and photojournalism which will be reviewed in class by peers and course facilitator as outlined in: Practice makes perfect!

General Course Policies:

Assignments on the following practical exercises will form the basis of evaluation for a maximum of 80% marks. The remaining 20% marks will be given on the basis of a practical test during the end semester examinations. Outstanding works submitted by students will be published on The Inquirer website: http://puinquirer.edu.in/

Practice makes perfect!

Let's learn through practical exercises and quizzes:

Assignment 1: Composition and Lens (wide angle shot, close up/portrait, mid shot, any picture of your choice)

Assignment 2: Technical Parameters (Shutter priority mode, aperture priority mode, program mode, manual mode, shallow depth of field, deep depth of field, High ISO at night)

Assignment 3:
a: Photo Essay Proposal and Mind Mapping (Selection of topic/subject)
b: Photo Essay Planned Shots
c/d/e: Photo Essay (Weekly pictures with text and photo captions)
f: Photo Essay (Final draft and original pictures)

Assignment 4:
a/b/c: Street photography (Weekly pictures)

Assignment 5:
a: Photo Essay (Selection of topic/subject)
b: Photo Essay (Final draft with original pictures) Quiz - 2

Capstone Project: Create a photojournalism project of your choice from any of the following: News events, Features, Human Interest Stories Campus Life, Travel Journalism, Sports Photography, Caring for the planet Documentary, Photography

Course Code : **MASC 415**
Course Title : **DESIGNING TOOLS FOR MODERN JOURNALISM**

Practical: **2 Credits / Hardcore**

Course Overview:

Journalism is an ever-evolving domain closely associated with technological innovations. Not just the content, but the way we express it also demands serious attention. The course tries to emphasize the much-needed changes in the design aspects of journalism. It discusses the principles of editing and designing for news in print /online journalism. The course imparts techniques and skills required for effective editing, layout and design of print/online media. It provides opportunities to design and edit newspapers and web portals including graphics, photos and headlines.

Learning Outcomes:

On completion of this paper students will be able to:

1. Sub-edit news stories and write headlines
2. Acquire the knowledge of elements of newspaper design
3. Use tools to design newspaper pages

COURSE CONTENTS

Unit 1: Editing and Proofreading
Principles and theories of editing and design; What sub-editors do; How an editor "reads" a story – Accuracy-Is the story easy to understand; Public taste-Proofreading a story or page – Deadline pressure- Headlines, then layout; Comma confusion- Word usage – Redundant words- Clichés- Gender mixing; Concrete expression- Explain acronyms

Unit 2: Style Guide
House style; Style books; Sensitivities; The rules; Trade names; Banned words – Imposing preferences; Design style

Unit 3: Techniques of Copy Editing
Copy editing; Editing style; Headline writing; Headlines; Typography Layout terms; Font and typeface; Type anatomy; Columns Hyphenation Early type designers

Unit 4: Types of Page Layout and Design
Issues and challenges in page layout; Two levels of design; Basic architecture The typography; The 'layout pattern'; Optical weight; Design objectives Focus-Contrast-Balance

Unit 5: Designing Layout with Pictures
Issues and challenges in page layout 2; Layout Part 2; Stories without pictures Stories with headshots; Stories with display pictures; Display pictures centrally on the page – Picture editing; Picture selection; Formats, resolution, color mode etc. – Sizing and cropping; Selecting and ranking news

Textbooks:

1. An Introduction to Newspaper Editing and; Design by Allan Lee and Gregory Treadwell. Gibson, M. L. (1991). Editing in the Electronic Era. Iowa: Iowa State University Press.
2. Newspaper Editing and; Design by Allan Lee and Gregory Treadwell, Chapter 4 Baker, C. (1969). Ernest Hemingway: A life story. Michigan: Scribner.
3. Downman, S. (2008).Layout, design and; publication. Melbourne: Oxford University Press. Lee, A., and; Treadwell, G. (2009).
4. Newspaper editing and design: A guide to production journalism. Auckland: Pearson Education.
5. Harrower, T. (2008). The newspaper designer's handbook (6th ed.). New York: McGraw-Hill.

Course Code : **MASC 416**
Course Title : **VISUAL COMMUNICATION DESIGN**

Practical: **2 Credits / Hardcore**

Course Overview:

This course provides grounding in the fundamental theory and practice of visual communication. It attempts to develop the students' practical skills and explore the technical knowledge required for the creation of imagery in a digital context. It provides a critique of contemporary visual culture, surveying the mechanisms by which meaning is constructed through these images. It also attempts to explore the theoretical approaches to image analysis and applies these approaches to the creation of visual messages

Learning Outcomes:

On successful completion of this paper a student will be able to:

1. Apply the principles of visual communication
2. Produce different types of visual imagery like logo, poster , altered images etc., in digital forms
3. Develop a critical awareness of visual media and culture to the production of new images.

Course Prerequisite:

Knowledge in computer skills pertaining to designing

COURSE CONTENTS

Unit 1: Vector Drawing
Introduction to vector drawing – Abstraction: form, line and space
Vector drawing – Branding – Logos and icons

Unit 2: Typography
Introduction to Typography – Working with fonts – Introduction to colors and compositing – Photographic/bitmap imagery: selections, cut-outs, treatments

Unit 3: Techniques of Composition
Visual Composition – Basics of composition – Design and layout development

Unit 4: Photographic Imagery
Photographic imagery – Subject, foreground, background and depth Masking

Unit 5: Visual Literacy
Photorealistic composition – Light and Colour – Resolutions and grain – Perspectives on image framing – Effect Filters – Visual Literacy

Textbooks:

1. The Elements of Graphic Design (2002)_1 sted_ White, A. W_New York: Allworth Press.
2. A History of Graphic Design(1998)_ 1 sted_Meggs, P. B._ UK: John Wiley and Sons Press.
3. Evans, H. (1974). Editing and design (5th vol.). London: Heinemann.
4. Friend, C., Challenger, D., and; McAdams, K. (2005). Contemporary editing (2nd ed.). New York: McGraw-Hill.
5. Harrower, T. (2008). The newspaper designer's handbook (6th ed.). New York: McGraw-Hill.
6. Moen, D. (1989). Newspaper layout and design (2nd ed.). Iowa: Iowa State University Press.

Course Code : **MASC 417**
Course Title : **INFOGRAPHICS AND DATA JOURNALISM**

Theory: **2 Credits / Softcore**

Course Overview:

This course introduces students to the basics of the modes of representing data visually. Students will learn how to design successful charts and maps, and how to convey compelling storytelling pieces. This course teaches include Adobe Illustrator and other online tools and the principles of Graphic Design and of Interaction Design to visualize information.

Learning Outcomes:

1. To analyze and critique infographics and visualizations in newspapers, books, TV etc. To plan for data-based storytelling through charts, maps, and diagrams
2. To design infographics and visualizations that are attractive and informative
3. To apply the rules of graphic design and of interaction design to infographics and visualizations
4. To use Adobe Illustrator to create infographics

COURSE CONTENTS

Unit 1: Data Journalism Literacy

Defining Data journalism – Brief history of Computers in Journalism
Understanding elements of data story - Data Fundamentals Handling primary and secondary data – Role of data janitor: cleaning and organizing the data
Four key areas of Data Journalism: Deploying computer-assisted reporting, Practicing precision journalism, Visualizing data mapping and charting, Programming to obtain and analyse data for writing journalistic stories

Unit 2: Trends in Data Journalism

Drone Journalism, Sensor Journalism, Virtual and Augmented Reality Journalism
Computer-assisted reporting, Data journalism, and computational journalism
Open-source Culture – Shift from Investigative Journalism to Data Journalism
Different sort of Data resources - DIY Database

Unit 3: Working with tools and Creating Information Graphics

Understanding statistical concepts and software: Google Spreadsheets. Microsoft Excel Mapping and visualization tools and software: Infogram, Tableau, Esri mapping software, Google Fusion etc. – Working with open source tools
Teaching Advanced Data Skills: Visualization and Programming Visualising data
Understanding informational graphics – Use of colours, symbols, text,
Infographics and the internet – Storytelling with Data Visualization
Activity: Using a tool to create the visualised data on public affairs

Unit 4: Dealing with Social data

Using data in investigative reporting: Counting crime, hate tracker, farmer's suicide etc., - Handling scientific, economic and business data - Handling social data – Handling health data - Ethical issues in Data Journalism
Activity: Using a tool to create the visualised data on social, cultural issues

Unit 5: Project

Working with experts in media houses to create an infographic/ data journalism Project.

Textbooks:

1. Data Journalism Handbook. Edited by Jonathan Gray, LilianaBounegru and Lucy Chambers Data + Design By Trina Chiasson, Dyanna Gregory
2. CIJ Data Journalism Handbook by Elena Egawhary and Cynthia O'MurchuScraping for Journalists by Paul Bradshaw
3. Data journalism beyond legacy media: The case of African and European civic technology organizations.
4. Fink, K and Anderson, CW (2015) Data Journalism in the United States. Journalism Studies, 16 (4). pp. 467-481. ISSN 1461-670X
5. Baharah R. Heravi. 2018. "3WS of Data Journalism Education." Journalism Practice 0(0): 1-18.
6. Greg Treadwell, Tara Ross, Allan Lee, Jeff Kelly Lowenstein. 2016. "A Numbers Game: Two Case Studies in Teaching Data Journalism." Journalism & Mass Communication Educator 71(3): 297- 308.
7. Deb Halpern Wenger, Lynn C. Owens, Jason Cain. 2018. "Help Wanted: Realigning Journalism Education to Meet the Needs of Top U.S. News Companies." Journalism & Mass Communication Educator 73(1): 18-36.

Course Code : **MASC 418**
Course Title : **FILM AND TELEVISION ACTING**

Practical: **2 Credits / Softcore**

Course Overview:

Students are trained to perform in different types of filmmaking like compering, announcement, video and radio jockey, TV plays, moderator for different types of radio and video production s. Improvisation, scene practicals, mime, dialogue modulation, announcement, hosting different TV shows etc.

COURSE CONTENTS

Unit-1 : Voice, Dialogue, Speech and Diction.

Unit-2 : Improvisations - Single Improvisations, Dual Improvisations, Group Improvisations.

Unit-3 : Mime - Acting and creating the atmosphere with imagination. Imagination of volcano, rain, escaping fire, water drowning, swimming, dancing, dying, searching, dreams, deceases (fever, cough, leprosy, limping, stomach ache.

Unit-4 : Realistic performance, Stanislavsky' Method acting, Meyer holds Bio mechanism.

Unit-5 : Basics of Indian style dance (Bharadha Natiyum, Kuchipudi, Kadhakali, Kathak, Oddisi dance, Mohini Aatum, paavai koothu. Western dance, Disco dance, Jazz, break dance, Chinese dance, ballroom dance.

Textbooks:

Stanislavsky’s Method Acting
An actor prepares BharathaNatyasastram

Reference Films to study acting:

Raj Kapoor films, Shantharam films, Bandhulu films, NTR Films (Maya Bazaar), Shivaji Films, Navaraathiri, Sathya Films, Ulaga nayagan Dr. Kamalhaasan Films, Dr. Karunanithi films for script.(Thikatra Parvathi), Devadas, Salaam Bombay (Meera Nayar, Urdh Sathya, Muguliasm, Guna, Mohan lal and Mummuty films, Bandit queen, Urvashi Archana (Veedu).Female artistes: Savithri, Naalu pennugal, Marupakkam (Swarna Kamal Award).

SECOND SEMESTER

Course Code : **MASC 421**
Course Title : **BROADCAST JOURNALISM**

Practical: **3 Credits / Hardcore**

Course Overview:

The course will introduce students to the practical aspects of television news production through demonstrations and workshops. Practical assignments will form a regular part of the course with hands on training on reporting, writing and use of electronic media tools for news production and dissemination.

Learning Outcomes:

Upon completion of this course, students will be able to:

1. Report news, including live reporting, for Television
2. Produce audio visual news stories
3. Write news for television news
4. Use video and audio equipment for television reporting
5. Use online platforms for diffusion of content
6. Produce news bulletin

COURSE CONTENTS

Unit 1: Basics of RWE
Tools of news gathering – Preparing for reporting and interview
Researching for news, features and analysis

Unit 2: Writing for television news
Writing for visuals – Writing for different types of stories – On the spot writing
Rewriting wire news – Breaking news – Writing for preparation of bulletin

Unit 3: Use of resources
Smartphones for reporting and; editing Laptop for editing – DSLR for reporting
Professional Video camera for field reporting and indoor news production
Microphones and; uses in reporting

Unit 4: TV news production
Outdoor reporting Editing news stories – News production for social media
Indoor news bulletin production

Unit 5: Distribution
Use of Social media for content distribution Timely updating of News portals
Working of television news channels

Textbooks:

1. Managing Television News– A Handbook for Ethical and Effective Producing: B. William Silcock et al., Routledge, 2007.
2. Script to Screen– An Introduction to TV Journalism: Sharda B. Kaushik, Macmillan, 2003.
3. Writing and Producing Television News: Eric K. Gormlyand; Blackwell, reprinted in India by Surjeet, 2005.

Viewing news

Watching news on various TV news channels.

Assignments:

- Writing script for television news on topics assigned by the course teacher
- Producing 4 nos of 60 sec video stories
- Producing 2 nos of feature stories not less than 180 sec's. Contribution to production of news bulletin.

General Course Policies

The Assignments will form the basis of evaluation for a maximum of 80% marks. The remaining 20% marks will be given on the basis of a practical test during the semester end examinations.

Course Code : **MASC 422**
Course Title : **SCRIPT WRITING FOR AUDIO VISUAL PRODUCTION**

Theory: **3 Credits / Hardcore**

Learning Outcomes:

1. To understand the world of words from different perspective,
2. To learn fictional and non-fictional writing.
3. To practice visual thinking.
4. To do visual research, script research. Audience research
5. To appreciate and analyse popular and serious scripts

COURSE CONTENTS

Unit 1: Narrative structure

Script organization. Fundamentals of writing: Understanding the world of words, roots, text and subtext, idioms and phrases, simile and metaphor, tongue twister and visual twister, riddles, a quick comment, satire (religious, political, social, historical, literary, geographical, science, gender) Visual thinking: Practice to visualize the words, Understanding the concept of words and converting the visuals into words – Types of films: Fictional Short film and non-fictional short films Short films of different genres and styles (realistic or formalistic) Long films of different genres and styles. (realistic or formalistic)
Fictional long films and non-fictional long films (realistic or formalistic)

Unit 2: Visual Thinking

Visualization with all five senses, synaesthesia, Visualization without sound and visualization of sound. Visualization without colour, Visualization of three Dimensional world on two dimensional screen, Visualizing for the nose, .Visualizing for the tongue,Visualizing for the touch.
Approach: Atypical approach, Logical approach, Ethical approach, Personal approach, Historical Approach, reliability, Utility value, and Intellectual pleasure vs Physical sensation, Golden Mean or MIDDLE PATH.

Unit 3: Scripting Process and Techniques

Research: Script research-resource for story writing (personal experience, other people's experience, books, novels, history, epics. Audience research (Target audience), production research, technical research. Stages of scripting (8 stages). Idea, synopsis, three part outline, complete treatment – One line treatment, Master-scene script, shooting script, story board.

Unit 4: Structure of Scripts

Narrative Structure: Exposition (character, time, space and conflict), raising action, conflict (external and Internal), climax and crisis, falling action, resolution. Curtain raiser, character introduction, conflict introduction, conflict raises, climax, crisis, and conclusion.

Unit 5: Script organization

Registration of the story, title, story writer should be registered in writers association, Legal rights from story writer. Writers Association, Target audience consideration, title, significance of the title, title registration, story registration, script registration.

Pedagogical approach:

The course includes, classroom lectures, script discussion, script writing, script reading and analysis, dialogue analysis, screenplay analysis and making films (short and long films- short films are individual films long films should be made in groups.)

Textbooks:

1. Aristotle. Poetics. A translation and commentary for student of literature. Translations by Leon Golden commentary by O.B. Hatdison. Jr. Prentice-Hall-INC, Englewood Cliffs, 1968.
2. Egri, Lajos. The Art of Dramatic Writing. New York: Simon and Schuster, 1946. Miller, William. Screenwriting for Narrative Film and Television. New York: Communication Arts Books, 1980.
3. Monaco, J. How to Read a Film. New York: Oxford University Press, 1997.
4. Vale, Eugene. The Technique of Screen and Television Writing. New York: A Touchstone Book, 1986.
5. Outcomes: The students will be able to be a scriptwriter for different types of film and Television production. Pedagogue in Script writing.

Course Code : **MASC 423**
Course Title : **COMMUNICATION RESEARCH METHODS**

Theory: **3 Credits / Hardcore**

Course Overview:

This course provides an overview of the concepts, research methods, and tools by which communication research is designed, conducted, interpreted, and critically evaluated. The primary objectives of this course are to help students become well versed in communication research by exposing them to social science research methods in Communication discipline. The course also aims to help students understand how empirical research is conducted. Students will have a better understanding of the process of research and its importance in various career paths. Aspects of communication research will be explored through readings, lectures, published research, and statistical problems.

Learning Objectives:

1. To master the concepts and technical vocabulary of communication research, and be able to use this language appropriately.
2. To comprehend the relationship between theory and research methods in the study of communication as a social science
3. To assess the ethical choices of researchers in conducting and presenting research
4. To compare and contrast four major research methods (experimental, survey, textual analysis, and naturalistic inquiry) used to investigate communication behavior
5. To develop skills necessary for conducting communication research
6. To develop the ability to clearly communicate, both orally and in writing, the findings of original communication research to a lay audience
7. To become an intelligent consumer of research—able to read, understand, explain and critically evaluate communication and other research reported in scholarly journals as well as in the popular press.

Learning Outcomes:

1. Identify and understand methods for conducting communication research
2. Understand and evaluate academic research using common communication research methodologies
3. Analyze data from qualitative and quantitative perspectives
4. Use qualitative and quantitative data to inform communication research

COURSE CONTENTS

Unit 1: Introduction to Communication Research

Philosophy of Research - Inductive and Deductive Research -Epistemology and Ontology of Research – Quantitative and Qualitative Research Methods Research Design - Variables - Scales of measurement Research Questions and Research Design – Hypothesis Testing, Primary and Secondary data

Unit 2: Quantitative Methods and Textual Analysis

Survey Method – Tools of data collection – Experimental Research Descriptive Statistics – Inferential Statistics: Chi-square, t-test, ANOVA - Content Analysis Semiotic Analysis – Discourse Analysis/ Critical Discourse Analysis (CDA)

Unit 3: Ethnography and Visual Analysis

Ethnography – Focus Group Discussion/Interviews and Observations Digital Ethnography / Auto-ethnography – Visual Analysis Methods: Visual Anthropology, Multimodal Analysis

Unit 4: Doing Research

Researching news Applied Media Research – Researching Films, Television content Researching Digital Spaces

Unit 5: Data Analysis and Dissertation/Thesis Writing

Reporting Research Results Coding Qualitative Data – Open access Journals - APA - MLA - CMS styles - Zotero and Mendely for Research Management – Structure of a thesis

Textbooks:

1. Booth, W. C., Colomb, G. G., & Williams, J. M. (2008). The craft of research. (3rd ed.). Chicago: University of Chicago Press.

2. Morgan, S. E., Reichert, T., & Harrison, T. R. (2002). From numbers to words: Reporting statistical results for the social sciences. Boston, MA: Allyn & Bacon

3. Baxter, L. A., & Babbie, E. R. (2003). The basics of communication research. Boston, MA: Wadsworth

4. David Silverman & Amir Marvasti (2008). Doing Qualitative Research: A Comprehensive Guide. Sage.

5. Gregory C. Stanczak. (2007). Visual Research Methods: Image, Society & Representation. Sage.

Course Code : **MASC 424**
Course Title : **DIGITAL MEDIA PRODUCTION**

Theory: **1 Credit;** Practical: **2 Credits - 3 Credits / Hardcore**

Course Overview:

This course will introduce you to the world of multimedia storytelling through hands-on experience individually and in groups. You will learn the building blocks for digital media production. You will explore what it is to be a journalist and a storyteller. Along with peer group learning, you will also focus on developing skills in areas of interest to you.

Learning Outcomes:

1. Introduce the process of digital media storytelling– Preparing and conducting effective interviews, Reporting, writing and structuring immersive content for the web and mobile journalism.
2. Hone the art and skill of becoming storytellers – Case Studies – Reporting the alternate perspective –Creating One Minute Video Stories.
3. Know your audience – Gauging relevance of ideas to your audience – Planning the treatment of the story through multi-modal media.
4. Develop skills for social media storytelling – Optimal use of different platforms – Using video, audio, music, photographs, graphics, animation – Copyright and fair use for multimedia elements.
5. Produce and deliver the stories – Implementing your production plan with a time schedule and deadlines – Publishing your work on The Inquirer website.

COURSE CONTENTS

Unit 1: Digital media storytelling

Where do ideas come from? – Preparing and conducting effective interviews Planning and strategizing news gathering and documentary production The skill of asking the right questions – Sifting, sorting and choosing information Online storytelling forms – Reporting, writing and structuring immersive content for the web and mobile journalism Working with sources – making notes – using quotes correctly – Practical Exercises

Unit 2: Becoming storytellers

How to find stories every day? Crowd sourcing your content Case Studies of Scroll, Quint, BuzzFeed, ScoopWhoop stories Reporting the alternate perspective – Understanding the digital storytelling model Choosing formats for news stories documentary production Creating One Minute Video Stories, Social media tools, Mobile Journalism (MoJo) Practical Exercises.

Unit 3: Knowing your audience

Engaging online audiences – Doing a pre-survey to gauge relevance of ideas to your audience Analysing the responses and freezing your production plan Elements of a good lead – Writing the story – Planning the treatment of the story through multi-modal media Practical Exercises

Unit 4: Social media storytelling

How to use video – Optimal use of different platforms – Facebook – Twitter – Instagram – Hashtag trending – Live videos – Vlogs – Trending topics
How to use audio and music How to use photographs
How to use graphics and animation Using documents and press releases
Copyright and fair use for multimedia elements Practical Exercises

Unit 5: Producing and delivering the stories

Implementing your production plan with a time schedule and deadlines Reviewing your progress at regular intervals and modifying plan if necessary Completing your post-production, reviewing and submitting within the deadline Publishing your work on The Inquirer website – Doing a peer review and audience feedback
Using feedback for improving your content, packaging and delivery
Practical Exercises

Pedagogical Approach:

A combination of lectures, tutorials, group discussions, practical exercises and review of work by peers and course facilitator using the media as outlined in: Practice makes perfect!

General Course Policies:

Written and practical assignments, including multi-media presentations and videos, will form the basis of evaluation for a maximum of 80% marks. The remaining 20% marks will be given on the basis of a practical test during the end semester examinations. Outstanding works submitted by students will be uploaded on The Inquirer website: http://puinquirer.edu.in/

Practice makes perfect!

Let's learn through practical exercises:
As part of this course, students you have a choice of digital media productions to choose from:

1. Text Board News Stories
2. Video News Features
3. Photo Features/Photo Essays
4. Aural News Features
5. Short Documentaries on contemporary issues
6. Long form journalistic writing/documentaries
7. Infographics and data-based stories for a converged news media environment
8. Editing stories and curating photographs for online publishing

The areas you can cover include, but are not limited to:

- Local news, Features, Campus life, Science and Environment, Sports, Travel, Healthcare, Human interest stories, Opinion pieces
- You will have to pitch your proposals and in consultation with the faculty, prepare a production plan for the entire semester with a minimum of eight deliverables (any one of the above mentioned work or a combination of the above) in the semester.

Course Code : **MASC 425**
Course Title : **COMMUNICATIONS MANAGEMENT**

Theory: **2 Credits;** Practical: **1 Credit - 3 Credits / Hardcore**

Course Overview:

This course introduces the field of communications management, including public relations and corporate communications. What are the various possibilities for organizations, communities, NGOs, charities, celebrated personalities, political personalities, political bodies, nations, etc. to manage their communications and be leaders in their fields, will be explored through this course. This will also require critical observation of communications management in various media including interpersonal communication and the web, print, radio, television, outdoors, and event management. The aim of this course is to develop you as an effective and successful professional in the field of communications management.

Learning Outcomes:

1. Introduce definitions, origin and development – Historic PR campaigns, case studies – Competencies for internal and external communication – Corporate communication publics.
2. Understand the role of PR in branding and brand communications – Role of PR as an effective means of organisational and social communication in marketing and communications strategy – PR and corporate identity – Corporate social responsibility, corporate community involvement & cause- related marketing – Corporate communication in crisis management.
3. Through discussion of case studies, brand manuals, online websites, events management, to understand how organisational identity is build and communicated with internal and external stakeholders – How media and business to business relationships are developed – Necessity of governance and ethics – Anticipating crisis communication – Practicing social responsibility and community involvement.
4. Experientially explore the building blocks of Managerial Communications – Apply the competencies of listening and non-verbal communication – Work towards building teams and leadership development – Reflect on best practices for communication in team crisis, conflict resolution and problem solving.
5. Familiarize with government information services – Analyse international and global communications management – Necessity of transparency, accessibility, interactivity – Moving from two-way asymmetric to two-way symmetric approach – Integrated 360 degree approach and digital communication.

COURSE CONTENTS

Unit 1: Introduction to public relations and corporate communication

Definitions, origin and development Historical PR campaigns
Scope and functions – Professionalism, ethics and regulation Tools of PR & corporate communication – Competencies for internal and external communication – Research and evaluation – Creativity & innovation – Preparation of PR campaign plans Corporate communication publics

Unit 2: Components of communications management

Role of PR in branding and brand communications

Role of PR as an effective means of organisational and social communication in marketing and communications strategy – PR and corporate identity Corporate social responsibility, corporate community involvement & cause-related marketing Corporate communication in crisis management

Unit 3: Communicating organisational identity – Case Studies

Building and communicating organisational identity Communicating with internal and external stakeholders – Media and business to business relationships Governance and ethics – Academic institutions and nonprofit PR
Social responsibility of business and community involvement
Crisis communication

Unit 4: Managerial communications – Capacity Building

Listening and non-verbal communication Role of communication in building teams – Communication approaches in leadership development Communication in team crisis and conflict resolution Challenges of communication and problem solving

Unit 5: PR practices – Preparing for the Future

Government information services and e-Governance Public relations and globalization – International and global communications management Necessity of transparency, accessibility, interactivity – From two-way asymmetric to two-way symmetric approach – From corporate social responsibility to human social responsibility Integrated 360degree approach and digital communication

Pedagogical Approach:

A combination of lectures, tutorials, group discussions and case studies, role plays, media relations techniques, etc. Individual and group practical exercises which will be reviewed in class by peers and course facilitator. These would include any of the following: organising logistics for events, gathering research, pitching stories, writing press releases, e-mails, creating campaigns, brand manuals, brand identity, building and communicating organisational identity.

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General Course Policies:

Quizzes, written and practical assignments, including multi-media presentations and videos, will form the basis of evaluation for a maximum of 40% marks. The remaining 60% marks will be assessed through a written end semester examination. Outstanding works submitted by students will be uploaded on The Inquirer website: http://puinquirer.edu.in/

Textbooks:

1. Corporate Communication – Principles and Practice: Jaishri Jethwaney, Sage, 2018. Effective Public Relations: S. M. Cutlip & A. C. Center, Prentice Hall, 2008.
2. Handbook of PR in India: D. S. Mehta, Allied, 1997. Handbook of Public Relations: Philip Lesley, Jaico, 2000.

3. International Communications Strategy – Developments in Cross-Cultural Communications, PR and Social Media: Silvia Cambie and Yang-May Ooi, Kogan Page, 2009.
4. Practical Public Relations: Sam Black, Prentice, 1983.
5. The Public Relations Handbook: Alison Theaker, Routledge, 2008.

Web Resources:

The Era of Corporate Social Responsibility is Ending | Rachel Hutchisson | TEDxWilmington, @ https://www.youtube.com/watch?v=N8dXNzCIVxg

The social responsibility of business | Alex Edmans | TEDxLondonBusinessSchool, @ https://www.youtube.com/watch?v=Z5KZhm19EO0

Re-thinking corporate social responsibility: Andy Le Seelluer at TEDxStHelier, @ https://www.youtube.com/watch?v=jga4s0Ei7Zs

Evolution of PR in India and its present status by Prof. Jaishri Jethwaney, @ http://www.newswriters.in/2015/10/10/evolution-of-pr-in-india-and-its-present-status/ Book Review on "Corporate Communication", @ https://www.youtube.com/watch?v=iu1I_zkq444

Career in Public Relations, @ https://www.youtube.com/watch?v=zdiNCOixLBA

Course Code : **MASC 426**
Course Title : **INTERCULTURAL COMMUNICATION: THEORY AND PRACTICE**

Theory: **3 Credits / Hardcore**

Course Overview:

This course examines various intercultural communication theories and principles. It tries to develop a range of intercultural communication competencies needed to understand real life situations well and develop approaches towards conflict resolutions. The course discusses the factors underlying cultural variations and codes. Last but not least, the course provides overall experience about various intercultural communication perspectives.

Learning Outcomes:

On completion of this paper successful students will be able to:

1. Assess various intercultural communication theories and principles
2. Understand the factors underlying cultural variations and codes
3. Appreciate the causes and significance of intercultural differences in verbal and non-verbal communication
4. Apply intercultural communication knowledge to real-world contexts
5. Develop a range of intercultural communication competencies.

COURSE CONTENTS

Unit 1: Introducing intercultural communication
Defining interpersonal and intercultural communication: concepts and terminology Taxonomies of cultural patterns: Hall, Hofstede and others

Unit 2: Processes of intercultural communication
Perceptual processes – Identity and bias in intercultural communication Verbal intercultural communication – Nonverbal intercultural communication Listening within and across cultures

Unit 3: Intercultural communication competence
The ethics of communication – Developing intercultural communication competence The synergy principle

Unit 4: Contexts
Intercultural communication across different contexts Intercultural communication and the mass media Intercultural communication in interpersonal relationships

Unit 5: Issues and challenges
Issues and challenges of intercultural communication Intercultural business communication

Textbooks:

1. Ting-Toomey, S. and; L. Chung (2004) Understanding intercultural communication. USA: Roxbury Publishing Co.
2. Chaney, L. and; S. Martin (2006) Global business etiquette: a guidebook to international communication and customs. USA: Praeger.
3. Gudykunst, W. (ed). (2003) Cross-cultural and intercultural communication. USA: Sage. Novinger, T. (2001) Intercultural communication: a practical guide. Austin: University of Texas Press.
4. Klyukanov, I. E. (2005). Principles of intercultural communication. Boston: Pearson.

Course Code **: MASC 427**
Course Title **: PUBLIC SPEAKING SKILLS FOR EFFECTIVE COMMUNICATION**

Practical: **3 Credits / Softcore**

Course Overview:

This is a life skills course that will enable you to be an effective communicator, leader and team-player in any situation. Experientially and creatively, you will develop public speaking skills based on a foundation of Theatre-in-Education and Self Development. It will introduce the components of effective communication, including the usage of verbal and non-verbal communication. You will engage with deep listening and learn through inter-personal communication, group work and individual assignments. It aims to build your potential to communicate with diverse audiences with confidence, compassion, clear thinking, and empathy.

Course Outcomes:

1. Introduce the processes and principles of effective communication – Overcoming barriers to communication – Taking initiative, building trust, team-work, self-confidence, and leadership skills.
2. Know the art and skill of effective communication – Building your own style of assertive communication; verbal communication skills; and non-verbal communication skills.
3. Practice deep listening, critical thinking and analysing skills– Ideating, planning and preparing concepts.
4. Develop skills for public speaking – Knowing and engaging your audience – Demonstrating confidence, enthusiasm, clarity and understanding.
5. Develop and practice skills for oral presentations; extempore speaking; group discussions; seminars and question & answer sessions.

COURSE CONTENTS

Unit 1: Introduction to effective communication
Processes and principles of effective communication – Overcoming barriers to communication – Building trust, team-work and collaborative communication – Taking initiative, building self-confidence and leadership skills – Finding your voice and identifying your strengths and interests

Unit 2: Building verbal and non-verbal communication skills
The art and skill of effective communication – Building your own style of assertive communication – Verbal communication skills – Non-verbal communication skills including posture, body language, eye contact, and voice modulation.

Unit 3: Building deep listening, critical thinking and planning skills
Critical thinking and analysing skills – The art of visualization – Deep listening and interviewing skills – Ideating, planning and preparing concepts.

Unit 4: Understanding one's audience and building life skills
Skills for public speaking – Knowing your audience
Engaging your audience – Role of the personality, interpersonal skills and language proficiency – Demonstrating confidence, enthusiasm, clarity and understanding.

Unit 5: Preparing for a wide range of communication settings

Skills for oral presentations – Extempore speaking – Group discussions
Seminars and question & answer sessions.

Pedagogical Approach:

Through various theatre techniques, the curriculum will introduce essentials of public speaking skills for effective communication theoretically and practically. You will see and hear videos of eminent public speakers. You will also receive training for public speaking presentation skills through practical exercises in verbal communication and non-verbal communication. You will maintain a self-reflective journal in which you will record your learning experiences in this course and also share with your peers and the course facilitator.

General Course Policies:

Weekly self-reflective journal entries and practical oral assignments, including individual and group presentations, will form the basis of evaluation for a maximum of 80% marks. The remaining 20% marks will be given on the basis of a practical oral test during the end semester examinations.

Textbooks:

1. Effective Communication and Public Speaking: S. K. Mandal, Jaico, 2007
2. Essentials of Effective Communication: Vasantha R. Patri & Neelakant Patri, Greenspan, 2002.
3. Mastering Public Speaking– Exercise Your Body Parts and Build Your Speaking Skills: Dorothy Lynn & Jessica Selasky, Jaico, 2008.

PONDICHERRY UNIVERSITY

NATIONAL EDUCATION POLICY (NEP) REGULATIONS

2023–2024

Certificate in Philosophy

I Year (Semester – I)

PHLMJD-1: Classical Indian Philosophy – I

(4 Credits)

Course Objectives

The course aims to provide students with a foundational understanding of Classical Indian Philosophy. Through exploration of key concepts and historical context, students will develop critical thinking skills for analyzing philosophical arguments. Emphasis is placed on fostering a comparative approach, enabling students to appreciate the interconnectedness of classical Indian philosophical ideas with global philosophical traditions.

Learning Outcomes

Upon completion, students will possess a comprehensive knowledge of major philosophical schools in Classical Indian Philosophy. The course hones analytical skills, allowing students to critically assess arguments in classical Indian philosophical texts. Cultural awareness is a key outcome, with students gaining insights into the deep connection between philosophical

thought and classical Indian culture. Effective communication skills are developed through articulate discussion and written expression of complex philosophical ideas. Additionally, students will reflect on the ethical implications of classical Indian philosophical theories and their relevance to contemporary ethical dilemmas.

UNIT – 1

Introduction

Common characteristics of Indian philosophy
Classification of Darsanas.

Vedic and Upanishadic Philosophy

Vedas:Four Vedas andthe parts of the Vedas – Vedic religion and philosophy.
Upanishads: *Brahman*, *Jiva* and *Jagat* and their nature, function and inter-relation.

UNIT – 2

Carvaka

Pratyaksha as the only *pramana*– Rejection of other *pramanas*.
Materialism– Soul as an epi-phenomenon – Denial of God.
'Pleasure' as the *summum bonum*.

UNIT – 3

Jainism

Nature and kinds of knowledge – *Syad-vada* – *Saptabhanginaya-vada*.
Anekanta-vada and Classification of Substances – *Jiva*, it's nature and classification.
Bondage and liberation of *jiva*.
Brief introduction to the schools of Jainism.

UNIT – 4

Buddhism

The Four-fold Noble Truths.
World as constantly changing flux (*Kshanikavada*)– *Anatma-vada*.
Bondage and liberation –Dependent Origination – Eight-fold Noble Path – *Nirvana.*
Brief introduction to the schools of Buddhism.

UNIT – 5

Nyaya – Vaiseshika

Nyaya:Four *pramanas*
Sixteencategories according Nyaya
Proofsfor the existence of God.
Vaiseshka:Seven categories – AtomicTheory – *Arambhavada*.

Essential Readings

1. Satischandra Chatterjee &Dhirendramohan Datta, *An Introduction to Indian Philosophy*, Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 2016.
2. Chandradhar Sharma, *A Critical Survey of Indian Philosophy*, Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 2013.
3. T.M.P. Mahadevan, *Invitation to Indian Philosophy*, Arnold-Heinemaan, New Delhi, 1982.
4. M. Hiriyanna, *Outlines of Indian Philosophy*, Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 2014.
5. M. Hiriyanna, *The Essentials of Indian Philosophy*, Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 2015.

Further Readings

1. Surendranath Dasgupta, *History of Indian Philosophy* (Vols. 1–5), Motilal Banarsidass Publishers Pvt. Ltd, New Delhi.
2. S. Radhakrishnan, *Indian Philosophy*, (Vols. 1& 2), Oxford University Publishers, New Delhi, 2009.
3. (Edr), History of Philosophy – Eastern and Western (Vol. 1), George Allen & Unwin Ltd, London, 1952.
4. Jadunath Sinha, *Indian Philosophy*, (Vols. 1–3), Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 1999.
5. P.T. Raju, *Structural Depths of Indian Thought*, South Asian Publishers Pvt. Ltd,New Delhi, 1985.

PHLMID-1(A): Principles of Philosophy – I

(4 Credits)

Course Objectives

This course aims to elucidate philosophy's significance, its ties to ontology and metaphysics, and its impact on human life. It examines how philosophy intersects with science, religion, art, and other disciplines, fostering interdisciplinary understanding. Analysis of logic, epistemology, and theories of truth, alongside exploration of judgment and reality interpretation, provide a comprehensive understanding. This exploration covers diverse philosophical frameworks, including realism, idealism, and pragmatism, within a concise framework.

Learning Outcomes

Students will demonstrate a solid grasp of philosophy's foundational concepts, including ontology, metaphysics, and the value of inquiry. They'll critically analyze philosophy's links to other disciplines, fostering interdisciplinary understanding. Evaluating theories of knowledge origin and skepticism will enhance critical thinking. Proficiency in analyzing experiences through judgment and inference will develop logical reasoning. Through critical reflection on reality and truth theories, students will assess philosophical frameworks' implications for understanding existence and truth.

UNIT – 1

Meaning, scope and value of philosophy: Meaning and scope of philosophy – Ontology, metaphysics and philosophy – Origin of philosophical enquiry – Philosophy and life – Value of the study of philosophy.

Philosophy and other Ccognate studies: Philosophy and science – Philosophy, religion and art – Philosophy and epistemology – Philosophy and metaphysics.

UNIT – 2

Problems of Llogic and Eepistemology: Psychology, logic and epistemology – Theories of origin of knowledge – Empirical theory – Rational theory – Critical theory – Intuitionism – Empiricism and scepticism – Value of scepticism.

UNIT – 3

Interpretation of Eexperience: Knowledge and judgment – Definition and analysis of judgment – Propositions and its constituents – Affirmative and negative judgments – Judgements of fact and judgments of value – Characteristics of judgment – Judgments and construction of Reality – Inference – Meaning and forms of inference.

UNIT – 4

Theories of Reality: Reality and its types: Monistic, dualistic and pluralistic Realisms – Idealism and its types: Platonic idealism, Idealism of Berkeley, Idealism of Kant, Pluralistic spiritualism of Leibnitz and Absolute Idealism of Hegel.

UNIT – 5

Truth and Reality: Knowledge, Truth and Reality in Realism, in Subjective Idealism, Objective Idealism and in Pragmatism – Theories of Truth: Correspondence theory, Coherence theory, Pragmatic theory and Self-evidence theory.

Essential Readings

1. Hari Mohan Bhattacharyya, *The Principles of Philosophy*, University of Calcutta, 1959.
2. A.C. Ewing, *The Fundamental Questions of Philosophy*, Allied Publishers Pvt. Ltd., New Delhi, 1951.
3. Dev Raj Bali, *Introduction to Philosophy*, Sterling Publishers Pvt. Ltd., New Delhi, 1989.
4. Avrum Stroll & Richard H. Popkin, *Philosophy Made Simple*, Heinemann, London, 1981.
5. David Stewart, H. Gene Blocker & James Petrik, *Fundamentals of Philosophy*, Pearson, Delhi, 2013.

Further Readings

1. Samuel Enoch Stump, *Socrates to Sartre: A History of Philosophy*, McGraw-Hill Book Company, New Delhi, 1982.
2. Michael Scriven, *Primary Philosophy*, McGraw-Hill Book Company, New York, 1966.

PHLMLD-1: Critical Thinking

(3 Credits)

Course Objectives:

The course introduces critical thinking basics: claims, concealed claims, and arguments. Students learn premise evaluation, logical deduction, and argument repair. They develop skills in compound claim analysis, counterargument construction, and analogy comprehension. Critical thinking applications cover modeling, numerical analysis, generalization, cause and effect, and population dynamics. Students also explore explanations, fallacy identification, reasoning evaluation, coherent argument writing, and informed decision-making.

Learning Outcomes:

Students will grasp critical thinking basics, recognizing and analyzing claims and arguments. They'll learn to evaluate premises, conduct experiments, and draw logical conclusions. Proficiency in identifying and repairing flawed arguments, constructing counterarguments, and

using analogical reasoning will be developed. Practical skills in analyzing models, interpreting data, generalizing findings, and understanding cause and effect will be gained. Competence in recognizing fallacies, evaluating reasoning, constructing structured arguments, and making informed decisions will be demonstrated.

UNIT – 1

Introduction – Claims – Concealed claims – Arguments.

UNIT – 2

Evaluating premises – Experiments – The conclusion follows.

UNIT – 3

Repairing arguments – Compound claims – Counter arguments – General claims – Analogies.

UNIT – 4

Models – Numbers – Generalizing – Cause and effect – Cause in populations.

UNIT – 5

Explanations – Fallacies – Evaluating reasoning – Writing good arguments – Making decisions.

Essential Readings

1. Richard L. Epstein, *The Pocket Guide to Critical Thinking*, Wadsworth, Canada, 2003. (Question paper must be set only from this book).

Further Readings

1. Alec Fisher, *Critical Thinking: An Introduction*, Cambridge University, 2011.
2. David A. Hunter, *A Practical Guide to Critical Thinking – Deciding what to do and Believe*, Wiley India Pvt. Ltd, 2012.
3. Madsen Pirie, *The Book of the Fallacy: A Training Manual for Intellectual Subversives*, Routledge & Kegan Paul, London, 1985.
4. Zygmunt Ziembinski, *Practical Logic*, D. Reidel Publishing Co., U.S.A.,

PHLSEC-1(A): Basics of Yoga

(3 Credits)

Course Objectives

The course offers an understanding of yoga's meaning and historical development within Indian philosophy. It explores the macrocosmic and microcosmic nature of humanity, covering concepts like Panchakosha, consciousness states, trigunas, nadis, and chakras. Students are introduced to various yoga paths, including Karma, Bhakti, Jnana, Raja, Kundalini, and Hatha yoga. The concept of yoga siddhis, encompassing major and minor abilities, is explained. Practical aspects include various asanas and pranayama techniques in different positions.

Learning Outcomes:

Students will grasp yoga's historical and philosophical foundations, understanding its significance in Indian culture. They'll explore the human psyche through macrocosmic and microcosmic aspects. Knowledge of various yoga paths will empower them to choose a suitable path for personal growth. Understanding potential attainments (siddhis) in yoga practice will aid their spiritual journey. They'll apply learned principles and techniques to cultivate well-being through yoga asanas and pranayama.

UNIT 1

Introduction: Meaning of Yoga – Origin and the development of yoga – Place of yoga in Indian philosophy – Yoga school of Indian philosophy.

UNIT 2

Nature of Man: Macrocosm ((*Maha-brahmanda*) and microcosm (*Ksudra-brahmanda*) – *Panchakosha* – Four states of Consciousness – *Trigunas – Yoga Nadis – Chakras*.

UNIT 3

Yoga Margas: *Karma yoga – Bhakti yoga – Jnana yoga – Raja yoga – Kundalini yoga – Hatha yoga – Mantra* yoga *– Laya yoga – Nadha yoga – Poorna yoga*.

UNIT 4

Yoga Siddhis: Eight major s*iddhis* (*Ashtamasiddhi*) – Minor s*iddhis*.

UNIT 5

Asanas and Pranayam**a (Standing,Sitting,& Lying)**

Essential Readings

1. Swami Satyanandha Saraswati, *Meditations from the Tantras*, Yoga Publications Trust, Munger, Bihar, 2000.
2. Swami Sivananda, *Kundalini Yoga*, The Divine Life Society, Uttaranchal, 2001.
3. Sir John Woodroffe, *Introduction to Tantra Sastra*, Ganesh & Co., Chennai, 2008.
4. T.N. Ganapathy, *The Philosophy of the Tamil Sidhas*, Indian Council of Philosophical Research, New Delhi, 1992.
5. Ananda Balayogi Bhavanani, *A Primer of Yoga Theory*, Puducherry, 2004.

Further Readings

1. Swami Niranjanananda Saraswati, *Yoga Darshan*, Yoga Publications Trust, Munger, Bihar, 2005.
2. Sir John Woodroffe, *The Serpent Power*, Ganesh & Co. Chennai, 1992

I Year (Semester -II)

PHLMJD-2: Western Philosophy – I (Ancient and Medieval)

(4 Credits)

Course Objectives

This course traces the origins of philosophy in the Western tradition in the thinkers of Ancient Greece. It begins with the Pre-Socratic natural philosophers like Thales and Anaximander. Then it moves on to Heraclitus and Parmenides of Elea. Then, it discusses the counter position of Sophists and Socrates. Finally, there is discussion on Plato's theory of virtue and Forms.

Learning Outcomes

This course facilitates a comprehension of early Greek tradition. A comprehensive understanding of it is like a foundation course in the Classics. The two great classical traditions, viz., Greek and Indian have left a rich legacy of philosophic knowledge that can be pragmatically and scholastically contextualized in the present-day times. Students of Delhi University read Indian Philosophy, this course in Greek Philosophy complements it fairly well for understanding of the classics.

Unit-1

Naturalism (Cosmos, Arche & Logos, Being & Becoming)
Thales, Anaxagoras, Anaximenes, Ionians, Pythagoras, Parmenides, Heraclitus and Democritus.

Unit-2

The Sophists and Socrates

Sophists (Protagoras): Relativism and Scepticism
Socrates: Critical Enquiry and Virtue is Knowledge

Unit-3

Plato – Theory of knowledge, knowledge and opinion, theory of Ideas, the method of dialectic, soul and God.

Unit -4

St. Augustine: Theory of knowledge – Theology – Problem of evil.
St. Anselm: Ontological Proof
St. Thomas Aquinas: Philosophy and theology – Theory of knowledge – Proofs for the existence of God.

Essential Readings

1. Y. Masih, *A Critical History of Western Philosophy*, Motilal Banarsidass, New Delhi, 2013.

2. B.A.G. Fuller, *A History of Philosophy*, Oxford and IBH Publication, 1989.

3. Frank Thilly, *A History of Philosophy*, SBW Publishers, 2015.

4. Bertrand Russell, *History of Western Philosophy*, Oxford University Press, 2004.

5. John Cottingham, *The Rationalists*, Oxford University Press, Oxford, 1988.

Further Readings

J. Barnes, *Early Greek Philosophy*. Harmondsworth: Penguin Books,1981. p.xi-xxv.

Curd, Patricia. *A Presocratic Reader: Selected Fragments and Testimonia* Second Edition Edited, with Introduction. Translations by Richard D Mckirahan and Patricia Curd (Hackett Publishing Company, Inc,2011) ,p.13-19, p.39-65.

Warren, James & Frisbee Sheffield (eds.). *The Routledge Companion to Ancient Philosophy*. Routledge: London and New York, 2014. Part-1.,94-124, Part-II, chapters 13-16.

Kirk,G.S and Raven, J.E, *The Presocratic Philosophers: A Critical History with Selection of Texts* (Cambridge; At The University Press,1957) pp74-99

G.S Kirk and J.E.Raven, *The Presocratic Philosophers*, Chapters vi and

PHLMID-2(A): Principles of Philosophy – II

(4 Credits)

Course Objectives:

The course aims to explore fundamental philosophical inquiries about the world, including Aristotle's views on causality and evolution. It delves into the mind-body problem and the evolution of self-consciousness. Critical evaluation of arguments regarding self-immortality and transcendence is emphasized. Diverse conceptions of God and the problem of evil, along with arguments for God's existence, are examined. The course also investigates theories of reality and value, covering monistic, dualistic, and pluralistic perspectives on realism and idealism.

Learning Outcomes:

Students will grasp philosophical perspectives on causality, materialism, and evolution. They'll critically analyze the mind-body problem and theories of self-consciousness, understanding the self's nature. Evaluation of arguments about self-immortality and transcendence will be emphasized. Diverse conceptions of God and responses to the problem of evil will be explored. Students will engage in critical reflection on theories of reality and value, discerning philosophical frameworks' implications for existence and ethical decision-making.

UNIT – 1

Philosophy of the world: Aristotle’s views of cause – Problem of matter and motion – Problem of space and time – Materialism – World as creation – World as evolution – Theories of evolution.

UNIT – 2

Philosophy of the Self: Body, Mind and the Soul – Mind–Body problem – Evolution of self-consciousness.

UNIT – 3

Problem of immortality of the Self: Man's desire for immortality – Arguments in favour of the immortality of the Self.

Unit – 4

Problem of God: God-idea – Origin of the consciousness of a God – God and the world – 'Isms' on God: Deism, Pantheism, Panentheism and Polytheism – Arguments for the existence of God – Problem of evil.

UNIT – 5

Theories of Reality: Reality and its types: Monistic, dualistic and pluralistic Realisms – Idealism and its types: Platonic idealism, Idealism of Berkeley, Idealism of Kant, Pluralistic spiritualism of Leibnitz and Absolute Idealism of Hegel.

UNIT – 5

Philosophy of value: Meaning of value – Fact and value – Value and Reality – Types of values: Physical value, Economic value and Psychical value – Extrinsic and intrinsic values, Subjective and objective values, Relative and Absolute values.

Essential Readings

1. Hari Mohan Bhattacharyya, *The Principles of Philosophy*, University of Calcutta, 1959.
2. A.C. Ewing, *The Fundamental Questions of Philosophy*, Allied Publishers Pvt. Ltd., New Delhi, 1951.
3. Gideon Rosen, Alex Byrne, et.al., *The Norton Introduction to Philosophy*, W.W. Norton & Company Inc., New York, 2018.
4. Cecile Landau, Andrew Szudek & Sarah Tomley, *The Philosophy Book*, DK Publishers, London, 2011.
5. Stephen Law, *Philosophy*, DK Publishers, Delhi, 2007.

Further Readings

1. Samuel Enoch Stump, *Socrates to Sartre: A History of Philosophy*, McGraw-Hill Book Company, New Delhi, 1982.
2. Michael Scriven, *Primary Philosophy*, McGraw-Hill Book Company, New York, 1966.

PHLMLD 2: LOGICAL REASONING FOR COMPETITIVE EXAMS

(3 Credits)

Course Objectives:

Students will grasp proposition fundamentals, structure, and classification for logical statement analysis. They'll master deductive reasoning, covering inference, syllogism, truth, validity, and fallacy identification for improved logical skills. Exploring inductive reasoning principles, including postulation, aids in evidence evaluation and real-world conclusion drawing. Insight into symbolic logic, proposition classification, truth tables, and argument validity testing enhances understanding. Essential readings deepen comprehension and prepare for competitive exam applications in logic.

Learning Outcomes:

Students will achieve conceptual clarity in logical concepts, precisely identifying and analyzing propositions, inferences, and fallacies. They'll develop analytical skills to assess deductive argument validity, construct proofs, and discern reasoning patterns. Proficiency in inductive reasoning enables systematic evidence evaluation and sound conclusion formulation. Mastery of symbolic logic techniques, like truth-table analysis, enhances problem-solving efficiency. Engagement with logical reasoning principles fosters critical thinking skills, preparing students for success in exams and beyond.

UNIT – 1

Propositions

Proposition – Parts of a proposition – Classification of propositions into Unconditional and Conditional propositions – Euler's Circle and distribution of terms in the categorical propositions.

UNIT – 2

Deductive Logic

Inference – Classification of inference –Immediate inference by the method of opposition and by the method of eduction – Syllogism – Truth and validity – Proposition and propositional form – Argument and argument form – Classification of syllogisms – Validity of a pure categorical syllogism – Venn Diagram – Validity of hypothetical and disjunctive syllogisms – Fallacies.

UNIT – 3

Inductive Logic

Inductive reasoning – Postulation – Kinds of induction into scientific and imperfect inductions – Stages in a scientific induction – Fallacies.

UNIT – 4

Symbolic / Modern Logic

Classification of propositions – Constants and variables – Basic Truth-tables – Tautology, contradiction and contingency – Testing the validity of an argument using direct and indirect truth-table methods

Essential Readings

1. K.T. Basantani, *Introduction to Logic*, A.R. Sheth & Co., Bombay, 1973.
2. James E. Creigton & Harold R. Smart, *An Introductory Logic*, Macmillan, London, 1957.
3. Morris R. Cohen & Ernest Nagel, An Introduction to Logic and Scientific Method, Allied Publishers Pvt Ltd, New Delhi, 1989.
4. P. Balasubramanian, *An Invitation to Symbolic Logic*, University of Madras, 1977.
5. P. Balasubramanian, *Symbolic Logic and Its Decision Procedures*, University of Madras, 1980.

Further Readings

1. Irwing M. Copi, *Introduction to Logic*, Macmillan, London, 1990.
2. Irwing M. Copi, *Symbolic Logic*, Prentice Hall Publications, New Delhi, 2009.

PHLSEC-2(B) - Creative Writing

(3 Credits)

Course Objectives:

The Creative Writing course aims to provide participants with a foundational understanding of creative writing, exploring its various genres, including poetry, fiction, non-fiction, drama, and more. Participants will diversify their writing skills across different forms of creative expression and learn essential elements of crafting narratives, such as plot development and

characterization. The course also intends to familiarize participants with contemporary writing practices, including digital content creation, copywriting, and scriptwriting.

Learning Outcomes:

By the end of the course, participants will have acquired a versatile set of writing skills applicable across genres. They will be able to identify and employ key elements of narrative fiction, choose effective points of view, and refine their work through proofreading and editing. Additionally, participants will gain insights into contemporary creative writing practices, enabling them to engage with modern forms of expression, such as digital content creation and scriptwriting.

Unit-1

Fundamental of Creative Writing

What is Creative Writing?

Meaning and Significance of Creative Writing

Genres of Creative Writing: poetry, fiction, non-fiction, drama and other forms

Unit -2

Forms of Creative Writing

Fiction: short story, novella and novel, Drama

Poetry & Essay

Unit -3

Narrative Fiction

Elements of Narration – Story and Plot – Characterization

Choice of Medium of Narration – Point of View

Proof Reading and Editing

Unit -4

Contemporary Creative Writing

Digital Content, Copywriting, Script Writing

Essential Readings

1. LaPlante, Alice. *The Making of a Story: A Norton Guide to Creative Writing.* W.W. Norton & Company, 2007.
2. King, Stephen. *On Writing: A Memoir of the Craft.* Scribner, 2000.
3. Gardner, John. *The Art of Fiction: Notes on Craft for Young Writers*. Vintage Books, 1991.

4. Lamott, Anne. *Bird by Bird: Some Instructions on Writing and Life.* Anchor Books, 1995.
5. Goldberg, Natalie. *Writing Down the Bones: Freeing the Writer Within.* Shambhala Publications, 2005.

Further Readings

1. Dillard, Annie. *The Writing Life*. Harper Perennial, 1990.
2. Bell, Julia, and Paul Magrs, editors. *The Creative Writing Coursebook: Forty Authors Share Advice and Exercises for Fiction and Poetry*. Macmillan, 2001.
3. Sellers, Heather. *The Practice of Creative Writing: A Guide for Students*. Bedford/St. Martin's, 2012.
4. Brooks, Larry. *Story Engineering: Mastering the 6 Core Competencies of Successful Writing*. Writer's Digest Books, 2011.

Diploma in Philosophy

II Year (Semester –III)

PHLMJD-3: CLASSICAL INDIAN PHILOSOPHY – II
(4 Credits)

Course Objectives:

This course seeks to provide students with a comprehensive understanding of Classical Indian Philosophy. Objectives include delving into the foundational concepts of major philosophical schools such as Vedanta, Samkhya, Nyaya, and Vaisheshika. Students will explore the historical and cultural context that shaped these philosophical traditions, gaining insights into the interconnectedness of classical Indian thought. Emphasis will be placed on developing critical analysis skills for examining the intricate philosophical arguments present in classical texts. Additionally, students will engage in comparative studies, contrasting Classical Indian Philosophy with other philosophical traditions to foster a well-rounded perspective.

Course Outcomes:

Upon completion of the course, students will have acquired a nuanced knowledge of Classical Indian Philosophy, allowing them to articulate the key tenets of major philosophical schools. They will possess analytical skills to critically evaluate the complex arguments presented in classical Indian philosophical texts. Cultural awareness will be a prominent outcome, as students gain insights into the profound connection between philosophical thought and classical

Indian culture. Effective communication skills will be honed through discussions and written expressions of intricate philosophical ideas. Furthermore, students will reflect on the ethical implications embedded in classical Indian philosophical theories and apply these insights to contemporary ethical dilemmas. This course prepares students for a thoughtful engagement with the rich and diverse heritage of Classical Indian Philosophy.

UNIT – 1

Sankhya – Yoga

Satkaryavada and arguments by Sankhya in support of Satkaryavada.
Sankhya dualismof Purusha and Prakrti and arguments for their existence.
Sankhya's *Prakrtiparinamavada*.
Yoga: Modifications of *Citta* and its nullification – *Ashtanga yoga*.

UNIT – 2

Purva-Mimamsa

The authority of the Vedas.
Sources of knowledge.
Dharma, Karma, Apurva.
Doctrine of *Adrsta*.

UNIT – 3

Vedanta (Trans-theistic)

Advaita Vedanta:*Brahman, Jiva* and Jagat.
Doctrine of *Maya*.
Anirvacaniyakhyati – Brahma-Vivartavada.
Doctrine of *Jivanmukti.*
UNIT – 4

Vedanta (Theistic)

Visishtadvaita Vedanta: The inter-relation of *Brahman, Jiva* and *Jagat.*
*Bhakti*and *Prapatti – Sadhana Saptaka – Doctirne of Videhamukthi*.
Dvaita Vedanta: *Brahman, Jiva* and *Jagat*
Pancabheda – Nature, function and classification of Souls – Doctrine of *Videhamukthi*.

UNIT – 5

Saiva Siddhanta

The sources of knowledge.

Pati, *Pasu* and *Pasa*.
The thirty-six tattvas.
Bondage and liberation.

Essential Readings

1. Satischandra Chatterjee &Dhirendramohan Datta, *An Introduction to Indian Philosophy*, Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 2016.
2. Chandradhar Sharma, *A Critical Survey of Indian Philosophy*, Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 2013.
3. T.M.P. Mahadevan, *Invitation to Indian Philosophy*, Arnold-Heinemaan, New Delhi, 1982.
4. M. Hiriyanna, *Outlines of Indian Philosophy*, Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 2014.
5. *The Essentials of Indian Philosophy*, Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 2015.

Further Readings

1. Surendranath Dasgupta, *History of Indian Philosophy* (Vols. 1–5), Motilal Banarsidass Publishers Pvt. Ltd, New Delhi.
2. S. Radhakrishnan, *Indian Philosophy*, (Vols. 1& 2), Oxford University Publishers, New Delhi, 2009.
3. (Edr), *History of Philosophy – Eastern and Western* (Vol. 1), George Allen & Unwin Ltd, London, 1952.
4. Jadunath Sinha, *Indian Philosophy*, (Vols. 1–3), Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 1999.
5. P.T. Raju, *Structural Depths of Indian Thought*, South Asian Publishers Pvt. Ltd,New Delhi, 1985.

PHLMJD-4: Western Philosophy – II (Modern Period)

(4 Credits)

Course Objectives:

This Course will grasp key modern philosophers' foundational ideas and methodologies, including Descartes, Spinoza, Leibniz, Locke, Berkeley, and Hume. They'll analyze and evaluate each philosopher's arguments and concepts concerning truth, knowledge, existence, and metaphysics. Understanding modern philosophy's development and its impact on

subsequent thought, students will critically engage with diverse perspectives on fundamental questions about reality, consciousness, God, and human knowledge. They'll explore connections between Western philosophy and broader intellectual, cultural, and historical contexts.

Learning Outcomes:

Students will demonstrate a thorough grasp of major themes in modern Western philosophy, critically analyzing texts and arguments. They'll apply philosophical reasoning to contemporary debates, fostering interdisciplinary perspectives linking philosophy with science, religion, and ethics. Developing an appreciation for philosophical diversity, students will understand modern thought's relevance to contemporary inquiries. Through written and verbal communication, they'll engage deeply with philosophical concepts, enhancing their analytical skills and understanding of complex philosophical ideas..

UNIT – 1

Descartes: Conception of method, Criteria of truth, doubt and methodological scepticism, cogito ergo sum, innate ideas, Cartesian dualism: mind and matter, proofs for the existence of God, interactionism.

Spinoza: Substance, Attribute and Mode, the concept of 'God or Nature', Intellectual love of God, parallelism, pantheism, three orders of knowing.

UNIT – 2

Leibnitz: Monadology, truths of reason and fact, innateness of ideas, proofs for the existence of God, principles of non – contradiction, sufficient reason and identity of indiscernibles, the doctrine of pre -established harmony, problem of freedom.

UNIT – 3

Locke: Ideas and their classification, refutation of innate ideas, theory of substance, distinction between primary and secondary qualities, theory of knowledge, three grades of knowledge.

UNIT – 4

Berkeley: Rejection of the distinction between primary and secondary qualities, immaterialism, critique of abstract ideas, esse est percipi, the problem of solipcism; God and self.

Hume: Impressions and ideas, knowledge concerning relations of ideas and knowledge concerning matters of fact, induction and causality, the external world and the self, personal identity, rejection of metaphysics, scepticism, reason and the passions.

UNIT – 5

Immanuel Kant: Synthesis of Rationalism and Empiricism, Copernican Revolution – Judgments – a-priori, a-posteriori and synthetic a-priori, Phenomena and Noumena.

Hegel: Absolute Spirit, Reality and Actuality, Dialectics.

Essential Readings:

1. Y. Masih, *A Critical History of Western Philosophy*, Motilal Banarsidass, New Delhi, 2013.

2. B.A.G. Fuller, *A History of Philosophy*, Oxford and IBH Publication, 1989.

3. Frank Thilly, *A History of Philosophy*, SBW Publishers, 2015.

4. Bertrand Russell, *History of Western Philosophy*, Oxford University Press, 2004.

5. John Cottingham, *The Rationalists*, Oxford University Press, Oxford, 1988.

Further Readings:

Frederick Copleston. S.J., *A History of Philosophy* (Vols I, II & IV), Image Books, New York, 1994.

2. Anthony Kenny, *A New History of Western Philosophy* (Vols I, II & III), Clarendon Press, Oxford, 2006.

3. Nicholas Bunnin & E.P. Tsui-James (Edrs), *The Blackwell Companion to Philosophy*, Blackwell Publishing Company, USA, 2003.

4. Richard H. Popkin, *The Columbia History of Western Philosophy*, Columbia University Press, New York, 1998.

PHLMID 3(A): ECO-PHILOSOPHY
(4 Credits)

Course Objectives:

The course delves into the historical evolution of philosophical thought concerning knowledge, values, and ecological concerns. It critically analyzes contemporary philosophy's limitations in addressing ecological issues and explores eco-philosophy's distinct characteristics. Investigating ecological humanism's ethical implications, including co-defined ethics and cosmology, it examines architecture's relationship with eco-philosophy, showcasing how design reflects ecological values. Additionally, the course highlights religion's role in promoting a life-enhancing ethos and fostering reverence for the Earth.

Learning Outcomes:

Students will gain insight into the historical development and philosophical foundations of eco-philosophy. They'll critically assess contemporary philosophical paradigms' limitations in addressing ecological challenges, proposing alternative perspectives. Analyzing the ethical dimensions of ecological humanism, they'll consider its impact on individual and societal values. Applying eco-philosophical principles to architecture and spatial planning, students will emphasize sustainability and environmental stewardship. They'll also reflect on religion's role in promoting holistic approaches to ecological sustainability and well-being.

UNIT – 1

Knowledge and Values: Basic Historical Positions – The Eclipse of Values in the Nineteenth Century – Information, Knowledge and Wisdom.

UNIT – 2

Eco-Philosophy Versus Contemporary Philosophy: The Debacle of Contemporary Philosophy – The Characteristics of Eco-Philosophy.

UNIT–3

Ecological Humanism: At the Next Watershed – Ethics and Cosmology Co-Define Each Other – Three Alternatives: Kant, Marx, Schweitzer – The Promethean Heritage – The New Cosmology – The New Imperative.

UNIT – 4

Architecture and Eco-Philosophy: Form Follows Culture – Space and Life – The Quest for Quality.

UNIT – 5

Celebrating Life: Religion as a Life-Enhancing Phenomenon – Life as Knowledge.

Essential Readings:

1. Skolimowski, Henryk. *Eco-Philosophy: Designing New Tactics for Living*. Marion Boyers Publishers Ltd., London, 1981.
2. *Dancing Shiva in the Ecological Age*. Clarion Books, New Dellhi, 1991.
3. *A Sacred Place to Dwell - Living with Reverence upon the Earth*. Elements Book Ltd., Australia, 1993.

Further Readings:

1. Skolimowski, Henryk. *The Participatory Mind - A New Theory of Knowledge and of the Universe*. Arkana, Penguin Books, Australia, 1994.

2. *Living Philosophy - Eco-Philosophy as a Tree of Life*. Arkana, Australia, 1992.
3. *Technology and Human Destiny*. University of Madras, 1983.

PHLMLD 3: ART OF DEBATING

(3 Credits)

Course Objectives:

This course will teach how to debate fundamentals, including topic selection, evidence gathering, and speech delivery. They'll grasp elements of proofs, analyzing evidence, constructing arguments, identifying fallacies, and refuting arguments. Skills for building compelling cases, such as defining terms, conducting proof surveys, identifying key issues, and drafting concise briefs, will be honed. Techniques for persuasion, speech organization, conviction building, and strategic planning within debates will also be emphasized.

Learning Outcomes:

Students will master debate fundamentals, enabling active participation. They'll analyze evidence, formulate coherent arguments, identify fallacies, and counter opposing viewpoints. Competence in constructing well-defined cases, conducting proof surveys, identifying crucial issues, and preparing concise briefs will be developed. Enhanced persuasive skills, effective speech composition, and strategic thinking will lead to compelling plea making during debates.

UNIT – 1

Some basic principles

Nature of debate – Choosing the subject – Assembling the proof – Making the speech.

UNIT – 2

Elements of Proofs

Evidence – Argument – Fallacy – Refutation.

UNIT – 3

Case construction

Defining the terms – Surveying the proof – Finding the issues – Drawing the brief.

UNIT – 4

Plea making

Conviction – Persuasion – Speech composition – Strategy.

Essential Readings

1. Warren Choate Shaw, *The Art of Debate*, Norwood Press, USA, 1922.
2. Jarod Atchison, *The Art of Debate – Course Guidebook*, The Great Courses, Virginia, 2017.
3. Mehdi Hasan, *Win Every Argument: The Art of Debating*, Persuading and Public Speaking, Henry Holt and Co., 2023.

Further Readings

1. Bo Seo, *How Debate Teaches Us to Listen and Be Heard*, Penguin Books, 2023.

SEC-3(A): Art of Philosophical Counselling

Course Objectives:

This course will introduce Philosophical Counselling, distinguishing it from Psychiatry and Psychotherapy. The efficacy and criticisms of Philosophical Counselling, compared to Existential Psychotherapy and Rogerian Therapy, will be explored. The role of philosophical inquiry in counselling, examining life, philosophical consultation, and limitations will be examined. Integration of Buddhist psychology, emphasizing mindfulness-based therapies, and theoretical orientations in psychotherapy will be analyzed, including philosophical and psychological perspectives on personality and the mind-body relationship.

Learning Outcomes:

Students will grasp Philosophical Counselling principles, differentiating it from traditional approaches. They'll critically assess its strengths and weaknesses compared to Existential Psychotherapy and Rogerian Therapy. Developing the ability to apply philosophical inquiry to personal consultation, they'll recognize limitations and benefits of Philosophical Counselling. Understanding the integration of Buddhist psychology, especially mindfulness-based therapies, and various theoretical orientations in psychotherapy, including philosophical perspectives, will be emphasized.

Unit 1

The Efficacy of Philosophical Counselling

What is Philosophical Counselling?

Five common philosophical criticisms of Psychiatry

The Relationship between Philosophical Counselling and Psychotherapy

Unit 2

Existential Psychotherapy

Philosophical Criticism of Existential Psychotherapy

Rogerian Therapy

Unit 3

The Life Examined in Philosophical Counselling

The Philosopher as Personal Consultant

What Philosophical Counselling Can't Do

How can Philosophy Benefit from Philosophical Practice?

Unit 4

Four Stages of Counselling

An Introduction to Buddhist Psychology and Counselling

Pathways of Mindfulness-Based Therapies

Nature of Counselling and Theoretical Orientations in Psychotherapy

Personality: Philosophical and Psychological Issues

Mind–Body Relationship and Buddhist Contextualism

The principles of Buddhist psychology

Essential Readings:

Marinoff, Lou. *Philosophical Practice*. City College, The City University of New York, 2001.

Marinoff, Lou, editor. *Philosophical Practice.* Journal of the APPA, The City College of New York, 2001.

de Silva, Padmasiri. *An Introduction to Buddhist Psychology and Counselling*. 5th ed., Palgrave Macmillan, 2014.

Kalupahana, David J. *The Principles of Buddhist Psychology*. State University of New York Press, 1987.

Further Readings

Schuster, Gerd A. *Philosophical Practice: An Alternative to Counselling and Psychology*. Peter Lang, 2001.

Raabe, Peter. *Philosophical Counselling*. Peter Lang, 2001.

Hadot, Pierre. *Philosophy as a Way of Life.* Translated by Michael Chase, Blackwell Publishing, 1995.

Creel, Richard. *Thinking Philosophically.* Blackwell Publishers, 1994.

Nelson-Jones, Richard. *Theory and Practice of Counselling and Therapy*. Sage Publications, 2005.

de Botton, Alain. *The Consolations of Philosophy*. Vintage Books, 2001.

II Year (Semester – IV)

PHLMJD-5: -CONTEMPORARY INDIAN PHILOSOPHY – 1

(4 Credits)

Course Objectives:

The course delves into Contemporary Indian Philosophy, highlighting its fusion of Eastern and Western ideas. Philosophical contributions of figures like Swami Vivekananda, Rabindranath Tagore, Mahatma Gandhi, Sri Aurobindo, and Dr. B.R. Ambedkar are analyzed. Key concepts such as Practical Vedanta, Truth, Ahimsa, Integral Yoga, and Social Justice within Indian philosophical traditions are evaluated. Reflection on the relevance of these perspectives to societal challenges and individual spiritual growth is emphasized.

Learning Outcomes:

Students will grasp the fusion of Eastern and Western philosophies in Contemporary Indian Philosophy. They'll critically evaluate ideas of notable Indian thinkers. Applying principles

like Practical Vedanta, Satyagraha, Integral Yoga, and Social Justice to personal and societal contexts will be emphasized. Through interdisciplinary dialogue and reflection, students will deepen understanding of Indian philosophical concepts and their relevance for modern life.

UNIT 1

Characteristics of Contemporary Indian Philosophy: East–West synthesis – Interpretative and creative – Faithful to the tradition – Monism – Reality of the world – Integral nature of man – Dignity of manness – Reality of human freedom – Importance of intuitive knowledge.

Swami Vivekananda: Practical Vedanta – *Maya* – Ways of Self-realization – Universal Religion.

UNIT 2

Rabindranath Tagore: *Jivan-Devata* – Humanism – Aesthetic mysticism – Surplus Man.

UNIT 3

Mahatma Gandhi: Truth – *Ahimsa* – *Satyagraha* – *Sarvodaya* – Trusteeship – *Sarvadharma samobhava* – *Rama Rajya*.

UNIT 4

Sri Aurobindo: Concept of Absolute – Involution and Evolution – Integral Yoga – Gnostic Being

UNIT 5

Dr. B.R. Ambedkar: Anihilation of Caste – Critique of *Varnasrama dharma* – Social Justice – Views on Buddhism.

Essential Readings

1. Basant Kumar Lal, *Contemporary Indian Philosophy*, Motilal Banarsidass, New Delhi, 1980.

2. T.M.P. Mahadevan & G.V. Saroja, *Contemporary Indian Philosophy*, Sterling Publishers, New Delhi, 1985.

3. D.S. Sarma, *Hinduism Through the Ages*, Bharatiya Vidya Bhavan, Mumbai, 1989.

4. P. Nagaraja Rao, *Contemporary Indian Philosophy*, Bharatiya Vidya Bhavan, Bombay, 1970.

Further Readings

1. Vasant Moon (Compiler), *Dr. Babasaheb Ambedkar Writings and Speeches*, Vols III & IV (Relevant chapters only), Education Department, Government of Maharashtra, 1987.
2. Ramalingam, *Anmaikkalathu Indhiya Meipporuliyal* (Tamil), Tamil Nadu Textbook Society, Chennai.
3. Viswanath S. Naravane, *Modern Indian Thought*, Orient Longman Ltd, New Delhi, 1978.
4. D.S. Sarma, *Studies in the Renaissance of Hinduism*, Benares Hindu University, 1944.
5. Dhananjey Keer, *Babasaheb Ambedkar*, Popular Prakasan Pvt Ltd, 2011

PHLMJD 6: CONTEMPORARY WESTERN PHILOSOPHY
(4 Credits)

Course Objectives:

The course aims to provide a comprehensive understanding of major movements in contemporary Western philosophy: Analytic, Pragmatic, Phenomenological, and Existentialist. It analyzes methodologies, key concepts, and contributions of major thinkers in each movement. Through examination of philosophical arguments, theories of truth, and concepts of reality, existence, and human experience, critical thinking skills are fostered. Relevance of Western philosophical ideas to contemporary issues is explored, while encouraging critical engagement with primary and secondary sources.

Learning Outcomes:

Students will exhibit nuanced understanding of historical context, foundational ideas, and key figures in major contemporary Western philosophy movements. They'll critically evaluate and compare methodologies, theories, and arguments within each movement. Developing clear and persuasive oral and written communication skills, they'll articulate complex philosophical concepts. Applying philosophical principles, they'll analyze contemporary societal, ethical, and existential issues. Proficiency in independent research, utilizing primary and secondary sources effectively, will be ~~demonstrated..~~demonstrated.

UNIT – 1

Introduction

General outline of contemporary western philosophy.

Analytic Movement

The origin and development of the Analytic Movement – Vienna Circle – Anti-metaphysical attitude
Bertrand Russell: Logical Atomism – Naming theory of Meaning.

A.J. Ayer and Rudolph Carnap: Verification theory – Phenomenalism – Logical Positivism.
Ludwig Wittgenstein: Picture theory of Meaning – Language Games – Use theory of Meaning.

UNIT – 2

Pragmatic Movement

The origin and development of the Pragmatic Movement.
William James: Pragmatism as a method – Theory of Truth – The role and the status of the Will – Relevance of the Will to Believe.
John Dewey: The spectator versus experience – Habit, intelligence and learning – Value in a world of fact.

UNIT – 3

Phenomenological Movement

The origin and development of the Phenomenological Movement.
Franz Brentano: Theory of Intentionality.
Edmund Husserl: Philosophy as a rigorous science – Reductionism – Essence – The relation between 'noema' and 'noesis'.

UNIT – 4

Existentialist Movement

The origin and development of the Existentialist Movement.
Soren Kierkegaard: Critique of Hegel – The three stages of existence.
Martin Heidegger: Dasein – 'World' and 'Being-in-the-World' – Authentic and inauthentic modes of disclosure.
Jean Paul Sartre: The distinction between the 'for-itself' and the 'in-itself' – Bad faith – The treatment of freedom.

Essential Readings

1. Barry R. Gross, *Analytic Philosophy: An Historical Introduction*, Oxford & IBH Publishing Co., New Delhi, 1981.
2. Mrinal Kanti Bhadra, *A Critical Survey of Phenomenology and Existentialism*, Allied Publishers & ICPR, ND, 1990.
3. S.V. Rajadurai, *Existentialism* (in Tamil), Kriya Publishers, Chennai, 1983.
4. S.V. Rajadurai, *IruththaliyamumMarxiyamum* (in Tamil), Vidiyal Pathipakam, Kovai, 2011.
5. M.S.M. Anas, *Meiyiyal: GirekkamMudhalTharkaalamvarai* (in Tamil), Adaiyalam Publishers, Tiruchi, 2013.

Further Readings

1. Frederick Copleston. S.J., *A History of Philosophy* (Vols. VIII & IX), Image Books, New York, 1994.
2. Anthony Kenny, *A New History of Western Philosophy* (Vol. IV), Clarendon Press, Oxford, 2006.
3. Nicholas Bunnin & E.P. Tsui-James (Edrs), *The Blackwell Companion to Philosophy*, Blackwell Publishing Company, USA, 2003.
4. Richard H. Popkin, *The Columbia History of Western Philosophy*, Columbia University Press, New York, 1998.

PHLMJD-7: Traditional Western Logic

(4 Credits)

Course Objectives:

This logic course aims to provide students with foundational skills in logical reasoning. Objectives include mastering basic concepts such as propositions, deductive and inductive arguments, and understanding truth, validity, and soundness. In traditional logic, students will comprehend terms, categorical propositions, and immediate inference techniques. Unit-III introduces symbolic logic, focusing on truth functions, statements, and logical analysis using the indirect truth table method. The course concludes with an exploration of informal fallacies, specifically Ignoratio Elenchi, aiming for students to recognize and understand faulty reasoning in arguments.

Learning Outcomes:

By the end of the course, students are expected to possess a strong grasp of both traditional and symbolic logic, enabling them to construct valid arguments, assess logical propositions, and identify common fallacies. Recommended readings from prominent logicians supplement theoretical knowledge, ensuring practical insights into logical reasoning and fostering critical thinking skills applicable across various disciplines.

UNIT 1

Introduction to logic and propositions: Definition and scope of logic – Logic as formal and normative science – Its relation to other sciences – Reduction of sentences to propositions – Categorical propositions – Distribution of Terms and the Euler's Circle – Hypothetical propositions – Disjunctive propositions.

UNIT 2

Deductive inference: Immediate inference: Opposition of propositions and Education method (Obversion and Conversion only) – Mediate Inference: Categorical Syllogism – Formal Rules and Testing the Validity – Moods and Figures – Testing the validity of a categorical syllogism using Venn Diagram.

UNIT 3

Deductive inference (continued): Hypothetical Syllogism – Pure and Mixed Hypothetical Syllogisms – Finding the validity of hypothetical syllogisms - Disjunctive Syllogisms – Pure and Mixed Disjunctive Syllogisms – Finding the validity of disjunctive syllogisms – Fallacies.

UNIT 4

Dilemma: What is a dilemma? – Simple constructive dilemma – Simple destructive dilemma – Complex constructive dilemma – Complex destructive dilemma – Taking the dilemma by horns – Escaping between the horns of a dilemma – Rebutting the dilemma.

UNIT 5

Inductive Inference: Meaning and nature of induction – Problem of induction – Inductive leap – Postulates of induction – Enumeration and Analogy – Fallacies - The concept of Cause – Observation and Experiment – Facts – Hypothesis – Theory – Law.

Essential Readings

1. K.T. Basantani, *Introduction to Logic*, A.R. Sheth & Co., Bombay, 1973.
2. Krishna Jain, *A Textbook of Logic*, D.K. Printworld (P) Ltd, New Delhi, 2009.
3. James E. Creigton & Harold R. Smart, *An Introductory Logic*, Macmillan, London, 1957.
4. Morris R. Cohen & Ernest Nagel, An Introduction to Logic and Scientific Method, Allied Publishers Pvt Ltd, New Delhi, 1989.

Further Readings

1. Irwing M. Copi, *Introduction to Logic*, Macmillan, London, 1990.

PHLMID-4(A): Feminist Philosophy

(4 Credits)

Course Objectives:

This course in Feminist Philosophy and Gender Studies aims to provide students with a comprehensive understanding of key concepts, theories, and movements within the feminist discourse. The course begins by examining the historical roots of patriarchy, utilizing texts such as Gerda Lerner's "The Creation of Patriarchy," to establish a foundational understanding of systemic gender oppression. It progresses to explore feminist epistemology, critically engaging with Sandra Harding's work on the existence of a feminist method and Moira Gatens' critique of traditional philosophical frameworks.

Learning Outcomes:

Upon completion of the course, students are expected to critically engage with feminist literature, analyze complex issues related to gender, and contribute to discussions on women's experiences in various societal and cultural domains. The course aims to foster a nuanced understanding of feminist philosophy and its implications for societal structures.

UNIT 1

Introduction: Meaning of feminism – Need for feminism – The diversity of feminist thinking.

UNIT 2

Liberal and Radical feminism

UNIT 3

Marxist and Social feminism

UNIT 4

Psychoanalytic and Care-focused feminism

UNIT 5

Post-colonial feminism, Eco-feminism, Postmodern and Third-Wave feminism

Essential Readings

1. Rosemarie Tong, *Feminist Thought: A More Comprehensive Introduction*, Westview Press, Colorado, 2009.
2. Neeru Tandon, *Feminism: A Paradigm Shift,* Atlantic Publishers & Distributors (P) Ltd., New Delhi, 2012.

3. Brooke Noel Moore & Kenneth Bruder, *Philosophy: The Power of Ideas*, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2005. (Chapter on 'Feminist Philosophy' only).
4. Chris Beasley, *Gender & Sexuality: Critical Theories, Critical Thinkers*, Sage Publications, New Delhi, 2005.
5. Bell Hooks, *Feminism is for Everybody: Passionate Politics*, South End Press, Cambridge, 2000.

Project: Winter Project / Internship: - Community Engagement (15 days)

Degree in Philosophy III Year (Semester – V)

PHLMJD 8: MODERN WESTERN LOGIC
(4 Credits

Course Objectives:

In this course Students will explore symbolic logic's evolution, highlighting its superiority over Aristotelian logic and its role in modern analysis. They'll grasp proposition classification, emphasizing constants, variables, and symbolizing processes. Understanding truth tables as tools for propositional and argument analysis, focusing on truth functions, is emphasized. Skills to assess argument validity using methods like Direct Truth-table, Case Analysis, and Indirect Truth-table are provided. Decision procedures, including equivalence rules and CNF, RAA, and Truth-tree techniques, are introduced.

Learning Outcomes:

Students will understand the principles and benefits of symbolic logic, appreciating its importance in contemporary analysis. Proficiency in symbolizing propositions and constructing truth tables will aid in evaluating complex expressions and arguments. They'll assess argument validity using direct and indirect methods, enhancing critical thinking. Application of decision procedures will enable effective analysis and validation of arguments, deriving logical conclusions and identifying fallacies. Grasping quantifiers' role in logical quantification allows precise analysis and formulation of statements.

UNIT 1

Symbolic Logic: Advancement of symbolic logic over traditional / Aristotelian logic – Modern classification of propositions – Constants and Variables – Symbolizing simple and compound propositions – Well-formed formula (wff) and Ill-formed formula (iff).

UNIT 2

Truth Tables: Propositional forms and Argument forms – Truth functions and the Basic Truth-tables.

UNIT 3

Validity of arguments: Finding the validity of an argument using the Direct Truth-table method – Case Analysis method – Tautology, Contradiction and Contingency – Indirect Truth-table method.

UNIT 4

Decision Procedures: Rules of Equivalence and Rules of Inference – Finding the validity of an argument by method of derivation by substitution – CNF (Conjunctive Normal Form) method – RAA (Reductio ad absurdum) method –Truth-tree technique.

UNIT 5

Quantifiers: What is a quantifier? – Universal and existential quantifiers – Quantification Rules.

Essential Readings

2. P. Balasubramanian, *An Invitation to Symbolic Logic*, University of Madras, 1977.
3. P. Balasubramanian, *Symbolic Logic and Its Decision Procedures*, University of Madras, 1980.
4. A.H. Basson and D.J. O'Connor, *Introduction to Symbolic Logic*, The Free Press ofGlencoe, Illinois, 1960.
5. K.T. Basantani, *Introduction to Logic*, A.R. Sheth & Co., Bombay, 1973.
6. Krishna Jain, *A Textbook of Logic*, D.K. Printworld (P) Ltd, New Delhi, 2009.
7. James E. Creigton & Harold R. Smart, *An Introductory Logic*, Macmillan, London, 1957.

8. Morris R. Cohen & Ernest Nagel, *An Introduction to Logic and Scientific Method*, Allied Publishers Pvt Ltd, New Delhi, 1989.

Further Readings

3. Irwing M. Copi, *Introduction to Logic*, Macmillan, London, 1990.
4. Irwing M. Copi, *Symbolic Logic*, Prentice Hall Publications, New Delhi, 2009.

PHLMJD-9: Western Ethics

(4 Credits)

Course Objectives:

In this course Students will be introduced to fundamental Western ethical concepts, exploring notions of good, justice, and virtue, along with various ethical theories. They'll analyze perspectives like Eudaemonism and Deontological Theories, contrasting frameworks such as Egoism and Universalism. Kant's moral theory and Utilitarianism, including principles by Bentham and Mill, will be examined. Ethical issues in punishment and the distinction between cognitivism and non-cognitivism will also be discussed.motivism, Prescriptivism, and Descriptivism in understanding moral judgments.

Learning Outcomes:

Students will understand foundational Western ethical concepts, facilitating engagement with ethical discourse. They'll develop analytical skills to evaluate diverse moral frameworks. Insight into Kant's moral theory and Utilitarianism will enable critical assessment of moral principles. Analyzing theories of punishment and ethical cognitivism/non-cognitivism fosters deeper moral reasoning understanding. Proficiency in articulating ethical issues allows engagement in discourse and application of theories to real-world scenarios.

Unit – 1

Concepts of Good, right, justice, duty, obligation, cardinal virtues, Eudaemonism, Intuition as explained in Teleological and Deontological Theories.

Unit -2

• Egoism, Altruism, Universalism

• Subjectivism, Cultural Relativism, Super-naturalism.

• Ethical realism and Intuitionism,

Unit – 3

• Kant's moral theory: Postulates of morality, Good-will, Categorical Imperative, Duty, Mean and ends, Maxims.

• Utilitarianism: principle of utility, problem of sanction and justification of morality, kinds of utilitarianism, Moral theories of Bentham, J. S. Mill, Sidgwick

Unit –4

• Theories of Punishment

• Ethical cognitivism and non-cognitivism: Emotivism, Prescriptivism, Descriptivism

Essential Readings:

1. Mackenzie, J.S. *A Manual of Ethics*. Oxford University Press, 1977.
2. Lillie, W. *An Introduction to Ethics*. Methuen & Co. Ltd., London, 1948.
3. Nuttall, Jon. *Moral Questions: An Introduction to Ethics*. Polity Press, 1993.
4. Ayer, A.J. "Emotivism." *Language, Truth and Logic*, Dover, 1946.
5. Hare, R.M. "Prescriptivism: The Structure of Ethics and Moral." *Essays in Ethical Theory*, Oxford University Press, 1989.

PHLMJD-10: Socio-Political Philosophy (Western)

(4 Credits)

Course Objective:

The objective of the course is to explore the socio-political philosophies of Western tinkers, spanning from classical antiquity to contemporary times, with a focus on understanding concepts of justice, liberty, equality, and community.

Learning Outcomes:

Students will grasp classical socio-political thought through Plato's ideal state and social contract theories by Locke, Hobbes, and Rousseau. Insights into liberty, as per Isaiah Berlin, and its implications on governance will be gained. They'll critically evaluate contemporary theories including liberalism by Rawls, Nozick, and Dworkin, alongside Marxist perspectives. Communitarian critiques of liberal individualism and multiculturalism, feminism, and its various strands will be explored, analyzing recognition politics and minority rights.

Unit 1

Plato: Ideal State and Justice

Locke, Hobbes, Rousseau: Social Contract Theory

Isaiah Berlin: Conceptions of Liberty

Unit 2

Bernard Williams: Idea of Equality

Liberalism: Rawls; Distributive justice, Nozick; Justice as Entitlement, Dworkin;Justice as equality;

Amartya Sen: Global Justice, Freedom and Capability.

Marxism: Dialectical Materialism, Alienation, Critique of Capitalism, Doctrine of Class Struggle and Classless Society.

Unit 3

Communitarianism: Communitarian critique of liberal self, Universalism Vs. Particularism,Theory of Charles Taylor, MacIntyre, Michael Sandel

Multiculturalism: Charles Taylor; Politics of recognition, Will Kymlicka; conception of Minority Rights

Unit 4

Feminism: Basic Concepts: Patriarchy, misogyny, Gender, Theories of Feminism; Liberal,Socialist, radical and eco-feminism

Essential Readings:

- Plato. *The Republic*. c. 380 BCE.
- Locke, John. *Second Treatise of Government*. 1689.
- Hobbes, Thomas. *Leviathan*. 1651.
- Rousseau, Jean-Jacques. *The Social Contract*. 1762.
- Berlin, Isaiah. *Four Essays on Liberty*. 1969.
- Williams, Bernard. *Equality and Discrimination: Essays in Freedom and Justice*. 1990.
- Rawls, John. *A Theory of Justice*. 1971.

Further Readings

- Nozick, Robert. *Anarchy, State, and Utopia*. 1974.
- Dworkin, Ronald. *A Matter of Principle*. 1985.
- Sen, Amartya. *Development as Freedom*. 1999.
- Marx, Karl, and Friedrich Engels. *The Communist Manifesto*. 1848.
- Marx, Karl. *Das Kapital*. Volume I published in 1867.
- Taylor, Charles. *Sources of the Self: The Making of the Modern Identity*. 1989.

PHLMID 5(A): CONTEMPORARY INDIAN PHILOSOPHY – II
(4 Credits)

Course Objectives:

The course examines philosophical ideas of notable Indian thinkers and contemporary concepts of self, society, and spirituality. Relevance of philosophical perspectives in addressing social issues is critically assessed. Diverse philosophical schools and their implications for modern Indian thought are compared and contrasted.

Learning Outcomes:

The course delves into the philosophical foundations of Muhammad Iqbal, Dheendayal Upadhyaya, Jiddu Krishnamurthy, and other thinkers, assessing their impact on Indian society and culture. Through engagement with primary texts and secondary literature, students develop critical thinking skills. They synthesize insights from diverse philosophical traditions to tackle contemporary challenges in Indian society.

UNIT – 1

Muhammad Iqbal: Self – God – Man and Superman – Intellect and intuition

UNIT – 2

Dheendayal Upadhyaya: Integral Humanism – Advaita Vedanta – Purusharthas.

Jiddu Krishnamurthy: Conception of Thought – Freedom from the known – Analysis of the Self – Choiceless awareness.

UNIT – 3

Jyotiba Phule: Critical understanding of Caste system.

Narayana Guru: The spiritual freedom and the social equality – One caste, one religion and one God.

UNIT – 4

M.N. Roy: Radical Humanism – Materialism.

Periyar E.V. Ramasamay: Casteism – Rationalist Movement – Self-Respect Movement

UNIT – 5

Thiruvalluvar: The ethical thoughts of Thiruvalluvar.

Saint Ramalinga: Jivakarunyam – Anmaneya orumaippadu – Maranamillaa peruvazhvu.

Sri Ramana Maharshi: Enquiry into the Self.

Essential Readings

1. Basant Kumar Lal, *Contemporary Indian Philosophy*, Motilal Banarsidass, New Delhi, 1980.
2. T.M.P. Mahadevan & G.V. Saroja, *Contemporary Indian Philosophy*, Sterling Publishers, New Delhi, 1985.
3. Dev Raj Bali, *Modern Indian Thought* (*Rammohan Roy to M.N. Roy*), Sterling Publishers Pvt Ltd, New Delhi, 1980.
4. M.N. Jha, *Modern Indian Political Thought* (*Ram Mohan Roy to Present Day*), Meenakshi Prakashan, Meerut, 1975.
5. Mahesh Chandra Sharma, *Pandit Deendayal Upadhyay*a (Builders of Modern India Series), Publications Division, New Delhi, 2015.

Further Readings

1. Dhananjey Keer, *Mahatma Jotirao Phooley: Father of the Indian Social Revolution*, Popular Prakasan Pvt. Ltd, 2005.
2. T. Bhaskaran, *Brahmarshi Sree Narayana Guru*, Sahitya Academy Publications, New Delhi, 2013.
3. Swami Muni Narayana Prasad, *The Philosophy of Narayana Guru*, D.K. Print World (P) Ltd., New Delhi, 2010. (Relevant Chapters only)
4. Aru. Azhagappan, *Periyar E.Ve.Ra.* (in Tamil), Sahitya Akademi, New Delhi, 2014.
5. M.N. Roy, Materialism: *An Outline of the History of Scientific Thought, Renaissance Publication*, UP, 1940.

PHLMJD-15: Summer Internship (60 days) Report submission on completion

Degree in Philosophy III YEAR (SEMESTER – VI)

PHLMJD-11: Indian Logic

(4 Credits)

Course Objectives:

The course explores Indian logic's unique features, closely tied to metaphysics and epistemology. It examines methods used in establishing philosophical systems and refuting

opposing views. Analysis of Anumana (inference) from Nyaya, Buddhist, Jaina, and Advaitic perspectives is conducted. Investigations delve into Anumana's types and constituents, along with inductive elements and logical processes within Indian philosophical traditions.

Learning Outcomes:

The course explores the synergy of logic, epistemology, and metaphysics in Indian philosophical systems. It assesses the importance of logical reasoning in shaping and scrutinizing philosophical stances. Comparative analysis of Anumana definitions, constituents, and processes across traditions is conducted. Through engagement with essential readings and primary sources, students demonstrate comprehension of advanced topics in Indian logic.

Unit -1

The close relationship of logic, epistemology and metaphysics in the Indian tradition; primacy of logical reasoning in establishing one's own system and refuting all rival systems; the method of purvapaksa and siddhanta; the concepts of anviksiki and anumiti.

a) Logic or anumana pramana as part of epistemology (pramana sastra)
b) Logic or anumana pramana as rooted in metaphysic (pramey sastra)
A) Logic or anumana pramana as Hetuvidya or Vadavidhi and Anviksiki

Unit -2

Definition of Anumana: Nyaya and Buddhist perspectives
Constituents of Anumana: Nyaya, Buddhist, Jaina and Advaitic perspectives
Process of Anumana: Nyaya, Buddhist, Jaina and Advaitic perspectives

Unit-3

Types of Anumana: Nyaya, Buddhist, Jaina and Advaitic perspectives
Nyaya: paksata; paramarsa; definition of vyapti
Inductive elements in Indian Logic: the concepts of vyaptigrahopaya, samanya laksana pratyasatti, tarka, upadhi.

Unit- 4

Hetucakra Damaru of Dinnaga
Hetvabhasas

Essential Readings:

- Barlingay, S.S. *A Modern Introduction to Indian Logic*.
- Guha, D.C. *Navya Nyaya System of Logic*.
- Banyopadhyay, Nandita. *The Concept of Logical Fallacies*.
- Matilal, B.K. *The Navya Nyaya Doctrine of Negation*.
- *Logic, Language and Reality*.
- Stcherbatsky, F. Th. *Buddhist Logic* Vols. I & II.
- Bhatt, S. R. (Tr). *Buddhist Epistemology*.

PHLMJD-12: Indian Ethics

(4 Credits)

Course Objectives:

The course aims to explore Indian ethics, delving into the foundational concepts, principles, and practices derived from ancient Indian philosophical traditions, including Hinduism, Jainism, Buddhism, and Carvaka's Hedonism.

Learning Outcomes:

The course offers a comprehensive understanding of core Indian ethical concepts like Purusārtha, Dharma, Karma, and Varṇāshrama, emphasizing their role in guiding conduct and ethical decisions. Principles of Karma-yoga and Svadharma are analyzed for their impact on personal growth, social harmony, and spiritual enlightenment. Ethical implications of Apurva, Adṛṣta, and the Law of Karma are explored. Practical ethics in Hinduism, Jainism, and Buddhism are examined, alongside critical analysis of Carvaka's Hedonism.

UNIT -1

Concept of Purusārtha, Śreyas and Preyas

Varṇāshrama, Dharma, Sādhāraṇa Dharma

Ṛna and yajña, Concept of duty

UNIT-2

Karma-yoga, Sthitprajña, Svadharma, Lokasaṃgraha

UNIT -3

Apurva and Adṛṣta

Sādhya-Sādhana, Itikartavyata

Law of Karma: ethical implications

Ṛta and Satya

Yoga-kśema

UNIT -4

Yoga: Astānga Yoga

Jainism: Samvara-nirjarā, Tri-ratṇa, Panch-vrata.

Buddhism: Upāya-Kaushal, Brahma-vihāra: matri, karuṇā, muditā, upeksha, bodhi-sattva

Carvaka's Hedonism

Essential Readings:

- Maitra, S.K. *The Ethics of the Hindus*.
- Prasad, R. *Karma, Causation and Retributive Morality*.
- Brahma, N.K. *Philosophy of the Hindu Sadhana*.
- Sri Aurobindo. *Essays on the Gita*.
- Tilak, B.G. *Srimadbhagavadgita Rahasya*.

Further Readings

- Hiriyanna, M. *The Indian Conceptions of Values*.
- Sharma, I.C. *Ethical Philosophies of India*.
- Dasgupta, Surama. *Development of Moral Philosophy in India*.

PHLMJD-13: Socio-Political Philosophy (Indian)

(4 Credits)

Course Objectives:

The course delves into ancient Indian texts like the Mahabharata, Kautilya's Arthashastra, and Kamandaki's Nitisara, examining their relevance to modern governance and law. It analyzes Kautilya's theoretical framework on statecraft and governance, and Kamandaki's concept of social order. It also explores contemporary governance issues such as constitutional morality, secularism, and colonialism's impact on Indian social institutions, offering insights into post-colonial challenges and transformations.

Learning Outcomes:

The course explores governance, law, and ethics in the Mahabharata, focusing on Danda-niti and Rajdharma, and applies insights to contemporary political dilemmas. It evaluates Kautilya's concepts of sovereignty and statecraft, proposing strategies for modern challenges. Kamandaki's theories on social order are examined for governance implications. It critiques constitutional morality and secularism's impact on inclusive societies. Lastly, colonialism's effects on Indian social institutions are analyzed, with a focus on post-colonial resilience.

Unit -1- Mahabharata: Danda-niti, foundations, Raj dharma, Law and Governance, Narada's Questions to King Yudhisthir

Unit–2- Kantilla: Sovereignty, Seven Pillars of State-craft, State, Society, Social-life, State administration, State economy, law and justice, internal security, welfare and external affairs

Unit -3 -Kamandaki: Social order and State elements

Unit -4 - Constitutional Morality, Secularism and Fundamental Rights

Constitutionalism, Total revolution, terrorism, Swadeshi, Satyagrah, Sarvodaya, Social Democracy, State Socialism, Affirmative Action, Social Justice

Social Institutions: Family, Marriage, property, education and religion

Colonialism

Essential Readings:

- "The Constitution of India." 1950.
- Guha, Ramachandra. *India After Gandhi: The History of the World's Largest Democracy.* 2007.
- Khilnani, Sunil. *The Idea of India.* 1997.
- Sen, Amartya. *The Argumentative Indian: Writings on Indian History, Culture and Identity.* 2005.

Further Readings

- Mehta, Pratap Bhanu. *The Burden of Democracy.* 2003.
- Srinivas, M. N. *Caste in Modern India and Other Essays.* 1962.
- Doniger, Wendy. *The Hindus: An Alternative History.* 2009.
- Uberoi, Patricia (ed.). *The Family in India: Critical Essays.* 2002.
- Bose, Subhas Chandra. *The Indian Struggle.* 1935.
- Tharoor, Shashi. *An Era of Darkness: The British Empire in India.* 2016.
- Cohn, Bernard S. *Colonialism and Its Forms of Knowledge: The British in India.* 1996.

PHLMJD-14: Applied Philosophy

(4 Credits)

Course Objectives: -

This course in moral philosophy and applied ethics is designed to equip students with a comprehensive understanding of ethical theories and their application to real-world situations. The course begins by introducing students to the fundamental concepts of moral philosophy, human rights, and ethical principles. It aims to foster critical thinking and ethical reasoning skills that students can apply to various contexts.

Learning Outcomes: -

By the end of the course, students are expected to have a deepened understanding of moral philosophy, applied ethics, and human rights. They should be able to critically analyze ethical issues, articulate well-reasoned ethical positions, and apply ethical principles to navigate the complexities of moral decision-making. The course aims to empower students with the knowledge and skills necessary for ethical reasoning and decision-making in their personal and professional lives.

UNIT – 1

Applied philosophy: Nature of applied philosophy – Value of applied philosophy.

Philosophy of technology: Technology, dominance, power and social inequalities – Democratization of technology – Ethical implications of information technology and bio-technology.

UNIT – 2

Environmental Ethics: Nature as means or end – Land ethics of Aldo Leopold – Deep ecology of Arne Naess – Animal rights of Peter Singer.

UNIT – 3

Medical ethics: Surrogacy – Doctor–Patient relationship – Abortion – Euthanasia–Female infanticide.

Professional ethics: Corporate governance and ethical responsibilities.

UNIT – 4

Media ethics: Ethical issues in privacy – cyber space – pornography – representation and differences – Marginalization.

Legal ethics: Law and morality – Legal obligation – Authority and validity of law.

UNIT – 5

Social ethics: Dowry – Subjugation of women – Increasing Old Age Homes – Caste and communalism – Corruption in public life – 'Turn a blind eye' towards social evils attitude.

Theories of Punishment: Retributive, Deterrent and Reformative.

Essential Readings

1. Harold Titus, *Ethics for Today*, Eurasia Publishing House, New Delhi, 1966.
2. Jacques P. Thiroux & Keith W. Kraseman, *Ethics – Theory and Practice*, Pearson Higher Education, 2014.
3. Barbara MacKinnon, *Ethics: Theory and Contemporary Issues*, Thomson Wadsworth, Canada, 2004.
4. Stephen Satris, *Taking Sides: Clashing Views on Controversial Moral Issues*, Dushkin / McGraw Hill, USA, 1998.
5. Andrew I. Cohen & Christopher Heath Wellman (Edrs), *Contemporary Debates in Applied Ethics*, Blackwell Publishing Ltd, USA, 2005.

Further Readings

1. Steven M. Cahn & Peter Markie (Edrs), *Ethics: History, Theory and Contemporary Issues*, Oxford University Press, New York, 2012.
2. Emmett Barcalow, *Moral Philosophy: Theories and Issues*, Thomson Wadsworth, UK, 2007.
3. T.M.P. Mahadevan (Edr), *Philosophy: Theory and Practice* (*Proceedings of the International Seminar on World Philosophy*), University of Madras, 1970.

PHLMID-6(C): Philosophy of Dr. B.R. Ambedkar

(4 Credits)

Learning Objectives:

The aim of this course is to introduce the alternative approaches of contemporary Indian philosophical thought with special focus on Philosophy of B R Ambedkar. This course is an exploration of democratic and normative philosophical thought in reconstruction Indian society. This course introduces the essential philosophical writings of contemporary Indian Thinker B R Ambedkar by discussing the Philosophical method in general and Social- Political philosophy and philosophy of religion of Ambedkar in particular.

Learning Outcomes:

Learn Ambedkar's alternative reading of Indian philosophy by interrogating dominant philosophical systems and its texts.

Critical engagement with social reality conditioned by the caste system.

Learn the liberative and democratic potential of philosophy of Ambedkar in reconstructing Indian nation.

To make good citizen by understudying the indigenous democratic philosophical thought.

Unit 1 Life world of B R Ambedkar

1. Life and Essential Writings of Ambedkar

2. Concepts and methodology of B.R.Ambedkar

Unit 2 Philosophy of Religion

Philosophy of Religion and Hindu Social Order

Buddhism and Marxism

Unit 3 Socio-Political Philosophy

Annihilation of Caste and Ideal society

State Socialism

Unit -4 On Emancipation

Nation and Nationalism

Democracy

Essential Readings:

Ambedkar, B.R. "The Hindu Social order: Its Essential Principles." *Dr. Babasaheb Ambedkar Writings and Speeches*, vol. 3, Dr. Ambedkar Foundation, 2014, pp. 95-115.
Ambedkar, B.R. "Introduction." *The Essential Writings of B.R. Ambedkar*, edited by Valerian Rodrigues, Oxford Press, 2002, pp. 20-36.
Rodrigues, Valerian (ed.). "Introduction." *The Essential Writings of B.R. Ambedkar*, Oxford Press, 2002, pp. 267-268, 275-277, 294-304.
Rodrigues, Valerian (ed.). "Buddha or Karl Marx." *The Essential Writings of B.R. Ambedkar*, Oxford Press, 2002, pp. 173-189.
Rodrigues, Valerian (ed.). "Democracy." *The Essential Writings of B.R. Ambedkar*, Oxford Press, 2002, pp. 60-64.

Further Readings:

Ambedkar, B.R. "Introduction." *The Essential Writings of B.R. Ambedkar*, edited by Valerian Rodrigues, Oxford Press, 2002, pp. 1-43.
Ambedkar, B.R. "Krishna and His Gita." *The Essential Writings of B.R. Ambedkar*, edited by Valerian Rodrigues, Oxford Press, 2002, pp. 193-204.
Ambedkar, B.R. "Basic Features of Indian Constitution." *The Essential Writings of B.R. Ambedkar*, edited by Valerian Rodrigues, Oxford Press, 2002, pp. 473-495.
Ambedkar, B.R. "Caste, Class, and Democracy." *The Essential Writings of B.R. Ambedkar*, edited by Valerian Rodrigues, Oxford Press, 2002, pp. 132-148.
Aloysius, G. *Nationalism without a Nation in India.* Oxford University Press, 1997.
Aloysius, G. *Ambedkar on Nation & Nationalism.* Critical Quest, New Delhi, 2009.

Honours in Philosophy IV Year (Semester – VII)

PHLMJD-16: PHILOSOPHY OF SCIENCE

(4 Credits)

Course Objectives:

This course aims to provide students with a comprehensive understanding of the philosophy of science, fostering critical thinking and analytical skills. The overarching objective is to familiarize students with the nature of science, distinguishing it from non-science and pseudo-science, and examining the intricate relationship between natural and social sciences. Throughout the course, students will explore the foundations of scientific knowledge, grappling with issues of induction, theory confirmation, and models of explanation.

Course Outcomes:

Throughout this course, students will attain a multifaceted understanding of the philosophy of science, developing a nuanced perspective on the nature, foundations, and methodologies of scientific inquiry. By engaging with diverse topics, including the demarcation of science from non-science and pseudo-science, the distinctions between natural and social sciences, and the critical examination of scientific knowledge, students will cultivate analytical and evaluative skills.

UNIT 1. What is Science?

(a) Science and non-science (b) Science and pseudo-science (c) Natural and social sciences (d) Scientific method and research

UNIT 2. Scientific Knowledge

(a) Induction and its problem (b) What is theory? (c) Theory confirmation (d) Models of explanation

Contemporary Science and Philosophy

(a) Scientific verification (b) Biological conceptions (c) Revolution in physics (d)Science and logic

UNIT 3. The Logic of Science

(a) Causation and indeterminism (b) Elimination of psychologism (c) Deductivetesting of theories (d) Falsifiability

Truth, Rationality and the Growth of Scientific Knowledge

(a)Background knowledge (b) Scientific growth Skepticism (c) The requirements for the

growth of scientific knowledge

UNIT 4. Paradigms in Science

(a) Normal science (b) The paradigm concept (c) Puzzle solving (d) Scientific revolutions (e)Rationality and progress

Methodological Problems of Social Sciences

(a) Cultural relativism and social laws (b) functionalism and social science (c)Methodological individualism and social science

Essential Readings

1. Nagel, Ernest. *The Structure of Science*. New Delhi: Macmillan India Limited, 1984. First Indian Edition.
2. Popper, Karl. *The Logic of Scientific Discovery*. London & New York: Routledge and Kegan Paul, 2010.
3. Kuhn, Thomas. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press, 1996. 3rd edn.
4. Bartolitti, Lisa. *An Introduction to Philosophy of Science*. Cambridge: Polity Press, 2008.

PHLMJD-17: Philosophy of Mind

(4 Credits)

Course Objectives:

Explore the nexus of philosophy and psychology concerning the mind's essence. Assess significant mind theories like Cartesian dualism, behaviorism, and materialism. Analyze

challenges these theories present in understanding mind-body relationships and consciousness. Investigate contemporary philosophy of mind debates, like phenomenal consciousness and cognitive science's role.

Learning Outcomes:

Grasp the historical and conceptual roots of philosophical inquiry into the mind's essence. Evaluate diverse perspectives on the mind-body problem and causal interactionism critically. Apply philosophical theories to real-world and scientific advancements in mental phenomena understanding. Foster interdisciplinary discourse among philosophy of mind, psychology, and cognitive science to tackle consciousness mysteries and related philosophical enigmas.

Unit -1

Philosophy and psychology of mind: mind in empirical psychology; mind in a priori philosophy; philosophical taxonomy of mental phenomena; sensations and propositional attitudes.

Unit – 2

Philosophical theories of mind: Cartesian dualism: the mind-body relation; problems of causal interactionism: mind and science

Unit – 3

Behaviourism; methodological and philosophical behaviourism: explanatory inadequacy; cognitivism in psychology

Materialism: mind-brain identity theory: problems of materialism: the problem of phenomenal consciousness

Unit –4

Functionalism: mind as a functional system: the computational mind; problems of inverted spectrum and absent qualia: criticism of strong Artificial Intelligence

Consciousness, cognitive science and philosophy: the mystery of consciousness and the explanatory gap naturalism about phenomenal consciousness.

Essential Readings:

Chalmers, David. *The Conscious Mind.* Oxford University Press, 1996.

Block, Flanagan, and Guzeldere (Eds). *The Nature of Consciousness.* MIT Press, 1997.

Lowe, E. J. *An Introduction to the Philosophy of Mind.* Cambridge University Press, 2000.

Churchland, Paul M. *Matter and Consciousness: A Contemporary Introduction to Philosophy of Mind.* Cambridge, Mass: MIT Press, 1998.

Wilkerson, T. E. *Minds, Brains, and People.* Oxford: Clarendon Press, 1974.

PHLMID -18: PHILOSOPHY OF LANGUAGE

(4 Credits)

Course Objectives:

This course in Philosophy of Language aims to equip students with a comprehensive understanding of the fundamental theories, issues, and developments in the philosophy of language. Students will explore how language matters to philosophy, delving into metaphysical, logical, and analytical aspects. The course will critically examine various theories of meaning, including referential, ideational, picture, emotive theories, and the pragmatic view of meaning as use. It will also address the challenges and complexities of communication, exploring the nature of shared subjective experiences, barriers to effective communication, and the role of physical language. The course aims to familiarize students with the broad spectrum of linguistic philosophy, covering topics such as signs, conventions, and language as a system of symbols.

Learning Outcomes:

Upon completion of the course, students will be able to critically analyze and articulate the significance of language to philosophy, demonstrating an understanding of metaphysical, logical, and analytical dimensions. They will proficiently evaluate and compare various theories of meaning, recognizing the complexities of communication and the diverse challenges it poses. Students will gain a thorough understanding of linguistic philosophy, including the notions of signs, conventions, and symbolic systems.

Unit-1

Introduction

(a)How does language matter to philosophy (b) Metaphysics (c) Logic (d) Reform of language (e)Philosophy as analysis

Unit-2

Theories of Meaning

(a) Referential theory (b) Ideational theory (c) Picture theory (d) Emotive theory (e) Meaning as use

Unit-3

Problems of Communication

(a) Is only structure communicated? (b) Removable and irremovable barriers to communication (c)Sharing one's subjective experience to others (d) Physical language (e) What does mutualunderstanding presuppose?

Unit-4

Language and its Near Relations

(a) The generic notion of a sign (b) Regularity of correlation and regularity of usage (c) Icon, index and symbol (d) The notion of convention (e) Language as system of symbols

Unit-5

Empirical Criterion of Meaninglessness

(a) Meaningless sentences (b) The semantic stratification of stratification of language (c) Logicalatomism (d) Verifiability as a criterion of meaning

Unit-6

Grammatical Models

(a)What is vagueness? (b) Ambiguity (c) Language-games (d) The metaphysical aura around certain words

New Horizons in Language

a) Speech acts (b) Generative grammar (c) Deconstruction (d) Private language

Essential Readings:

Alston, William P. *Philosophy of Language.* New Delhi: Prentice-Hall, 1988.

Waismann, F. *The Principles of Linguistic Philosophy.* London: Macmillan, 1968.

Miller, Alexander. *Philosophy of Language.* London and New York: Routledge, 2004. (First Indian Reprint).

Further Readings:

Searle, John. *Speech Acts: An Essay in Philosophy of Language.* London: Cambridge University Press, 1970.

Chomsky, Noam. *New Horizons in the Study of Language and Mind.* London: Cambridge University Press, 2000.

Norris, Christopher. *He: Theory and Practice.* London: Routledge, 2002.

PHLMID-7(A)- PHILOSOPHY OF SRI AUROBINDO
(4 Credits)

Course Objectives:

This course aims to provide students with a comprehensive understanding of SriAurobindo's life and integral philosophy. By exploring the foundational concepts of his philosophy, such asevolution and involution, students will gain insight into the profound nature of Aurobindo's thought. Themodules dedicated to The Life Divine; and The Synthesis of Yoga; will deepen students; comprehension ofkey aspects like the human aspiration, the Supreme Consciousness, and the yogic path.

Course Outcomes:

By the end of the course, students are expected to have a profound grasp of SriAurobindo's integral philosophy, enabling them to analyze and interpret his ideas with depth and clarity. Overall, the course intends to instill in students a comprehensive understanding of Sri Aurobindo's philosophyand its relevance to contemporary thought.

UNIT -1

Sri Aurobindo's Integral Non-dualism (Poorna Advaita): Life sketch – The philosophical background – Integration of the Matter and the Spirit – Reality as Sat-Chit-Ananda.

UNIT- 2

Involution and Evolution: The world process as involution and evolution – Role of *lila* and *maya* in the world process – Nature of ignorance and the seven-fold ignorance – The two hemispheres in the realm of reality – The intermediary levels from Mind to Supermind.

UNIT -3

The Triple Transformation: The triple status of the Supermind – The triple transformation – Gnostic Being and its nature – Types of Gnostic Beings – Difference between Gnostic Beings and Jivanmuktas – The Divine life.

UNIT- 4

Integral (Poorna) Yoga: Meaning and aim of Yoga – Integral approach to yoga.

UNIT -5

Integral Education: Meaning and aim of integral education – Perfecting the physical, the vital, the psychic, the mental and the spiritual aspects of human.

Essential Readings

1. V.M. Reddy, *Sri Aurobindo's Philosophy of Evolution*, Sri Aurobindo Ashram, Pondicherry, 2004.

2. Aparna Banerjee, *Integral Philosophy of Sri Aurobindo*, Decent Books, 2012.

3. S.K. Maitra, *An Introduction to the Philosophy of Sri Aurobindo*, Sri Aurobindo Ashram, Pondicherry, 1986.

4. Basant Kumar Lal, *Contemporary Indian Philosophy*, Motilal Banarsidass, New Delhi, 1989.

5. Sri Aurobindo & The Mother, *On Education*, Sri Aurobindo Ashram, Pondicherry.

Further Readings

1. Sri Aurobindo, *The Life Divine*, Sri Aruobindo Ashram, Pondicherry.

2. Sri Aurobindo, *The Synthesis of Yoga*, Sri Aurobindo Ashram, Pondicherry.

3. Ragunath Pani, *Integral Education: Thought and Practice*, Ashish Publishing House, New Delhi, 1987.

PHLMID 6(B): INTRODUCTION TO INDIAN EPISTEMOLOGY

(4 Credits)

Course Objectives:

Investigate Indian epistemology's core principles, covering knowledge sources and philosophical traditions. Analyze perception, inference, truth theories, and error concepts. Evaluate truth and error theories. Explore knowledge acquisition methodologies in Indian philosophy.

Learning Outcomes:

Grasp Indian philosophy's tripartite knowledge system and its diverse knowledge sources. Differentiate perception and inference types, crucial in epistemological discussions. Critique truth and error theories like self-evidence and correspondence theories. Apply Indian epistemology's principles to modern philosophical debates.

UNIT 1

Introduction: Tripartite knowledge – Sources of Knowledge and the Schools of Indian philosophy.

UNIT 2

Perception: Perception – Indeterminate and Determinate perception – External and Internal perception – Normal and Supranormal perception.

UNIT 3

Inference: Inference – Inference for one’s own sake and Inference for the sake of others.

UNIT 4

Theories of Truth: The Self-Evidence Theory –The Correspondence Theory

UNIT 5

Theories of Error: Asatkhyati – Atmakhyati – Anyathakhyati – Akhyati – Anirvacaniyakhyati Yatharthakhyati – Abhinava-Anyathakhyati.

Essential Readings

Chatterjee, Satischandra, and Dhirendramohan Datta. *An Introduction to Indian Philosophy*. Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 2016.
Mahadevan, T.M.P. *Invitation to Indian Philosophy*. Arnold-Heinemaan, New Delhi, 1982.
Banerjee, Nikunja Vihari. *The Spirit of Indian Philosophy*. Arnold–Heinemann Publishers Pvt Ltd, New Delhi, 1974.
Kar, Bijayananda. *The Theories of Error in Indian Philosophy: An Analytical Study*. Ajanta Publications (India), Delhi, 1978.

Further Readings

Datta, Dhirendramohan. *The Six Ways of Knowing*. University of Calcutta, Calcutta, 1998.
Bhatt, Govardhan P. *The Basic Ways of Knowing*. Motilal Banarsidass Publishers Pvt Ltd, Delhi, 1989.
Satprakashananda, Swami. *Methods of Knowledge*. Advaita Ashram, Kolkata, 2001.
Chatterjee, Satischandra. *The Nyaya Theory of Knowledge*. University of Calcutta, 1978.
Kandaswamy, S.N. *Indian Epistemology as Expounded in the Tamil Classics*. International Institute of Tamil Studies, Chennai, 2000.

IV YEAR (SEMESTER – VIII)

PHLMJD-19: Hermeneutics and Deconstruction

(4 Credits)

Course Objectives:

Hermeneutics delves into the fundamental theories of interpretation, exploring their application across various texts. This field examines the intricate relationship between language, culture, and interpretation, as elucidated by influential thinkers. Additionally, hermeneutics engages with deconstruction, critiquing modernist and Enlightenment ideologies. By scrutinizing deconstruction's ethical implications, this discipline contributes to contemporary discourse on societal norms and knowledge systems.

Learning Outcomes:

Explore interpretation theories by Scheleiermacher, Dilthey, Heidegger, and Gadamer. Assess hermeneutics' role in understanding cultural artifacts and historical contexts. Critically examine postmodernist notions, like metaphysical rejection and traditional concept deconstruction. Reflect on deconstruction's implications for societal power dynamics, language, and ethical norms.

Part 1 Hermeneutics

1.Scheleiermacher: Theory of Interpretation of The Bible

2.Wilhelm Dilthey: Theory of meaning and interpretation cultural products and the spirit of an age; the hermeneutics circle

3.Martin Heidegger Phenomenology as hermeneutics the defining capacity of Dasein as the interpretative understanding of its world; theoretical understanding and interpretation in an action

4.Hans-Georg Gadamer: theory of fore-conceptions and prejudices; consciousness as effective -historical; lived acquaintance with developing tradition; fusion of horizons.

Part-II Deconstruction

1.The connection between post-modernism and wider cultural movements

2.Modernism and post-modernism

3.Hostility to depth

4.The death of the author

5.Rejection of metaphysics as the ground for our basic practices, discourses and beliefs

6.Rejection of Enlightenment appeal to reason; incredulity towards metanarratives

7.The fall of the self as the rational subject

8.Michael Foucault relation between power and knowledge

9.Derrida: Rejection of the metaphysics of presence; logocentricism; language a species of writing

10.The ethics of deconstruction: liberation and alienation

Essential Readings

Dilthey, Wilhelm. *Selected Writing. Translated by H. Rickman*, Cambridge University Press, 1986.

Heidegger, Martin. *The Basic Problems of Phenomenology*. Translated by A. Hofstadter, Bloomington Indiana University Press, 1982.

Heidegger, Martin. *Being and Time.* Translated by J. Macquarie and E. Robinson, Oxford Blackwell, 1980.

Heidegger, Martin. *Basic Writings.* Translated by D. F. Krell, London Routledge & Kegan Paul, 1978.

Dreyfus, H.L. *Being-in-the-world*. Cambridge Mass: MIT Press, 1991.

Further Readings:

Hans-Georg Gadamer: *Truth and Method*, Tr W. Glen-Doepel, London Sheed & Ward, 1979

J Bleicher(Ed): *Contemporary Hermeneutics* London: Routledge & Kegan Paul, 1980

H. Dreyfus & P. Rabinow: *Michael Foucault Beyond Structuralism and Hermeneutics Chicago*: University of Chicago Press, 1982

Jacques Derrida*: Writing and Difference*, Tr. A. Bass, London: Routledge & Kegan Paul, 1978

David Cooper: *World Philosophies*: An Historical Introduction Oxford Blackwell 1995

PHLMJD-20: RESEARCH METHODOLOGY IN PHILOSOPHY

(4 Credits)

Course Objectives:

This course aims to equip students with a comprehensive understanding of research methodology in philosophy, fostering the development of critical thinking and scholarly skills. The primary objective is to elucidate the nature of research in philosophy, exploring its multifaceted dimensions and the underlying methodology. Students will delve into the qualifications essential for engaging in philosophical research, emphasizing both general prerequisites and specialized capacities such as heuristic motivation and reflective ability.

Learning Outcomes:

By the end of the course, students will have honed their research skills, gained proficiency in topic selection and project execution, and developed the ability to present philosophical research effectively. The recommended readings will serve as valuable resources, ensuring a well-rounded understanding of research practices in philosophy.

UNIT I

What is Research Methodology?

(a) The term "research" (b) The methodology of research(c) The finished products of research (d) Methods of philosophy

Qualifications for Research in Philosophy

(a) General qualifications for research (b) Heuristic motivation (c) Reflective(d) ability (e) Special qualifications for research in philosophy (f) Capacity for(g) high degree of generalization

UNIT 2

Topics for Research

(a) Types of topics (b) Thinker or text-based topics (c) concept-based topics(d) meta-philosophical topics (e) Inter-disciplinary topics

Principles and Steps in Choosing a Topic

(a) How to choose a topic? (b) Scope of topic for original contribution(c) The nature of originality in philosophy (d) Identifying an area

UNIT 3

Stages in the Execution of a Research Project

(a) The source of material (b) classification of data(c) Organization of materials (d) Methods of organization(e) Kinds of synthesis required for research

Presentation of thesis

(a) Form of the thesis and contents (b) introduction (c) Chapters(d) titles, sub-titles, foot or end-notes (e) Citation of quotations(f) Transliteration and bibliography

UNIT 4

Critical Edition of Works

(a) The meaning of critical edition (b) material required for critical edition(c) Equipment for a critical editor

Epistemology and Methodology of Research in Philosophy

(a) Epistemology as the methodology of metaphysics(b) The distinction between epistemology and the methodology of research in philosophy

Essential Readings

Ramachandran, T. *The Methodology of Research in Philosophy.* University of Madras, Madras

Lang, Berel, editor. *Philosophical Style: An Anthology about the Reading and Writing in Philosophy.* Nelson-Hall, 1980, Chicago.

PHLMID-21: RESEARCH PROJECT (Alternatively)

or

PHLMID-22: Extensive Study into Buddhist Philosophy

(4 Credits)

Course Objectives –

Since the time of the Buddha, Buddhists have developed a rigorous and profound tradition of philosophy. The Buddhist path consists in the combined practice of philosophical reasoning,

ethical practice and meditation. This course will focus on philosophical reasoning. For Buddhists, enlightenment is attained by gaining insight into the nature of reality (metaphysics), knowledge (epistemology), language (philosophy of language) and our ways of living (ethics). The course proceeds by analyzing some core texts of Buddhist philosophy (in English translation) together with some secondary literature.

Learning Outcomes –

Upon successful completion of this course, students will have the knowledge and skills to demonstrate a general knowledge and figures some issues in the Buddhist tradition of Philosophy. They can express and expound views and pre-suppositions of Buddhist philosophers clearly and lucidly and understand it critically. They also can evaluate theories, arguments and presuppositions of Buddhist philosophers.

Unit – 1 – Nyāyabindu - Dharmakīrti : Pratyaksa Khanda

Unit – 2 – Nyāyabindu - Dharmakīrti : Anumāna Khanda

Unit – 3 – Mūlamadhyamakakārikā – Nāgārjuna (1st part)

Unit – 4 – Mūlamadhyamakakārikā – Nāgārjuna (2nd part)

Essential Readings

1. Dharmakīrti. Nyāyabindu: *With Dharmottara's Commentary*. L. D. Institute of Indology, 1 Jan. 1991.
2. Stcherbatsky, *Th. Buddhist Logic: In Two Volumes.* English translation of Nyāyabinduṭīkā, 1930.
3. Nāgārjuna. Mulamadhyamakakarika: *The Philosophy of the Middle Way.* Translated by David J. Kalupahana, Motilal Banarsidass Publishers, 1 Jan. 2015.
4. Siderits, Mark, and Shoryu Katsura. *Nagarjuna's Middle Way: Mulamadhyamakakarika.* Classics of Indian Buddhism, Wisdom Publications, 11 June 2013.

PHLMID 23: A COMPARATIVE STUDY OF VEDANTIC SCHOOLS OF PHILOSOPHY
(4 Credits)

Course Objectives:

This course aims to explore Vedanta philosophy's foundational texts and interpretive literature in Indian philosophical traditions. It compares epistemological perspectives of Advaita, Visistadvaita, and Dvaita Vedanta on knowledge, truth, and perceptual error. Metaphysical

frameworks of Vedantic schools, including Ultimate Reality, individual selves, world, and Maya, are analyzed. Concepts of bondage, liberation, and the path to liberation are evaluated, along with an overview of other Vedantic schools like Dvaitadvaita, Suddhadvaita, and Acintya-bhedabheda.

Learning Outcomes:

This course aims to equip students with a thorough grasp of Vedantic philosophy's foundational texts and interpretive literature. They'll critically examine epistemological positions of Advaita, Visistadvaita, and Dvaita Vedanta, analyzing their implications for truth and knowledge. Metaphysical frameworks of Vedantic schools will be evaluated, including key concepts and inter-school criticisms. Students will also delve into concepts of bondage, liberation, and ethical dimensions of Vedantic thought, fostering an understanding of its diverse schools and contributions to Indian philosophy.

UNIT – 1

Introduction: Place of Vedanta in Indian schools of philosophies – Foundations of Vedanta philosophy in the Upanishads, in Srimad Bhagvad Gita and the Brahmasutra of Badharayana – Commentarial tradition – A short introduction of the Vedantic schools of philosophies compared (Advaita Vedanta, Visistadvaita Vedanta and Dvaita Vedanta).

UNIT – 2

Epistemology of Vedantic Schools: Sources of knowledge – Theory of Truth – Theory of perceptual error – Criticisms levelled against the epistemological stands of one school by the other schools.

UNIT – 3

Metaphysics of Vedantic Schools: The Ultimate Reality – Individual Selves – World – Maya – Understanding the kind of relationship among them – Criticisms levelled against the metaphysical stands of one school by the other schools.

UNIT – 4

Bondage and Liberation of the Soul according to the Vedantic Schools: Cause of bondage of the Self – Doctrine of Karma – Path of liberation – Status of the liberated Self – Criticisms levelled against the ethical stands of one school by the other schools.

UNIT – 5

A short introduction to other Vedantic Schools: Dvaitadvaita of Nimbarka – Suddhadvaita of Vallabha – Acintya-bhedabheda of Sri Caitanya.

Essential Readings

1 Satischandra Chatterjee & Dhirendramohan Datta, *An Introduction to Indian Philosophy*, Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 2016.

2 Chandradhar Sharma, *A Critical Survey of Indian Philosophy*, Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 2013.
3 T.M.P. Mahadevan, *Invitation to Indian Philosophy*, Arnold-Heinemaan, New Delhi, 1982.
4 M. Hiriyanna, *Outlines of Indian Philosophy*, Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 2014.
5 Jadunath Sinha, *Outlines of Indian Philosophy*, Pilgrims Publishing, Varanasi, 2005.

Further Readings

1. Surendranath Dasgupta, *History of Indian Philosophy* (Vols. 1–4), Motilal Banarsidass Publishers Pvt. Ltd, New Delhi.
2. S. Radhakrishnan, *Indian Philosophy*, (Vols. 1 & 2), Oxford University Publishers, New Delhi, 2009.
3. (Edr), History of Philosophy – Eastern and Western (Vol. 1), George Allen & Unwin Ltd, London, 1952.
4. Jadunath Sinha, *Indian Philosophy*, (Vols. 1 & 2), Motilal Banarsidass Publishers Pvt. Ltd, New Delhi, 1999.
5. P.T. Raju, *Structural Depths of Indian Thought*, South Asian Publishers Pvt. Ltd, New Delhi, 1985.
6. Nikunja Vihari Banerjee, *The Spirit of Indian Philosophy*, Arnold–Heinemann Publishers Pvt. Ltd, New Delhi, 1974.

PHLMID 24: PHILOSOPHY OF STRUCTURALISM
(4 Credits)

Course Objectives:

This course delves into structuralism's foundational concepts and methodologies, focusing on its approach to reality, knowledge, and binary oppositions. Key figures like Saussure, Levi-Strauss, Lacan, Althusser, and Barthes are examined for their contributions. The interplay between language, communication, and social structures is analyzed within structuralism. The transition to post-structuralism, critiques, and developments are explored. Implications for understanding language, ideology, and culture are critically evaluated.

Learning Outcomes:

This course ensures students grasp foundational principles of structuralism, including its treatment of language and social structures. They analyze major structuralist thinkers' works critically, understanding their impact on subsequent discourse. Students apply structuralist theories to interpret cultural texts and social phenomena. Transitioning to post-structuralism,

they identify key critiques and developments. Engaging with primary and secondary sources, they articulate informed critiques and original perspectives on these theories' relevance to contemporary philosophical debates.

UNIT – 1

Introduction: Rise of Structuralism as an intellectual movement – Reality and knowledge – Binary oppositions – Synchrony and Diachrony.

UNIT – 2

Ferdinand de Saussure: Langue – Parole – Signifier – Signified – Value or Differentiation.

Claude Levi-Strauss: Communication and social unity.

UNIT – 3

Jacques Lacan: Unconscious as the discourse of the other – Confirmation of the individual self-hood as the ultimate ideal.

UNIT – 4

Louis Althusser: Importance of ideologies – Ideology and language.

Roalnd Barthes: Mythologies and the ordinary things of the world.

UNIT – 5

Introduction to Post Structuralism.

Essential Readings

1. Richard Harland, *Superstructualism: The Philosophy of Structuralism and Post-Structuralism*, Routledge, London, 1991.
2. Catherine Belsey, *Poststructuralism – A Very Short Introduction*, Oxford University Press, 2002.
3. John Sturrock (Edr), *Structuralism and Since – From Levi Strauss to Derrida*, Oxford University Press, Madras, 1979.
4. Edith Kurzweil, *The Age of Structuralism: Levi Strauss to Foucault*, Columbia University Press, New York, 1980.

Further Readings

1. Madan Sarup, *An Introductory Guide to Post-structuralism and Postmodernism*, The University of Georgia Press, Athens, 1989.

2. Gopi Chand Narang, *Structuralism, Post-Structuralism and Eastern Poetics* (in Hindi and in Tamil), Sahitya Akademi, New Delhi.

PONDICHERRY UNIVERSITY

DEPARTMENT OF PHYSICAL EDUCATION

NCTE- Regulations

Scheme of Examination and Syllabus for the

Master of Physical Education Course

(M.P.Ed., 2020-2021 onwards)

(FOUR SEMESTERS - CBCS)

PONDICHERRY UNIVERSITY

DEPARTMENT OF PHYSICAL EDUCATION

NCTE- Regulations,

Scheme of Examination and Syllabus for the

Master of Physical Education Course (M.P.Ed., 2020-2021 onwards)

(FOUR SEMESTERS - CBCS)

Preamble:

The Master of Physical Education (M.P.Ed) two years (Four Semesters, Choice Based Credit System) programme is a professional programme meant for preparing Physical Education Teachers for senior secondary (Class XI and XII) level as well as Assistant Professor/Directors/Sports Officers in Colleges/Universities and teacher educators in Colleges of Physical Education.

Course objectives:

To enable the students to

- ✓ Attain wholesome development through physical education and sports
- ✓ Produce resourceful physical education teachers
- ✓ Encourage participation of students in sports and physical education activities
- ✓ Create awareness of health and fitness among all the stakeholders
- ✓ Acquire professional skills in various games and sports for teaching learning purpose
- ✓ Gain knowledge of the rules, regulation and their interpretation for "officiating" in sports and games
- ✓ Inculcate the ability to organize sports and games in a professional manner
- ✓ Gain knowledge on scientific principles from allied subjects in Physical Education & Sports
- ✓ Understand the concepts and role of different methods of sports training
- ✓ Develop desirable health habits and social integration of sportspersons

1.0 Intake

40 students in one unit each year as specified by NCTE.

1.1 Eligibility

(a) Bachelor of Physical Education (B.P.Ed.,) or equivalent with at least 50 % of marks.(up to 2015-16 one year B.P.Ed)

OR

Bachelor of Science (B.Sc.) in Health and Physical Education with at least 50% marks.

(b) The reservation in seats and relaxation in the qualifying marks for SC/ST/OBC/EWS and other categories shall be as per the rules of the Central Government/State Government, whichever is applicable.

1.2 Admission Procedure:

Admission shall be made on merit on the basis of marks obtained in the entrance examination (written test, skill test, interview and percentage in qualifying examination) or any other selection process as per the policy of the University & Central Government

1.3. Scheme of selection:

The selection of candidates for the M.P.Ed degree course is based on the following

CRITERIA FOR A GRAND TOTAL OF 100 MARKS

a) Entrance (written) examination -Objective Type Multiple Choices Questions **400 Marks**
(400 marks converted to 50 Marks)
b) Physical Fitness Test (100mts Run, Shot put & 12/8 minutes(Run/Walk Test) **30 Marks**
c) Games Proficiency Test in any one of the following games (Badminton, Basketball, Cricket, Football, Handball, Hockey, Kabbadi, Kho-Kho, Tennis and Volleyball) **20 Marks**

i. Entrance Examination converted to 50 Marks
ii. Practical Examination conducted for 50 Marks

Total ***100 Marks***

2.0 Duration:

The M.P.Ed programme is for the duration of two Academic years that is, **four semesters.** However, students shall be permitted to complete the programme requirements within a maximum period of three years from the date of admission to the programme.

3.0 The CBCS System:

All programmes shall run on Choice Based Credit System (CBCS). It is an instructional package developed to suit the needs of students, to keep pace with the developments in higher education and the quality assurance expected of it in the light of liberalization and globalization in higher education.

4.0 Course:

The term course usually referred to, as "papers" is a component of a programme. All courses need not carry the same weightage. Each course defines specific learning objectives and learning outcomes. A course may be designed to comprise Lectures/Tutorials/Laboratory Work/ Field Work/ Outreach Activities/ Project Work/ Vocational Training/Viva/ Seminars/ Term Papers/Assignments/ Presentations/ Self-Study etc. or a combination of some of these.

5.0 Courses in M.P.Ed Programme:

The M.P.Ed Programme consists of a number of courses, the term "Course" is applied to indicate a logical part of subject matter of the programme and is invariably equivalent to the subject matter of a "paper" in the conventional sense. The following are the various categories of courses for the M.P.Ed. Programme.

- **Theory**

- **Core Course**
- **Elective Course**
- **Practicum**
- **Compulsory Course (Track and Field)**
- **Dissertation**
- **Teaching / Coaching Practices**
- **Internship**

6.0 Semesters:

An academic year is divided into two Semesters. Each semester will consist of 17-20 weeks of academic work equivalent to 100 actual teaching days. The 'odd semester' may be scheduled from July to December and 'even semester' from December to May. The institution shall work for a minimum of 36 working hours in a week (five or six days a week).

7.0 Working days:

There shall be at least 200 working days per year exclusive of admission and examination processes etc.

8.0 Credits:

The term 'Credit' refers to a unit by which the programme is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or one and half / two hours of practical work/field work per week. The term "Credit" refers to the weight given to a course, usually in relation to the instructional hours assigned to it. The total minimum credits, required for completing M.P.Ed. Programme is 128 credits and for each semester 32 credits.

9.0 Evaluation:

CBCS as adopted by Pondicherry University will be the method of Evaluation

9.1 Breakup of Internal/ External End Semester Exams:

1. All subjects in a PG programme shall carry an Internal Assessment component to the extent of 40 marks and End Semester for 60 marks.
2. In case of Laboratory /Field/Project work based subjects, appropriate distribution of marks for Practical Record/ Project Report, Practical end-Semester exam, Viva, if any by the respective Programme Committee.
3. A student shall not be permitted to repeat any course only for the purpose of improving the grade.

9.2 Break up of Internal Assessment Marks

Each teacher shall organize a continuous assessment of each of the courses assigned to him/her. The internal assessment marks shall be given as per the following

.

Breakup:	**Marks**
Internal Assessment Tests / Term Papers / Quizzes (Two)	**2 x 15 = 30**
Seminars/ Assignments/ Presentations/ Attendance/ Viva, etc.	**1x 10 = 10**
Internal Total	**40**

9.3 Internal Assessments

A schedule of Internal Assessment tests shall be prepared at the very beginning of the semester. Internal Assessment marks shall be displayed within a week from the date of conduct of examination and all corrected answer papers shall be given back to students with comments, if any. It is mandatory for all students to participate in all the Internal Assessment tests and in various course-work related activities for award of the above marks.

9.4. End- semester examinations

An End Semester examination shall be conducted for all courses offered in the department. The duration of the end semester examination shall be for 3 hours.

1. A schedule of End Semester examinations be prepared and displayed by the department at least one-month ahead of the conduct of the examination.
2. No student who has less than 70% attendance in any course shall be permitted to attend the end-semester examination and he shall be given grade of FA-failure due to lack of attendance. He shall be asked to repeat that course the next time it is offered.
3. Each teacher shall prepare a model question paper, a Panel of external examiners and submit the same to the Head of the Department.

9.5. Supplementary Exam

A failed student who meets the attendance requirement and has a minimum of 40% in internal assessment marks may be permitted to register for the next end-semester examination or in the following semester itself.

Students who have failed due to insufficient attendance and / or less than 40% in Internal Assessment marks should repeat the course as and when it is offered.

10.0 Classification of Final Results:

For the purpose of declaring a candidate to have qualified for the degree of Master of Physical Education in the First class / Second class / Pass class or First Class with Distinction, the marks and the corresponding CGPA earned by the candidate in Core Courses will be the criterion. It is further provided that the candidate should have scored the First / Second Class separately in both the grand total and end Semester (External) examinations.

11.0 Grievance Redresses Committee:

The department shall form a Grievance Redresses Committee for each course in each department with the course teacher / Director or the HOD and the faculty as the members. This Committee shall solve all grievances of the students.

12.0 Revision of Syllabi

Syllabi of every course will be revised according to the regulation of the NCTE.

13.0 Award of the M.P.Ed Degree

A candidate shall be eligible for the award of the degree of M.P.Ed. Only if he/she has earned the minimum required credit of 128 including bonus credits of the programme prescribed above.

COURSE SCHEME AND SCHEME OF EXAMINATIONS

SEMESTER I

Part-A : Theoretical Course (400 Marks)						
Course Code	**Title of the Papers**	**Weekly Contact Hour**	**Credit**	**Internal Marks**	**External Marks**	**Total Marks**
Core Course						
MPCC- 101	Research Process in Physical Education & Sports Sciences	4	4	40	60	100
MPCC-102	Physiology of Exercise	4	4	40	60	100
MPCC-103	Test and Measurement and Evaluation in Physical Education	4	4	40	60	100
Elective Course (Anyone)						
MPEC-104	Yogic Sciences	4	4	40	60	100
MPEC-105	Sports Technology					
Part B: Practical Course (400 Marks)						
MPPC-106	**Track and Field-I** Aii Running Events & Relay	6	4	40	60	100
MPPC-107	**Laboratory Practical - I** Test and Measurement (according to the test and measurements theory paper)	6	4	40	60	100
MPPC-108	Yoga / Aerobics	6	4	40	60	100
Game of Specialization – I as offered by the department **(from MPPC 109- 117)**						
MPPC-109	**Basketball**	6	4	40	60	100
MPPC-110	**Cricket**	6	4	40	60	100
MPPC-111	**Football**	6	4	40	60	100
MPPC-112	**Handball**	6	4	40	60	100
MPPC-113	**Hockey**	6	4	40	60	100
MPPC-114	**Kabaddi**	6	4	40	60	100
MPPC-115	**Kho-Kho**	6	4	40	60	100
MPPC-116	**Tennis**	6	4	40	60	100
MPPC-117	**Volleyball**	6	4	40	60	100
	Total	**40**	**32**	**320**	**480**	**800**

SEMESTER -II

Part-A : Theoretical Course (400 Marks)						
Course Code	**Title of the Papers**	**Weekly Contact Hour**	**Credit**	**Internal Marks**	**External Marks**	**Total Marks**
Core Course						
MPCC-201	Applied Statistics in Physical Education & Sports	4	4	40	60	100
MPCC-202	Sports Biomechanics & Kinesiology	4	4	40	60	100
MPCC-203	Athletic Care and Rehabilitation	4	4	40	60	100
Elective Course (Anyone)						
MPEC-204	Sports Journalism and Mass Media	4	4	40	60	100
MPEC-205	Advance Sports Management in Physical Education					
Part B: Practical Course (400 Marks)						
MPPC-206	**Track and field - II** Jumping Events & hurdles	6	4	40	60	100
MPPC-207	**Laboratory Practical – II** Biomechanics & Kinesiology (5 tests each) (according to the Biomechanics & Kinesiology theory paper)	6	4	40	60	100
MPPC-208	Teaching Lessons of Indigenous Activities and Sports- 5 Lessons (4 Internal & 1 External)	6	4	40	60	100
Game of Specialization-I Teaching Coaching and Officiating Game of Specialization - I **(from MPPC 209 -217)**						
MPPC-209	**Basketball**	6	4	40	60	100
MPPC-210	**Cricket**	6	4	40	60	100
MPPC-211	**Football**	6	4	40	60	100
MPPC-212	**Handball**	6	4	40	60	100
MPPC-213	**Hockey**	6	4	40	60	100
MPPC-214	**Kabaddi**	6	4	40	60	100
MPPC-215	**Kho-Kho**	6	4	40	60	100
MPPC-216	**Tennis**	6	4	40	60	100
MPPC-217	**Volleyball**	6	4	40	60	100
	Total	**40**	**32**	**320**	**480**	**800**

SEMESTER III

Part-A : Theoretical Course (400 Marks)						
Course Code	**Title of the Papers**	**Weekly Contact Hour**	**Credit**	**Internal Marks**	**External Marks**	**Total Marks**
Core Course						
MPCC-301	Scientific Principles of Sports Training	4	4	40	60	100
MPCC-302	Sports Medicine	4	4	40	60	100
MPCC-303	Health Education and Sports Nutrition	4	4	40	60	100
Elective Course (Anyone)						
MPEC-304	Sports Engineering	4	4	40	60	100
MPEC-305	Physical Fitness and Wellness					
Part - B: Practical Course (400 Marks)						
MPPC-306	**Track and Field - III** Throwing Events & Gymnastics	6	4	40	60	100
MPPC-307	**Laboratory Practical – III** Sports Medicine and Physiotherapy (according to the Sports Medicine and Physiotherapy theory paper)	6	4	40	60	100
MPPC-308	Internship	6	4	40	60	100
Games Specialization-II as offered by the department **(from MPPC 309 -317)**						
MPPC-309	**Basketball**	6	4	40	60	100
MPPC-310	**Cricket**	6	4	40	60	100
MPPC-311	**Football**	6	4	40	60	100
MPPC-312	**Handball**	6	4	40	60	100
MPPC-313	**Hockey**	6	4	40	60	100
MPPC-314	**Kabaddi**	6	4	40	60	100
MPPC-315	**Kho-Kho**	6	4	40	60	100
MPPC-316	**Tennis**	6	4	40	60	100
MPPC-317	**Volleyball**	6	4	40	60	100
	Total	**40**	**32**	**320**	**480**	**800**

SEMESTER -IV

Part-A : Theoretical Course (400 Marks)						
Course Code	**Title of the Papers**	**Weekly contact Hour**	**Credit**	**Internal Marks**	**External Marks**	**Total Marks**
Core Course						
MPCC-401	Information & Communication Technology (ICT) in Physical Education	4	4	40	60	100
MPCC-402	Sports Psychology and Sports Sociology	4	4	40	60	100
MPCC-403	Dissertation	4	4	40	60	100
Elective Course (Anyone)						
MPEC-404	Value and Environmental Education	4	4	40	60	100
MPEC-405	Education Technology in Physical Education and Sports					
Part - B: Practical Course (400 Marks)						
MPPC-406	**Track and Field- IV** Combined Events	6	4	40	60	100
MPPC-407	**Laboratory Practical – IV** Exercise Physiology & Sports Psychology (5 tests each) (according to the Exercise Physiology & Sports Psychology theory paper)	6	4	40	60	100
MPPC-408	Officiating Lessons of Track and Field/ Lessons (4 Internal & 1 External)	6	4	40	60	100
Games Specialization- II Teaching Coaching and Officiating Games Specialization-– II **(from MPPC 409-417)**						
MPPC-409	**Basketball**	6	4	40	60	100
MPPC-410	**Cricket**	6	4	40	60	100
MPPC-411	**Football**	6	4	40	60	100
MPPC-412	**Handball**	6	4	40	60	100
MPPC-413	**Hockey**	6	4	40	60	100
MPPC-414	**Kabaddi**	6	4	40	60	100
MPPC-415	**Kho-Kho**	6	4	40	60	100
MPPC-416	**Tennis**	6	4	40	60	100
MPPC-417	**Volleyball**	6	4	40	60	100
	Total	**40**	**32**	**320**	**480**	**800**

SYLLABUS

Semester I

Theory Courses

MPCC-101 RESEARCH PROCESS IN PHYSICAL EDUCATION AND SPORTS SCIENCES

Learning Objectives:

- Introduce Research and its various aspects to the learner
- Give an overview of the types of Research
- Give a clear understanding of the sampling techniques
- To provide an understanding on writing a Research Proposal and Report

UNIT I – Introduction

Meaning and Definition of Research – Need, Nature and Scope of research in Physical Education. Classification of Research, Location of Research Problem, Criteria for selection of a problem, Qualities of a good researcher.

UNIT II – Methods of Research

Descriptive Methods of Research; Survey Study, Case study, Introduction of Historical Research, Steps in Historical Research, Sources of Historical Research: Primary Data and Secondary Data, Historical Criticism: Internal Criticism and External Criticism.

UNIT III – Experimental Research

Experimental Research – Meaning, Nature and Importance, Meaning of Variable, Types of Variables. Experimental Design - Single Group Design, Reverse Group Design, Repeated Measure Design, Static Group Comparison Design, Equated Group Design, Factorial Design.

UNIT IV – Sampling

Meaning and Definition of Sample and Population. Types of Sampling; Probability Methods; Systematic Sampling, Cluster sampling, Stratified Sampling. Area Sampling – Multistage Sampling. Non- Probability Methods; Convenience Sample, Judgement Sampling, Quota Sampling.

UNIT V – Research Proposal and Report

Chapterization of Thesis / Dissertation, Front Materials, Body of Thesis – Back materials. Method of Writing Research proposal, Thesis / Dissertation; Method of writing abstract and full paper for presenting in a conference and to publish in journals ,Mechanics of writing Research Report, Footnote and Bibliography writing.

Learning Outcome:

- Comprehend various aspects of Research and understand its types
- Competency in formulating the steps and sampling in research
- Capability to prepare a Research Proposal and a Report

REFERENCE:

Best J. W (1971) Research in Education, New Jersey; Prentice Hall, Inc

Clarke David. H & Clarke H, Harrison (1984) Research processes in Physical Education, New Jersey; Prentice Hall Inc.

Craig Williams and Chris Wragg (2006) Data Analysis and Research for Sport and Exercise Science, Londonl Routledge Press

Jerry R Thomas & Jack K Nelson (2000) Research Methods in Physical Activities; Illonosis; Human Kinetics;

Kamlesh, M. L. (1999) Research Methodology in Physical Education and Sports, New Delhi.

Moses, A. K. (1995) Thesis Writing Format, Chennai; Poompugar PathippagamRothstain, A (1985) Research Design and Statistics for Physical Education, Englewood Cliffs: Prentice Hall, Inc

Subramanian, R, Thirumalai Kumar S & Arumugam C (2010) Research Methods in Health, Physical Education and Sports, New Delhi; Friends Publication

Moorthy A. M. Research Processes in Physical Education (2010); Friend Publication, New Delhi.

MPCC-102 PHYSIOLOGY OF EXERCISE

Objectives: After studying this paper the student teachers will be able:

1. To know the effect of exercise on skeletal system.
2. To know the effect of exercise on cardiovascular system.
3. To know the effect of exercise on Respiratory system.
4. To understand metabolism a energy transfer.
5. To understand the climatic conditions, sports performance & ergogenic aids

UNIT I – Skeletal Muscles and Exercise

Macro & Micro Structure of the Skeletal Muscle,Chemical Composition. Sliding Filament theory of Muscular Contraction. Types of Muscle fibre. Muscle Tone, Chemistry of Muscular Contraction – Heat Production in the Muscle, Effect of exercises and training on the muscular system.

UNIT II – Cardiovascular System and Exercise

Heart Valves and Direction of the Blood Flow – Conduction System of the Heart – Blood Supply to the Heart – Cardiac Cycle – Stroke Volume – Cardiac Output – Heart Rate – Factors Affecting Heart Rate – Cardiac Hypertrophy – Effect of exercises and training on the Cardio vascular system.

UNIT III – Respiratory System and Exercise

Mechanics of Breathing – Respiratory Muscles, Minute Ventilation – Ventilation at Rest and During Exercise. Diffusion of Gases – Exchange of Gases in the Lungs –Exchange of Gases in the Tissues – Control of Ventilation – Ventilation and the Anaerobic Threshold. Oxygen Debt – Lung Volumes and Capacities – Effect of exercises and training on the respiratory system.

UNIT IV – Metabolism and Energy Transfer

Metabolism – ATP – PC or Phosphagen System – Anaerobic Metabolism – Aerobic Metabolism – Aerobic and Anaerobic Systems during Rest and Exercise. Short Duration High Intensity Exercises – High Intensity Exercise Lasting Several Minutes – Long Duration Exercises.

UNIT V – Climatic conditions and sports performance and ergogenic aids Variation in Temperature and Humidity – Thermoregulation – Sports performance in hot climate, Cool Climate, high altitude. Influence of: Amphetamine, Anabolic steroids, Androstenedione, Beta Blocker, Choline, Creatine, Human growth hormone on sports performance. Narcotic, Stimulants: Amphetamines, Caffeine, Ephedrine, Sympathomimetic amines. Stimulants and sports performance.

Note: Laboratory Practicals in Physiology be designed and arranged internally.

REFERENCES:

Amrit Kumar, R, Moses. (1995). Introduction to Exercise Physiology. Madras:
Poompugar Pathipagam.
Beotra Alka, (2000) Drug Education Handbook on Drug Abuse in Sports: Sports Authority of India Delhi.
Clarke, D.H. (1975). Exercise Physiology. New Jersey: Prentice Hall Inc., Englewood Cliffs.
David, L Costill. (2004). Physiology of Sports and Exercise. Human Kinetics.
Fox, E.L., and Mathews, D.K. (1981). The Physiological Basis of Physical Education and Athletics. Philadelphia: Sanders College Publishing.
Guyton, A.C. (1976). Textbook of Medical Physiology. Philadelphia: W.B. Sanders co.
Richard, W. Bowers. (1989). Sports Physiology. WMC: Brown Publishers.
Sandhya Tiwaji. (1999). Exercise Physiology. Sports Publishers.
Shaver, L. (1981). Essentials of Exercise Physiology. New Delhi: Subject Publications.
Vincent, T. Murche. (2007). Elementary Physiology. Hyderabad: Sports Publication. William, D. Mc Aradle. (1996). Exercise Physiology, Energy, Nutrition and Human
Performance. Philadelphia: Lippincott Williams and Wilkins Company.

MPCC-103 TEST, MEASUREMENT AND EVALUATION IN PHYSICAL EDUCATION

Learning Objectives

1. To understand the importance of test, measurement and evaluation in the field of physical education which is applicable for evaluating administer a variety of tests, health and fitness.

2. To learn the administration of test for conducting research

UNIT I – Introduction

Meaning and Definition of Test, Measurement and Evaluation. Need and Importance of Measurement and Evaluation. Criteria for Test Selection – Scientific Authenticity. Meaning, definition and establishing Validity, Reliability, Objectivity. Norms – Administrative Considerations.

UNIT II – Motor Fitness Tests

Meaning and Definition of Motor Fitness. Test for Motor Fitness; Indiana Motor Fitness Test(for elementary and high school boys, girls and College Men) Oregon Motor Fitness Test(Separately for boys and girls) - JCR test. Motor Ability; Barrow Motor Ability Test – Newton Motor Ability Test – Muscular Fitness – Kraus Weber Minimum Muscular Fitness Test.

UNIT III – Physical Fitness Tests

Physical Fitness Test: AAHPERD Health Related Fitness Battery (revised in 1984), ACSM Health Related Physical Fitness Test, Roger‟s Physical Fitness Index. Cardio vascular test; Harvard step test, 12 minutes run / walk test, Multi-stage fitness test (Beep test)

UNIT IV – Anthropometric and Aerobic-Anaerobic Tests

Physiological Testing: Aerobic Capacity: The Bruce Treadmill Test Protocol, 1.5 Mile Run test for college age males and females. Anaerobic Capacity: Margaria-Kalamen test, Wingate Anaerobic Test, Anthropometric Measurements: Method of Measuring Height: Standing Height, Sitting Height. Method of measuring Circumference: Arm, Waist, Hip, Thigh. Method of Measuring Skin folds: Triceps, Sub scapular, Suprailiac.

UNIT V – Skill Tests

Specific Spots Skill Test: Badminton: Miller Wall Volley Test. Basketball: Johnson Basketball Test, Harrison Basketball Abilit y Test. Cricket: Sutcliff Cricket test.Hockey: Friendel Field Hockey Test, Harban‟s Hockey Test, Volleyball, Russel Lange Volleyball Test, Brady Volleyball Test. Football: Mor-Christian General Soccer Ability Skill Test Battery, Johnson Soccer Test, Mc-Donald Volley Soccer Test. Tennis: Dyer Tennis Test.

Learning outcomes

1. Understand the Test, Measurement and Evaluation in physical education, Health and Fitness.
2. Know about the different types of skill test for different sports and games.
3. Apply the tests in minor & major research areas.
4. Analyse the performance and movements in the field of sports.
5. Evaluate the battery test and others tests prescribed for knowing various information out of it..

Note: Practical of indoors and out-door tests be designed and arranged internally.

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MPEC-104 Yogic Sciences (Elective)

Learning Objectives

1. To understand and apply the underlying concepts of Yoga
2. To promote knowledge and awareness of skeletal alignment and body mechanics, emphasizing a safe and intelligent use of the body
3. To cultivate breath control, relaxation techniques and kinaesthetic awareness

Unit I – Introduction

Meaning and Definition of Yoga. Astanga Yoga: Yama, Niyama, Aasna, Pranayama, Prathyahara, Dharana, Dhyana, Samadhi, Concept of Yogic Practices; Principles of Breathing – Awareness – Relaxation, Sequence – Counter pose – Time – Place – Clothes – Bathing – Emptying the bowels – Stomach – Diet – No Straining – Age – Contra- Indication – Inverted asana – Sunbathing.

Unit II – Aasanas and Pranayam

Loosening exercise: Techniques and benefits. Asanas: Types- Techniques and Benefits,
Surya Namaskar: Methods and benefits. Pranayama: Types- Methods and benefits. Nadis: Meaning, methods and benefits, Chakras: Major Chakaras- Benefits of clearing and balancing Chakras.

Unit III – Kriyas

Shat Kriyas- Meaning, Techniques and Benefits of Neti – Dhati – Kapalapathi- Trataka – Nauli – Basti, Bandhas: Meaning, Techniques and Benefits of Jalendra Bandha, Jihva Bandha, Uddiyana Bandha, Mula Bandha.

Unit IV – Mudras

Meaning, Techniques and Benefits of Hasta Mudras, Asamyukta hastam, Samyukta hastam , Mana Mudra, Kaya Mudra, Banda Mudra, Adhara Mudra. Meditation: Meaning, Techiques and Benefits of Meditation – Passive and active, Saguna Meditation and Nirguna Meditation.

Unit V – Yoga and Sports

Yoga Supplemental Exercise – Yoga Compensation Exercise – Yoga Regeneration Exercise-Power Yoga. Role of Yoga in Psychological Preparation of athelete: Mental Welbeing, Anxiety, Depression Concentration, Self Actualization. Effect of Yoga on Physiological System: Circulatory, Skeletal, Digestive, Nervous, Respiratory, Excretory Syste.

Learning outcomes

1. Understand the basic Concepts of Yoga
2. Apply the principles of Yoga to live healthy and active life style.
3. Promote the awareness of health through yoga
4. Analyse the techniques and of body posture to bring out healthy change.
5. Develop the knowledge through practice, participate and organize.

Note: Laboratory Practicals be designed and arranged internally.

REFERENCE:

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Moorthy A.M. & Alagesan. S. (2004) Yoga Therapy. Coimbatore: Teachers Publication House.
Swami Kuvalayanda, (1998), Asanas. Lonavala: Kaivalyadhama.
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Tiwari O.P. (1998), Asanas-Why and How. Lonavala: Kaivalyadham.

MPEC-105 SPORTS TECHNOLOGY (Elective)

Learning Objectives

1. To understand the procedure of selection and use of various sports technologies.
2. To learn the method of construction and installation of sports surface
3. Help to improve knowledge about modern playing equipment

UNIT I – Sports Technology

Meaning, definition, purpose, advantages and applications, General Principles and purpose of instrumentation in sports, Workflow of instrumentation and business aspects, Technological impacts on sports.

UNIT II – Science of Sports Materials

Adhesives- Nano glue, nano moulding technology, Nano turf. Foot wear production, Factors and application in sports, constraints. Foams- Polyurethane, Polystyrene, Styrofoam, closedcell and open-cell foams, Neoprene, Foam. Smart Materials – Shape Memory Alloy (SMA), Thermo chromic film, High-density modelling foam.

UNIT III – Surfaces of Playfields

Modern surfaces for playfields, construction and installation of sports surfaces. Types of materials – synthetic, wood, polyurethane. Artificial turf. Modern technology in the construction of indoor and outdoor facilities. Technology in manufacture of modern play equipments. Use of computer and software in Match Analysis and Coaching.

UNIT IV – Modern equipment

Playing Equipments: Balls: Types, Materials and Advantages, Bat/Stick/ Racquets: Types, Materials and Advantages. Clothing and shoes: Types, Materials and Advantages. Measuring equipments: Throwing and Jumping Events. Protective equipments: Types, Materials and Advantages. Sports equipment with nano technology, Advantages.

UNIT V – Training Gadgets

Basketball: Ball Feeder, Mechanism and Advantages. Cricket: Bowling Machine, Mechanism and Advantages, Tennis: Serving Machine, Mechanism and Advantages, Volleyball: Serving Machine Mechanism and Advantages. Lighting Facilities: Method of erecting Flood Light and measuring luminous. Video Coverage: Types, Size, Capacity, Place and Position of Camera in Live coverage of sporting events.

Learning outcomes

1. Plan, develop, communicate, implement, and evaluate technology-infused strategic plans.
2. Maintain and manage a variety of digital tools and resources for use in technology-rich sports environment
3. Design, develop, and implement technology-rich sports program that model of sports field and promote digital age best practices in teaching, playing and assessment.
4. Find out how successful were the teachers' efforts in contributing to the realization of the fundamental objectives of sports.

5. Assessments which learning experiences were effective in promoting and enhancing learning, which teaching methods and techniques are effective in the realization of the sports objectives.

Note: Students should be encouraged to design and manufacture improvised sports testing equipment in the laboratory/workshop and visit sports technology factory/ sports goods manufacture

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MPCC-201 APPLIED STATISTICS IN PHYSICAL EDUCATION AND SPORTS

Learning Objectives

1. Gain knowledge about statistics
2. To testing the existing theories/trainings and modifying
3. To develop systematic and scientific approach
4. Ability to interpret the data's

UNIT I – Introduction

Meaning and Definition of Statistics. Function, need and importance of Statistics. Types of Statistics. Meaning of the terms, Population, Sample, Data, types of data. Variables; Discrete, Continuous. Parametric and non-parametric statistics.

UNIT II – Data Classification, Tabulation and Measures of Central Tendency

Meaning, uses and construction of frequency table. Meaning, Purpose, Calculation and advantages of Measures of central tendency – Mean, median and mode.

UNIT III – Measures of Dispersions and Scales

Meaning, Purpose, Calculation and advances of Range, Quartile, Deviation, Mean Deviation, Standard Deviation, Probable Error. Meaning, Purpose, Calculation and advantages of scoring scales; Sigma scale, Z Scale, Hull scale.

UNIT IV – Probability Distributions and Graphs

Normal Curve. Meaning of probability- Principles of normal curve – Properties of normal curve. Divergence form normality – Skewness and Kurtosis. Graphical Representation in Statistics; Line diagram, Bar diagram, Histogram, Frequency Polygon, Ogive Curve.

UNIT V – Inferential and Comparative Statistics

Tests of significance; Independent "t" test, Dependent "t" test – chi – square test, level of confidence and interpretation of data. Meaning of correlation – co-efficient of correlation – calculation of co-efficient of correlation by the product moment method and rank difference method. Concept of ANOVA and ANCOVA.

Learning outcomes

1. Understand and apply the statistics in research.
2. Organize the samples and sampling techniques which is relevant to the study.
3. Apply the statistics in research thesis for evaluation.

Note : It is recommended that the theory topics be accompanied with practical, based on computer software of statistics.

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MPCC-202 SPORTS BIOMECHANICS AND KINESIOLOGY

Learning Objectives

1. The primary objective of Biomechanics is to gain a better understanding of the cause-effect mechanisms of sports motions.
2. To understand the mechanical cause-effect relationships that determines the motions of living organisms. "In Human Performance."
3. Biomechanics contributes to the description, explanation, and prediction of the mechanical aspects of humanexercise, sport and play.
4. Sports biomechanics can be considered as the bridge between the knowledge of sports science and the principles of mechanical analysis and has an important role not only in improving the athletic performance, but also in increasing the safety of the athletes.
5. Kinesiology to improve performance by learning how to analyze the movements of the human body and to discover their underlying principles.

6. The study of kinesiology is an essential part of the educational experience of students of physical education and sports.

UNIT I – Introduction

Meaning, nature, role and scope of Applied kinesiology and Sports Biomechanics. Meaning of Axis and Planes, Dynamics, Kinematics, Kinetics, Statics Centre of gravity -Line of gravity plane of the body and axis of motion, Vectors and Scalars.

UNIT II – Muscle Action

Origin, Insertion and action of muscles: Pectoralis major and minor, Deltoid, Biceps, Triceps (Anterior and Posterior), Trapezius, serratus, Sartorius, Rectus femoris, Abdominis, Quadriceps, Hamstring, Gastrocnemius.

UNIT III – Motion and Force

Meaning and definition of Motion. Types of Motion: Linear motion, angular motion, circular motion, uniform motion. Principals related to the law of Inertia, Law of acceleration, and law of counter force. Meaning and definition of force- Sources of force -Force components .Force applied at an angle - pressure -friction -Buoyancy, Spin - Centripetal force - Centrifugal force.

UNIT IV – Projectile and Lever

Freely falling bodies -Projectiles -Equation of projectiles stability Factors influencing equilibrium - Guiding principles for stability -static and dynamic stability. Meaning of work, power, energy, kinetic energy and potential energy. Leverage -classes of lever - practical application. Water resistance - Air resistance -Aerodynamics.

UNIT V – Movement Analysis

Analysis of Movement: Types of analysis: Kinesiological, Biomechanical. Cinematographic. Methods of analysis – Qualitative, Quantitative, Predictive

Learning Outcomes

Describe the kinematics of projectile motion and factors influencing projectile trajectory.

1. Identify, analyze, and solve various biomechanical problems.
2. Demonstrate an understanding of kinetic concepts including inertia, force, torque, and impulse.
3. Identify the major factors involved in the angular kinematics of human movement.
4. Define Newton's laws of physics.
5. Identify the steps involved in finding the center of gravity.
6. The student will: Critically evaluate forms of information related to **kinesiology**, health, andphysical education.
7. Students will develop information literacy skills and abilities essential for adult learning.

8. Describe fundamental principles of Kinesiology, including anatomy and physiology, teaching movement related skills, health promotion, physiological response to exercise, and the mechanics and control of movement.
9. Utilize oral and written communication that meets appropriate professional and scientific standards in Kinesiology.

Note: Laboratory practical's should be designed and arranged for students internally

REFERENCE:

Deshpande S.H.(2002). Manav Kriya Vigyan – Kinesiology (Hindi Edition) Amravati :Hanuman Vyayam Prasarak Mandal.

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MPCC-203 ATHLETIC CARE AND REHABILITATION

Learning Objectives

1. By learning the subject the students will be aware of the various injury in sports.
2. The students after learning will gain knowledge about the treatment of various injury in sports.
3. After completion of this subject the students will learn how to give rehabilitation.
4. This subject will also make the student learn about prevention of injuries.

UNIT I – Corrective Physical Education

Definition and objectives of corrective physical Education. Posture and body mechanics, Standards of Standing Posture. Value of good posture, Drawbacks and causes of bed posture. Posture test – Examination of the spine.

UNIT II – Posture

Normal curve of the spine and its utility, Deviations in posture: Kyphosis, lordosis, flat back, Scoliosis, round shoulders, Knock Knee, Bow leg, Flat foot. Causes for deviations and treatment including exercises.

UNIT III – Rehabilitation Exercises

Passive, Active, Assisted, Resisted exercise for Rehabilitation, Stretching, PNF techniques and principles.

UNIT IV – Massage

Brief history of massage – Massage as an aid for relaxation – Points to be considered in giving massage – Physiological , Chemical, Psychological effects of massage – Indication / Contra indication of Massage – Classification of the manipulation used massage and their specific uses in the human body – Stroking manipulation: Effleurage – Pressure manipulation: Petrissage Kneading (Finger, Kneading, Circular) ironing Skin Rolling – Percussion manipulation: Tapotement, Hacking, Clapping, Beating, Pounding, Slapping, Cupping, Poking, Shaking Manipulation, Deep massage.

UNIT V – Sports Injuries Care, Treatment and Support

Principles pertaining to the prevention of Sports injuries – care and treatment of exposed and unexposed injuries in sports – Principles of apply cold and heat, infrared rays – Ultrasonic, Therapy – Short wave diathermy therapy. Principles and techniques of Strapping and Bandages.

Learning outcomes

1. Understand the primary responsibilities the sports trainer has in preventing sports injuries and providing initial care for injured athletes.
2. Demonstrate the basics of sport first aid during and after game situation.
3. Recognise and appropriately treat common sports injuries and conditions from onset through rehabilitation.
4. Identify and apply knowledge of anatomy to the design and execution of research studies.

Note: Each student shall submit Physiotherapy record of attending the Clinic and observing the cases of athletic injuries and their treatment procedure.(To be assessed internally)

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MPEC-204 SPORTS JOURNALISM AND MASS MEDIA (Elective)

Learning Objectives

1. To promote the awareness of sports through journalism
2. To learn the techniques to sports organization through media
3. To know about Sports journalism and mass media contribution in sports field

UNIT I Introduction

Meaning and Definition of Journalism, Ethics of Journalism – Canons of journalism- Sports Ethics and Sportsmanship – Reporting Sports Events. National and International Sports News Agencies.

UNIT II Sports Bulletin

Concept of Sports Bullet in: Journalism and sports education – Structure of sports bulletin – Compiling a bulletin – Types of bulletin – Role of Journalism in the Field of Physical Education: Sports as an integral part of Physical Education – Sports organization and sports journalism – General news reporting and sports reporting.

UNIT III Mass Media

Mass Media in Journalism: Radio and T.V. Commentary – Running commentary on the radio – Sports expert's comments. Role of Advertisement in Journalism. Sports Photography: Equipment- Editing – Publishing.

UNIT IV Report Writing on Sports

Brief review of Olympic Games, Asian Games, Common Wealth Games World Cup, National Games and Indian Traditional Games. Preparing report of an Annual Sports Meet for Publication in Newspaper. Organization of Press Meet.

UNIT –V Journalism

Sports organization and Sports Journalism – General news reporting and sports reporting. Methods of editing a Sports report. Evaluation of Reported News. Interview with and elite Player and Coach.

Practical assignments to observe the matches and prepare report and news of the same; visit to News Paper office and TV Centre to know various departments and their working. Collection of Album of newspaper cuttings of sports news.

Learning outcomes

1. Understand the basic Journalism and Mass Media in Journalism.
2. Apply the media in sports field for promotion.
3. Promote the awareness of Sports organization and Sports Journalism.
4. Develop the knowledge through Journalism and Mass Media, participate and organize.

REFERENCE:

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MPEC-205 ADVANCE SPORTS MANAGEMENT IN PHYSICAL EDUCATION AND SPORTS (Elective)

Learning Objectives

1. To identify the basic principles of Sports Management.
2. To know about organizational management and leadership.
3. To identify important issues and future trends in the field of sports management
4. Understand curriculum according to the needs of the students
5. Construct the curriculum for various levels
6. Update the present need which is mandatory

UNIT I –Sports Management Principles and Practices

Definition, Importance. Basic Principles and Procedures of Sports Management. Functions of Sports Management.The sports Manager –managing in the sports Environment –Management Function in sports –The Sports Manager: Basics of sports Management-Managing in the Sports Environment-Management functions in sports-Motivating Abilities:Fundamentals.

UNIT II – Program Management and planning in Sports organization

Importance of Programme development and the role of management, Factors influencing programme development. Steps in programme development, Competitive Sports Programs, Benefits, Management Guidelines for School, Colleges Sports Programs. Planning in sports organization:Preparing the organization for planning-Long term planning-Creating a medium term National Plan.

UNIT III – Equipments Event Management and Public Relation

Purchase and Care of Supplies of Equipment, Guidelines for selection of Equipments and Supplies, Purchase of equipments and supplies, Equipment Room, Equipment and supply Manager. Guidelines for checking, storing, issuing, care and maintenance of supplies and equipments. Meaning of Events-Event Management, Designing an event-5C's (Conceptualization, Costing, Canvassing, Customization, Carrying out. Public Relations in Sports: Planning the Public Relation Program – Principles of Public Relation – Public Relations in School and Communities – Public Relation and the Media.

UNIT IV – Sports Facility Management and Sports Marketing

Meaning of Facility management-Facility Planning-Facility System-facility Marketing-Facility preparations-Definition of Sports Marketing-Perspective in sports consumer behavior-role of Research in sports marketing-The sports product-Its Core and Extensions -Pricing strategies –Place/Product Distribution.

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UNIT V – Curriculum and Professionals Ethics

Meaning and Definition of Curriculum. Principles of Curriculum Construction: Approaches to Curriculum, Curriculum Framework-Factors affecting curriculum: Sources of Curriculum materials –Integration of Physical

Education with other Sports Sciences – Curriculum research, Objectives of Curriculum research – Importance of Curriculum research-Ethics In Sports-Sports as a Profession-Social and Ethical-Ethical Values-Corporate Social Responsibility.

Learning Outcome

1. Know sports management and employ principles of strategic planning, and financial and human resource management.
2. Assess marketing needs and formulate short term and long term solutions.
3. Conceive, plan, execute, and evaluate a sports event.
4. Introduce the teaching and curriculum objectives and course module design
5. Analyse the planning strategies, teaching, learning and assessment
6. Develop strategies to promote quality learning, practice marking and consider methods of course and self-evaluation
7. Evaluating learning intentions and the process that is guided through explicit and manageable criteria

Reference:

Aggarwal, J.C (1990). Curriculum Reform in India – World overviews, Doaba World Education Series – 3 Delhi: Doaba House, Book seller and Publisher.

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MPCC-301 SCIENTIFIC PRINCIPLES OF SPORTS TRAINING

Learning Objectives

1. Understand the scientific principles of sports training.
2. Fix and adopt the training load
3. Prepare the sports person for the competition

UNIT I – Introduction

Sports training: Definition – Aim, Characteristics, Principles of Sports Training, Over Load: Definition, Causes of Over Load, Symptoms of Overload, Remedial Measures – Super Compensation – Altitude Training – Cross Training

UNIT II – Components of Physical Fitness

Strength: Methods to improve Strength: Weight Training, Isometric, Isotonic, Circuit Training, Speed: Methods to Develop Speed: Repetition Method, Downhill Run, Parachute Running, Wind Sprints, Endurance, Methods to Improve Endurance: Continuous Method, Interval Method, Repetition Method, Cross Country, Fartlek Training.

UNIT III – Flexibility

Flexibility: Methods to Improve the Flexibility- Stretch and Hold Method, Ballistic Method, Special Type Training: Plyometric Training. Training for Coordinative abilities: Methods to improve Coordinative abilities: Sensory Method, Variation in Movement Execution Method, Variation in External Condition Method, Combination of Movement Method, Types of Stretching Exercises.

UNIT IV – Training Plan

Training Plan: Macro Cycle, Meso-Cycle. Short Term Plan and Long Term Plans - Periodisation: Meaning, Single, Double and Multiple Periodisation, Preparatory Period, Competition Period and Transition Period.

UNIT V – Doping

Definition of Doping – Side effects of drugs – Dietary supplements – IOC list of doping classes and methods. Blood Doping – The use of erythropoietin in blood boosting – Blood doping control – The testing programmes – Problems in drug detection – Blood testing in doping control – Problems with the supply of medicines Subject to IOC regulations : overthe- counter drugs (OTC) – prescription only medicines (POMs) – Controlled drugs (CDs). Reporting test results – Education

Learning outcomes

1. Understand training as performance based science

2. Explain different means and methods of various training

3. Prepare training schedule for various sports and games

4. Appraise types of periodization for performance development

5. Create various training facilities and plans for novice to advance performers

References :

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MPCC-302 SPORTS MEDICINE

Learning Objectives

1. The goal of a sports medicine is to help the student engage in exercise safely and effectively in order to achieve their training goals.
2. To provide knowledge about the causes of injuries.
3. To provide means or treatment for sports injuries and for rehabilitation of injuries.
4. To provide knowledge about the preventive measures of sports injuries.
5. To aware the student about the treatment procedure of different kinds of injury.

UNIT I - Introduction

Meaning and Definition of Sports Medicine, Definition and Principles of Therapeutic Exercises.Injuries: Acute, Sub-acute, Chronic. Advantages and Disadvantages of PRICE, PRINCE therapy.Preventive, Curative and Rehabilitation Aspects of Sports Injuries.

UNIT II - Basic Rehabilitation and Therapeutic Modalities

Basic Rehabilitation: Bandages, Strapping and Tapping: Role of Sports Rehabilitation, Classification of Rehabilitation. Therapeutic Modalities –Cold Modalities (Cryotherapy)- Principles of Modalities –Ice Massag –Ice Packs – Ice Immersion and Cold Whirlpool –Cry Stretch –Chemical Packs –Ice Compression. Heat Modalities (Thermotherapy)- Effects of Heat Applications-Infrared Lamp-Moist Heat Packs –Paraffin Wax Bath- Contrast Bath

- Sona Bath. Electrotherapy - Basic Principles of Electrotherapy (Therapeutic Effects)-Electrical Stimulator –Short Wave Diathermy-Microwave Diathermy –Ultrasound-Neuromuscular Electrical Stimulator –Interferential Current – Transcutaneous Nervous Stimulator (TENS) -Ultraviolet Therapy-Lasser.

UNIT III - Spine Injuries and Exercise

Head, Neck and Spine Injuries: Causes, Presentational of Spinal Anomalies, Flexion, Compression, Hyperextension, Rotation Injuries. Spinal Range of Motion.Rehabilitation Exercises for Spinal Injuries- Head, Neck and Spine.Supporting and Aiding Techniques and Equipment for Head, Neck and Spine Injuries.

UNIT IV - Upper Extremity Injuries and Exercise

Upper Limps and Thorax Injuries - Shoulder: Sprain, Strain, Dislocation, and Strapping. Elbow: Sprain,Strain, Strapping. Wrist and Fingers: Sprain, Strain, Strapping. Thorax, Rib Fracture.Rehabilitation Exercise for Upper Extremity Injuries - Shoulder, Elbow, Wrist and Hands.Supporting and Aiding Techniques and Equipment for Upper and Thorax Injuries.

UNIT V - Lower Extremity Injuries and Exercise

Lower Limp and Abdomen Injuries: Hip: Adductor Strain, Dislocation, Strapping. Knee: Sprain, Strain, Strapping. Ankle: Sprain, Strain, Strapping. Abdomen: Abdominal Wall, Contusion, Abdominal Muscle Strain. Rehabilitation Exercise for Lower Extremities-Hip, Knee, Ankle, Foot and Abdomen.

Learning Outcomes

- At students will be successful in graduating and gaining employment in the field of athletic training.
- Identify, describe, and explain concepts associated with the domains of athletic training education.
- Communicate effectively in the oral and written form using evidence based practice principles.
- Learning treatment and rehabilitation programme by the students.
- Develop and defend clinical reasoning skills in the clinical education setting when interacting with injured athletes.

Note: PRACTICALS: Lab. Practical and visit to Physiotherapy centre to observe treatment procedure of sports injuries; data collection of sports injuries incidences, visit to TV centre etc. should be planned internally.

REFERENCES:

1. Christopher M.Norris (1993), Sports Injuries Diagnosis and Management for Physiotherapists. East Kilbride: Thomason Litho Ltd.
2. G.Vinod Kumar (2015). Sports Medicine and Injuries Management. Kongunadu Publications India Ltd.
3. James, A.Gould& George J. Davies. (1985). Physical Physical Therapy. Toronto: C.V.Mosby Company.
4. Morris B. Million (1984). Sports Injuries and Athletic Problem. New Delhi: Surjeet Publication.
5. Pande (1998). Sports Medicine. New Delhi: KhelShitya Kendra.

6. Practical: Anthropometric Measurements.

MPCC-303 HEALTH EDUCATION AND SPORTS NUTRITION

Learning Objectives

1. Identify dietary carbohydrate and protein sources, Identify proper hydration principles and discuss the importance of hydration for physical performance
2. Demonstrate knowledge of a healthy diet for physical performance and demonstrate an ability to utilize this knowledge to complete a self-diet critique.
3. Demonstrate an understanding of health and to develop determination and values of desirable body weight

Unit - I Health Education

Implication, General health care, Health Education. Concept, Dimensions, Spectrum and Health Determinants. Health instructions, Objectives and Principles of Health Education. Health Service and supervision.

Unit - II Health Problems in India

Communicable and Non Communicable Diseases , Prevailing Metabolic Disorders in India, Food and food related disease, Environmental Health hazards, Role of health education in schools Health Services, Objective of school health service, Role of government in protection of health – Health Policies.

Unit- III Hygiene and Health

Meaning of Hygiene, Types of Hygiene and Sanitation, Personal and dental Hygiene, Effect of Alcohol on Health, Effect of Tobacco on Health, Life Style Management, Stress Management and its related disorder, Drugs -its uses and abuses.

Unit – IV Introduction to Sports Nutrition

Meaning and Definition of Sports Nutrition, Role of nutrition in sports, Basic Nutrition guidelines, Mechanism of Hydration in body, Metabolism of macro and micronutrients, Role of macro and micronutrients on sports performance.

Unit – V Nutrition for specific sports

Physiological and Biochemical changes during specific sports, Associated Common nutritional problems ; Guidelines specific to nutrition in specific sports; Identifying individual energy and other macronutrient requirements; Nutrient timing; Dietary periodisation; Supplement usage.

Specific Sports: Nutrition for popular team sports (Hockey, Football, Volleyball, Kabaddi and Cricket), Nutrition for Athletics, Racket Sports and Cyclic sports Athletics (Sprinters, middle and long distance, field events): Racket sports (Badminton, Tennis, Squash): Nutrition for Endurance Sports (Long distance Swimming, Cycling and Marathon): Nutrition for Weight-dependent and balance sports Strength and Combat sport (Wrestling, Weightlifting, Judo, Boxing, Taekwondo and Fencing): Nutrition for water sport and coordination sport

Learning outcomes

1. Restate the role of nutrients and caloric requirements
2. Sketch the basic classification, functions and utilization of nutrients.
3. Point out diet for various competitions and nutrient supplements for performance.
4. Evaluate the factors affects health and solutions for wellness.
5. Design caloric requirements for various sports and age groups.

References:

1. Bucher, Charles A. "Administration of Health and Physical Education Programme". Delbert, Oberteuffer, et. al." The School Health Education".
2. Ghosh, B.N. "Treaties of Hygiene and Public Health".
3. Hanlon, John J. "Principles of Public Health Administration" 2003. Turner, C.E. "The School Health and Health Education".
4. Moss and et. At."Health Education" (National Education Association of U.T.A.)Nemir A. 'The School Health Education" (Harber and Brothers, New York). Nutrition Encyclopedia, edited by Delores C.S. James, The Gale Group, Inc.
5. Boyd-Eaton S. et al (1989) The Stone Age Health Programme: Diet and Exercise as Nature Intended. Angus and Robertson.
6. Terras S. (1994) Stress, How Your Diet can Help: The Practical Guide to Positive Health Using Diet, Vitamins, Minerals, Herbs and Amino Acids, Thorons.
7. SatyanarayanaVaddepalli, Sports Nutrition and Weight Management (2015) Sports Publication, New Delhi
8. Fink, H. H., & Mikesky, A. E. (2017). Practical applications in sports nutrition. Jones & Bartlett Learning.
9. Eberle, S. G. (2013). Endurance Sports Nutrition, 3E. Human Kinetics.
10. Ryan, M. (2012). Sports nutrition for endurance athletes. Velo Press.
11. Campbell, B. (Ed.). (2013). Sports nutrition: enhancing athletic performance. CRC 23 Press.

MPEC-304 SPORTS ENGINEERING (Elective)

Learning Objectives

1. To understand the procedure of selection and use of various sports engineering and technologies.
2. To learn the mechanics of engineering materials in sports field
3. Help to improve knowledge about building and maintain playing surface.

UNIT - I Introduction to sports engineering and Technology

Meaning of sports engineering, human motion detection and recording, human performance, assessment, equipment and facility designing and sports related instrumentation and measurement.

UNIT - II Mechanics of engineering materials

Concept of internal force, axial force, shear force, bending movement, torsion, energy method to find displacement of structure, strain energy. Biomechanics of daily and common activities –Gait, Posture, Body levers, ergonomics, Mechanical principles in movements such as lifting, walking, running, throwing, jumping, pulling, pushing etc.

UNIT- III Sports Dynamics

Introduction to Dynamics, Kinematics to particles – rectilinear and plane curvilinear motion coordinate system. Kinetics of particles – Newton's laws of Motion, Work, Energy, Impulse and momentum.

UNIT- IV Building and Maintenance:

Sports Infrastructure- Gymnasium, Pavilion, Swimming Pool, Indoor Stadium, Out-door Stadium, Play Park, Academic Block, Administrative Block, Research Block, Library, Sports Hostels, etc.

Requirements: Air ventilation, Day light, Lighting arrangement, Galleries, Store rooms, Office, Toilet Blocks (M/F), Drinking Water, Sewage and Waste Water disposal system, Changing Rooms (M/F), Sound System (echo-free), Internal arrangement according to need and nature of activity to be performed, Corridors and Gates for free movement of people, Emergency provisions of lighting, fire and exits, Eco-friendly outer surrounding. Maintenance staff, financial consideration.

Building process:- design phase (including brief documentation), construction phase functional (occupational) life, Re-evaluation, refurnish, demolish.

Maintenance policy, preventive maintenance, corrective maintenance, record and register for maintenance.

UNIT – V Facility life cycle costing

Basics of theoretical analysis of cost, total life cost concepts, maintenance costs, energy cost, capital cost and taxation.

Learning outcomes

1. Plan, develop, communicate, implement, and evaluate technology-infused strategic plans.

2. Maintain and manage a variety of digital tools and resources for use in technology-rich sports environment

3. Design, develop, and implement technology-rich sports program that model of sports field and promote digital age best practices playing and assessment.

4. Find out how successful were the teachers' efforts in contributing to the realization of the fundamental objectives of sports.

Reference

Franz K. F. et. al., Editor, Routledge Handbook of Sports Technology and Engineering (Routledge, 2013)
Steve Hake, Editor, The Engineering of Sport (CRC Press, 1996)
Franz K. F. et. al., Editor The Impact of Technology on Sports II (CRC Press, 2007)
Helge N., Sports Aerodynamics (Springer Science & Business Media, 2009)
Youlin Hong, Editor Routledge Handbook of Ergonomics in Sport and Exercise
(Routledge, 2013)
Jenkins M., Editor Materials in Sports Equipment, Volume I (Elsevier, 2003)
Colin White, Projectile Dynamics in Sport: Principles and Applications
Eric C. et al., Editor Sports Facility Operations Management (Routledge, 2010)

MPEC-305 PHYSICAL FITNESS AND WELLNESS (Elective)

Learning Objectives

1. Promote the knowledge of physical fitness and wellness
2. Create fitness awareness among youth, various health problems and its impacts
3. Able understand the importance of physical fitness and to create good health.

UNIT I – Introduction

Meaning and Definition" of Physical Fitness, Physical Fitness Concepts and Techniques, Principles of physical fitness, Physiological principles involved in human movement. Components of Physical Fitness.
Leisure time physical activity and identify opportunities in the community to participate in this activity. Current trends in fitness and conditioning, components of total health fitness and the relationship between physical activity and lifelong wellness.

Wellness-Meaning, definition and concept of wellness, Need and Importance of wellness, Factors affecting wellness, Environmental and Occupational health and wellness- wellness program me.

UNIT II – Nutrition

Nutrients; Nutrition labeling information, Food Choices, Food Guide Pyramid, Influences on food choices-social, economic, cultural, food sources, Comparison of food values. Weight Management-proper practices to maintain, lose and gain. Eating Disorders, Proper hydration, the effects of performance enhancement drugs.

UNIT III – Aerobic and Anaerobic Exercise

Cardio respiratory Endurance Training: Monitoring heart rates during activity. Assessment of cardio respiratory fitness and set goals to maintain or improve fitness levels. Cardio respiratory activities including i.e. power walking, pacer test, interval training, incline running, distance running, aerobics and circuits.

Anaerobic Exercise Resistance Training for Muscular Strength and Endurance principles of resistance training, proper body alignment, lifting techniques, proper breathing techniques. Weight training principles and concepts; basic resistance exercises (including free hand exercise, free weight exercise, weight machines, exercise bands and tubing. medicine balls, fit balls) Advanced techniques of weight training.

UNIT IV– Flexibility Exercise

Flexibility Training, Relaxation Techniques and Core Training. Safety techniques (stretching protocol; breathing and relaxation techniques) types of flexibility exercises (i.e. dynamic, static), Develop basic competency in relaxation and breathing techniques. Pilates, Yoga.

UNIT –V- Psychological Health & Wellness

Psychological dimensions of Health, Stress management, Anger & its management, Yoga for stress management & Anger management. Physical activity for psychological Wellness Importance of Participation in regular Physical activity, Community recreation, Recreation for health & wellness, Leisure time Community health, Community health programme

Learning Outcome

1. Explain the history and philosophy of public physical fitness as well as its core values, concepts, and functions across the globe and in society.
2. Identify the methods, and tools of public health data collection, use, and analysis
3. Relate the underlying science of wellness and disease to opportunities for promoting and protecting health across the life course.
4. Identify the socio-economic, behavioural, biological, environmental, and other factors that impact physical fitness and contribute to health disparities.
5. Apply the principles of training and maintain a physical fitness.

Reference:

David K. Miller & T. Earl Allen, Fitness, A life time commitment, Surjeet Publication Delhi 1989. Dificore Judy, the complete guide to the postnatal fitness, A & C Black Publishers Ltd. 35 Bedford row, London 1998

Dr. A.K. Uppal, Physical Fitness, Friends Publications (India), 1992. Warner W.K. Oeger & Sharon A. Hoeger, Fitness and Wellness, Morton Publishing Company, 1990.

Elizabeth & Ken day, Sports fitness for women, B.T. Batsford Ltd, London, 1986.

Emily R. Foster, Karyn Hartiger & Katherine A. Smith, Fitness Fun, Human Kinetics Publishers 2002.

Lawrence, Debbie, Exercise to Music. A & C Black Publishers Ltd. 37, Sohe Square, London
1999

Robert Malt. 90 day fitness plan, D.K. publishing, Inc. 95, Madison Avenue, New York 2001

MPCC-401 INFORMATION & COMMUNICATION TECHNOLOGY (ICT) IN PHYSICAL EDUCATION

Learning Objectives

1. To know the necessity of information and communication technology in physical education
2. Helps to improves the computer assisted works in sports
3. Able use the applications of computer in sports

UNIT I – Communication & Classroom Interaction

Concept, Elements, Process & Types of Communication, Communication Barriers & Facilitators of communication, Communicative skills of English - Listening, Speaking, Reading & Writing

Concept & Importance of ICT Need of ICT in Education Scope of ICT: Teaching Learning Process, Publication Evaluation, Research and Administration Challenges in Integrating ICT in Physical Education.

UNIT II – Fundamentals of Computers

Characteristics, Types & Applications of Computers Hardware of Computer: Input,Output & Storage Devices Software of Computer: Concept & Types Computer Memory: Concept & Types

Viruses & its Management Concept, Types & Functions of Computer Networks Internet and its Applications Web Browsers & Search Engines Legal & Ethical Issues

UNIT III – MS Office Applications

MS Word: Main Features & its Uses in Physical Education

MS Excel: Main Features & its Applications in Physical Education

MS Access: Creating a Database, Creating a Table, Queries, Forms &

Reports on Tables and its Uses in Physical Education

MS Power Point: Preparation of Slides with Multimedia Effects

MS Publisher: Newsletter & Brochure

UNIT IV – ICT Integration in Teaching Learning Process

Approaches to Integrating ICT in Teaching Learning Process

Project Based Learning (PBL)

Co-Operative Learning

Collaborative Learning

ICT and Constructivism: A Pedagogical Dimension

UNIT V – E-Learning & Web Based Learning

E-Learning

Web Based Learning

Visual Classroom

Course Learning Outcome

1. Understand concept of information and communication technology in physical education field
2. Analyse sporting data of various types via astute use of statistical packages.
3. Practice mathematics, statistics, information technology in sport technology related problems.
4. Offer Hands on Knowledge in information and communication Technology

REFERENCES:

B. Ram, New Age International Publication, Computer Fundamental, Third Edition-2006

Brain under IDG Book. India (p) Ltd Teach Yourself Office 2000, Fourth Edition-2001

Douglas E. Comer, The Internet Book, Purdue University, West Lafayette in 2005

Heidi Steel Low price Edition, Microsoft Office Word 2003- 2004

ITL Education Solution Ltd. Introduction to information Technology, Research and Development Wing-2006

Pradeep K. Sinha & Priti; Sinha, Foundations computing BPB Publications -2006.

Rebecca Bridges Altman Peach pit Press, Power point for window, 1999

Sanjay Saxena, Vikas Publication House, Pvt. Ltd. Microsoft Office for ever one, Second Edition-2006

MPCC-402 SPORTS PSYCHOLOGY AND SPORTS SOCIOLOGY

Learning Objectives:

After studying this paper the student teachers will be able to:

1. Know the introduction to sports psychology.
2. Understand the personality traits.
3. Understand the anxiety, stress and aggression.
4. Know the psychological tests and its applications.
5. Know the introduction to Sports Sociology and its concepts.

UNIT I – Introduction

Meaning, Definition, History, Need and Importance of Sports Psychology. Present Status of Sports Psychology in India. Motor Learning: Basic Considerations in Motor Learning – Motor Perception – Factors Affecting Perception – Perceptual Mechanism. Personality: Meaning, Definition, Structure – Measuring Personality Traits. Effects of Personality on Sports Performance.

UNIT II – Motivation

Meaning and Definition, Types of Motivation: Intrinsic, Extrinsic. Achievement Motivation: Meaning, Measuring of Achievement Motivation. Anxiety: Meaning and Definition, Nature, Causes, Method of Measuring Anxiety. Competitive Anxiety and Sports Performance. Stress: Meaning and Definition, Causes. Stress and Sports Performance. Aggression: Meaning and Definition, Method of Measurement. Aggression and Sports Performance. Self-Concept: Meaning and Definition, Method of Measurement.

UNIT III – Goal Setting

Meaning and Definition, Process of Goal Setting in Physical Education and Sports. Relaxation: Meaning and Definition, types and methods of psychological relaxation. Psychological Tests: Types of Psychological Test: Instrument based tests: Pass-along test – Tachistoscope – Reaction timer – Finger dexterity board – Depth perception box – Kinesthesiometer board. Questionnaire: Sports Achievement Motivation, Sports Competition Anxiety.

UNIT IV – Sports Sociology

Meaning and Definition – Sports and Socialization of Individual Sports as Social Institution. National Integration through Sports. Fans and Spectators: Meaning and definition, Advantages and disadvantages on Sports Performance. Leadership: Meaning, Definition, types. Leadership and Sports Performance.

UNIT V – Group Cohesion

Group: Definition and Meaning, Group Size, Groups on Composition, Group Cohesion, Group Interaction, Group Dynamics. Current Problems in Sports and Future Directions – Sports Social Crisis Management – Women in Sports: Sports Women in our Society, Participation pattern among Women, Gender inequalities in Sports.

Learning outcome:

Practicals: *Atleast five experiments related to the topics listed in the Units above should be conducted by the students in laboratory. (Internal assessment.)*

References:

Authors Guide (2013) National Library of Educational and Psychological Test (NLEPT) Catalogue of Tests, New Delhi: National Council of Educational Research and Training Publication.

Authors Guide (2013) National Library of Educational and Psychological Test (NLEPT) Catalogue of Test, New Delhi: National Council of Educational Research and Training Publication.

Jain. (2002), Sports Sociology, Heal Sahety Kendre Publishers.

Jay Coakley. (2001) Sports in Society – Issues and Controversies in International Education, Mc-Craw Seventh Ed.

John D Lauther (2000) Psychology of Coaching. Ner Jersy: Prenticce Hall Inc.

John D. Lauther (1998) Sports Psychology. Englewood, Prentice Hall Inc.

Miroslaw Vauks & Bryant Cratty (1999). Psychology and the Superior Athlete. London: The Macmillan Co.

Richard, J. Crisp. (2000). Essential Social Psychology. Sage Publications.

Robert N. Singer (2001). Motor Learning and Human Performance. New York: The Macmillan Co.

Robert N. Singer. (1989) The Psychology Domain Movement Behaviour. Philadelphia: Lea and Febiger.

Thelma Horn. (2002). Advances in Sports Psychology. Human Kinetic.

Whiting, K, Karman.,. Hendry L.B & Jones M.G. (1999) Personality and Performance in Physical Education and Sports. London: Hendry Kimpton Publishers.

MPCC-403 DISSERTATION

1. A candidate shall have dissertation for M.P.Ed. – IV Semester and must submit his/her Synopsis and get it approved by the Head of Department on the recommendation of D.R.C. (Departmental Research Committee).
2. A candidate selecting dissertation must submit his/her dissertation not less than one week before the beginning of the IVth Semester Examination.
3. The candidate has to face the Viva-Voce conducted by DRC**.**

MPEC-404 VALUE AND ENVIRONMENTAL EDUCATION (Elective)

Learning Objectives

1. Promote the knowledge of value and environmental education.
2. Create health awareness among youth, various health problems and its impacts
3. Able understand the importance of environment and to create good environment

UNIT I – Introduction to Value Education.

Values: Meaning, Definition, Concepts of Values. Value Education: Need, Importance and Objectives. Moral Values: Need and Theories of Values. Classification of Values: Basic Values of Religion, Classification of Values.

UNIT II – Value Systems

Meaning and Definition, Personal and Communal Values, Consistency, Internally consistent, internally inconsistent, Judging Value System, Commitment, Commitment to values.

UNIT- III – Environmental Education

Definition, Scope, Need and Importance of environmental studies., Concept of environmental education, Historical background of environmental education, Celebration of various days in relation with environment, Plastic recycling & prohibition of plastic bag / cover, Role of school in environmental conservation and sustainable development, Pollution free ecosystem.

UNIT - IV Rural Sanitation and Urban Health

Rural Health Problems, Causes of Rural Health Problems, Points to be kept in Mind for improvement of Rural Sanitation, Urban Health Problems, Process of Urban Health, Services of Urban Area, Suggested Education Activity, Services on Urban Slum Area, Sanitation at Fairs & Festivals, Mass Education.

UNIT - V Natural Resources and related environmental issues:

Water resources, food resources and Land resources, Definition, effects and control measures of: Air Pollution, Water Pollution, Soil Pollution, Noise Pollution, Thermal Pollution Management of environment and Govt. policies, Role of pollution control board.

Learning Outcome

1. Explain the role of values, concepts, and functions across the globe and in society.
2. Able to explain Value Education- Goal Setting- Self Efficacy and Self Esteem

3 Apply the principles of project implementation, including planning, assessment, and evaluation in organizational and community initiatives.

Reference:

Miller T.G. Jr., Environmental Science (Wadsworth Publishing Co.)
Odum, E.P. Fundamentals of Ecology (U.S.A.: W.B. Saunders Co.) 1971.
Rao, M.N. & Datta, A.K. Waste Water Treatment (Oxford & IBH Publication Co. Pvt. Ltd.)
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Townsend C. and others, Essentials of Ecology (Black well Science)
Heywood, V.H. and Watson V.M., Global biodiversity Assessment (U.K.: Cambridge University Press), 1995.
Jadhav, H. and Bhosale, V.M. Environmental Protection and Laws (Delhi: Himalaya Pub. House), 1995.
Mc Kinney, M.L. and Schoel, R.M. Environmental Science System and Solution (Web enhanced Ed.) 1996.
Miller T.G. Jr., Environmental Science (Wadsworth Publishing Co.)

MPEC-405 EDUCATION TECHNOLOGY IN PHYSICAL EDUCATION AND SPORTS (Elective)

Learning Objectives:

- Introduce Education Technology and its various aspects to the learner
- Give an overview of approach systems in Physical Education and Communication
- Introduce various instructional designs and use of audio visual media
- Opening the learners mind towards new horizons in Educational technology

UNIT I – Nature and Scope

Educational technology-concept, Nature and Scope. Forms of educational technology: teaching technology, instructional technology, and behaviour technology; Transactional usage of educational technology: integrated, complementary, supplementary stand-alone (independent); programmed learning stage; media application stage and computer application stage. Systems Approach to Education and its Components: Goal Setting, Task Analysis, Content Analysis, Context Analysis and Evaluation Strategies; Instructional Strategies and Media for Instruction. Effectiveness of Communication in instructional system; Communication - Modes, Barriers and Process of Communication

UNIT III- Instructional Design

Instructional Design: Concept, Views. Process and stages of Development of Instructional Design. Overview of Models of Instructional Design; Instructional Design for Competency Based Teaching: Models for Development of Self Learning Material.

UNIT IV – Audio Visual Media in Physical Education

Audio-visual media - meaning, importance and various forms Audio/Radio: Broadcast and audio recordings - strengths and Limitations, criteria for selection of instructional units, script writing, pre-production, post-production process and practices, Audio Conferencing and Interactive Radio Conference. Video/Educational Television: Telecast and Video recordings Strengths and limitations, Use of Television and CCTV in instruction and Training, Video Conferencing, SITE experiment, countrywide classroom project and Satellite based instructions. Use of animation films for the development of children's imagination.

UNIT V – New Horizons of Educational Technology

Recent innovations in the area of ET interactive video - Hypertext, video-texts, optical fiber technology - laser disk, computer conferencing. etc. Procedure and organization of Teleconferencing/Interactive video-experiences of institutions, schools and universities. Recent experiments in the third world countries and pointers for, India with reference to Physical education. Recent trends of Research in Educational Technology and its future with reference to education.

Learning Outcome:

- Comprehend various aspects of Education Technology
- Understanding of the Systems Approach and communication
- Able to design instructions and incorporate audio visual media in teaching
- Present new ideas in teaching learning

REFERENCE:

Amita Bhardwaj, New Media of Educational Planning".Sarup of Sons, New Delhi-2003

Bhatia and Bhatia. The Principles and Methods of Teaching (New Delhi : Doaba House), 1959.

Communication and Education, D. N. Dasgupta, Pointer Publishers

Education and Communication for development, O. P. Dahama, O. P. Bhatnagar, Oxford Page 68 of 71 IBH Publishing company, New Delhi

Essentials of Educational Technology, Madan Lal, Anmol Publications

K. Sampath, A. Pannirselvam and S. Santhanam. Introduction to Educational Technology (New Delhi: Sterling Publishers Pvt. Ltd.) : 1981.

Kochar, S.K. Methods and Techniques of Teaching (New Delhi, Jalandhar, Sterling Publishers Pvt. Ltd.), 1982

Kozman, Cassidy and kJackson. Methods in Physical Education (W.B. Saunders Company,Philadelphia and London),

SEMESTER -I

PRACTICUM COURSE

MPPC- 106 TRACK AND FIELD I: All RUNNING EVENTS AND RELAY

- Fundamental skills –Short and Middle distance.
- Use of Starting blocks- stance on the blocks.
- Body position at the start- starting technique, change in body position during running, movements of the arms, stride length and frequency, position of torso while running and at finish.
- Advanced Skills Various techniques of sprint start: Bullet start, standing start,

MPPC- 107 Laboratory Practical –I

Test and Measurement- Total - Any 8 laboratory tests Practical classes to be designed based on the theory paper in the above subject

MPPC- 108 YOGA/ AEROBICS

Yoga, Asanas prescribed by Maharshi 'Patanjali', Shudhi Kriyas, jalneti, sutraneti, dugdhaneti, kunjal, Nauli, Bhastika, shatkriya, Pranayams, Anulom-vilom, Kapalbhati,

Aerobics

- Rhythmic Aerobics - dance
- Low impact aerobics
- High impact aerobics
- Aerobics kick boxing

Moves

- March single, basics, side to side alternate, turn s/a ,double side to side, step touch, grapevine, knee up, leg curl, kick front, toe touch, kick side, side lunge, over the top, back lunge, straddle, kick front, travel s 11. kick side, corner, heel to reft, shape, 'e' shape, shape w, shape, repeater left mode.
- Warm up and cool down.
- Being successful in exercise and adaptation to aerobic workout

MPCC-109 - 117: GAME OF SPECIALIZATION - I

(As offered by the department) Game of Specialization- I

General Course Content

Odd Semester

1. Fundamental Skills- Lead Up Games – Warm-up and Warm down - Technical Training
2. General Conditioning & Fitness, Safety, Injury Prevention and Emergency Response
3. Layout of Playfield with all Measurements, Equipment and its specifications
4. International, National and State Level Organizations and Trophies.

SEMESTER- II

PRACTICUM COURSE

MPPC- 206- TRACK AND FIELD II: JUMPING EVENTS & HURDLES

Fundamental Techniques: Broad Jump, Triple Jump, High Jump and Pole vault And Hurdles Advanced techniques in Jumps and Drills, Laying out of Jumping Sectors

MPPC-207 LABORATORY PRACTICAL- II

Sports Biomechanics & Kinesiology(Practical classes to be designed based on the theory paper in the above subject)

MPPC-208- TEACHING LESSONS OF INDIGENIOUS ACTIVITIES AND SPORTS

The students of M.P.Ed – II Semester need to develop proficiency in taking teaching classes in indigenous activities and sports under school situation. In view of this, the students shall be provided with such teaching experience. The duration of the lesson to be conducted by these students shall be in the range of 30 to 40 minutes depending on the class they are going to handle at school and college level.

The lessons will be supervised by the faculty members and experts who would discuss the merits and demerits of the concerned lesson and guide them for the future. In these lessons, the duration should slowly increase and all the parts of the lesson covered progressively.

MPPC-209-217 TEACHING, COACHING AND OFFICIATING IN GAME SPECIALIZATION-I

The students of M.P.Ed – need to develop proficiency in teaching, coaching and officiating lessons as per selected game of specialization. In view of this, the students shall be provided with experience in teaching, advance training and coaching and advance mechanism of officiating in their selected game. The duration of the lesson to be conducted by these students shall be in the range of 30 to 40 minutes depending on the class time they are going to handle at school and college level.

The lessons will be supervised by the faculty members and experts who would discuss the merits and demerits of the concerned lesson and guide them for the future. In these lessons, the duration should slowly increase and all the parts of the lesson to be covered progressively.

1. Basic coaching principles, talent identification, combining General and Specific Conditioning
2. Advanced Skills- Lead Up Games – Tactics and Strategies, Selection of Players and teams
3. Officiating and Scoring –Online & Offline
4. Basic coaching principles, talent identification, combining General and Specific Conditioning
5. Designing Coaching programs with and without coaching aids
6. Planning, Organization and Management of Tournaments

SEMESTER - III

PRACTICUM COURSE

MPPC- 306 TRACK AND FIELD -III

Throwing events and Gymnastics

Throwing Events

- Fundamental Techniques- Shot Put, Discus, Javelin and Hammer
- Advanced techniques in throws and their drills. Laying out of the throwing sectors.
- Fundamental Techniques- Gymnastics - training and drills in Gymnastics

MPPC-307 LABORATORY PRACTICAL - III

Sports Medicine and Physiotherapy (Practical classes to be designed based on the theory paper in the above subject)

MPPC-308: INTERNSHIP

The students of M.P.Ed – III Semester need to be develop proficiency in taking coaching lesson in selected game discipline. In view of this, the students shall be attached to the nearby schools for internship/ coaching practice in any of the games offered by this department.

MPPC-309 -317 GAME OF SPECIALIZATION - II

(As offered by the department)

The Candidate has choice to select any one of the following games as the Specialization – II (Second best) in Third Semester.

1. Fundamental Skills- Lead Up Games – Warm-up and Warm down - Technical Training
2. General Conditioning & Fitness, Safety, Injury Prevention and Emergency Response
3. Layout of Playfield with all Measurements, Equipment and its specifications
4. International, National and State Level Organizations and Trophies.

SEMESTER - IV

PRACTICUM COURSE

MPPC- 406 TRACK AND FIELD – IV COMBINED EVENTS

- Pentathlon- Order of events, Heptathlon - Order of events, Decathlon - Order of events
- Training for combined events.

MPPC-407 LABORATORY PRACTICAL - IV

Exercise Physiology & Sports Psychology (5 tests each) (Practical classes to be designed based on the theory paper in the above subject).

MPPC-408 OFFICIATING LESSONS OF TRACK AND FIELD

The students of M.P.Ed – IV Semester need to develop proficiency in taking officiating lesson in Track & Field. In view of this, the students shall be provided with advance mechanism of officiating in Track & Field. The duration of the lesson to be conducted by these students shall be in the range of 30 to 40 minutes depending on the class time they are going to handle at school and college level.

MPPC-409-417 TEACHING, COACHING AND OFFICIATING IN GAME SPECIALIZATION-II

The students of M.P.Ed – need to develop proficiency in teaching, coaching and officiating lessons as per selected game of specialization. In view of this, the students shall be provided with experience in teaching, advance training and coaching and advance mechanism of officiating in their selected game. The duration of the lesson to be conducted by these students shall be in the range of 30 to 40 minutes depending on the class time they are going to handle at school and college level.

. The lessons will be supervised by the faculty members and experts who would discuss the merits and demerits of the concerned lesson and guide them for the future. In these lessons, the duration should slowly increase and all the parts of the lesson to be covered progressively.

Note: Where ever details of any activities are not mentioned, it is expected to elaborate skills by the competent bodies of local Universities/ Autonomous Colleges.

1. Basic coaching principles, talent identification, combining General and Specific Conditioning
2. Advanced Skills- Lead Up Games – Tactics and Strategies, Selection of Players and teams
3. Officiating and Scoring –Online & Offline.
4. Basic coaching principles, talent identification, combining General and Specific Conditioning
5. Designing Coaching programs with and without coaching aids.
6. Planning, Organization and Management of Tournaments

PONDICHERRY UNIVERSITY

DEPARTMENT OF STATISTICS

SYLLABUS FOR B.Sc. STATISTICS (Honours)

(NEP 2020 Pattern)

Effective from the Academic Year 2023-2024

FIRST YEAR – SEMESTER I

Course Code	STAT 111	DESCRIPTIVE STATISTICS	L	T	P	Credits
Core	MAJOR 1	Semester I	4	1	-	4
Pre-requisite		Knowledge of Mathematics	Syllabus Version		2023-24	

Course Objectives

To learn the basic concepts of Statistics such as types of data and graphical approach to data.

Expected Course Outcomes

On the successful completion of the course, student will be able to classify and analyze the data

Unit:1

Definition of statistics: Scope and limitations of statistics – Types of data – Nominal, Ordinal, Ratio, Interval scale data - Primary and Secondary data – Data presentation tools – One dimensional, two dimensional data presentation – line diagram – Box plots – stem and Leaf plots – Scatter plots. Measures of Central Tendency: Arithmetic Mean, Median, Mode, Geometric mean and Harmonic mean.

Unit:2

Measures of Dispersion: Range, Quartile Deviation, Mean Deviation and Standard Deviation, Coefficient of Variation. Central and Non-Central moments and their interrelationship. Sheppard's correction for moments. Skewness and kurtosis.

Unit:3

Curve fitting: Bi-variate data, Principle of least squares, fitting of straight line, Second-degree parabola, power curve and exponential curves.

Correlation: Meaning, Types of Correlation, Measures of Correlation: Scatter diagram, Karl Pearson's Coefficient of Correlation, Rank Correlation Coefficient (with and without ties), Bi-variate frequency distribution, correlation coefficient for bi-variate data and simple problems. Concept of multiple and partial correlation coefficients (three variables only) and properties.

Unit:4

Attributes: Notations, Class, Order of class frequencies, Ultimate class frequencies, Consistency of data, Conditions for consistency of data for 2 and 3 attributes only, Independence of attributes, Association of attributes and its measures, Relationship between association and colligation of attributes, Contingency table: Square contingency, Mean square contingency, Coefficient of mean square contingency, Tschuprow's coefficient of contingency.

Total Lecture Hours | **60 Hours**

Books for Study

1. Hooda.R.P. (2003), Statistics for Business and Economics , 3/e, Mac Millan
2. Medhi.J. (2006), Statistical Methods: An Introductory Text , Wiley Eastern Ltd.
3. Gupta.S.C. and Kapoor.V.K. (2014), Fundamentals of Mathematical Statistics, 12/e, Sultan Chand and sons.
4. Agarwal.B.L (2013), Basic Statistics, 6/e, New Age International Publishers.

Reference Books

1. Anderson.R, Sweeney.J and Williams.A (2019): Statistics for Business and Economics, 13/e, Cengage Publishers
2. Sheldon M.Ross (2005), Introductory Statistics , 2/e, Elsevier Publications.
3. Murray R. Spiegel and Larry J. Stephens (2005), Schaum's Outline of Theory and Problems of Statistics, 3/e, Tata Mc Graw Hill Publishing Company Ltd, New Delhi.

Course Code	STAT 112	MATHEMATICS FOR STATISTICS – I	L	T	P	Credits
Core	MINOR 1	Semester II	4	1	-	4
Pre-requisite		Knowledge in Mathematics (higher secondary level)	Syllabus Version		2023-24	

Course Objectives

1. To understand the derivatives of functions
2. To apply the concept of derivative

Expected Course Outcomes

To understand geometric meaning of derivatives
To learn the concept of successive differentiation
To understand some basic functions and its partial differentiation

Unit:1

Derivative of a function- Differentiation rules- Rate of change- Derivatives of trigonometric functions- Chain Rule- Implicit differentiation rational exponents Inverse functions and their derivatives- Hyperbolic function.

Unit:2

Application of Derivatives- Increasing decreasing functions - Maxima minima-Error –Approximation-Optimization-Newton method- Mean value theorems- Taylor theorem- Maclaurins theorem.

Unit:3

Asymptotes- Test of concavity& convexity point of inflexion- Multiple point training curves in Cartesian & Polar co-ordinates.

Unit:4

Successive differentiation- Leibnitz rule- Problems and examples - Exponent function a^x, log—functions- Theorems on exponent & Log functions- Partial differentiation- Chain rule- Eulers theorem.

Total Lecture Hours **60 Hours**

Books for Study

1. George B.Thomas, Maurice D.Weir and Joel Hass, Thomas' Calculus 12th Edition, Pearson Education, 2015.

Reference Books

1. Richard Courant and Fritz John, Introduction to Calculus and Analysis, Vol.I, Springer 1999.
2. Serge Lang A First course in Calculus 5th edition, Springer, 1999.

Course Code	STAT 113	INTRODUCTION TO STATISTICS	L	T	P	Credits
Core	Multi-Disciplinary (MD 1)	Semester I	3	1	-	3
Pre-requisite		Knowledge in Mathematics (at higher secondary level)	Syllabus Version		2023-24	

Course Objectives

The main objectives of this course are to:

1. To learn the about different data types, diagrammatic and graphical representation of the data
2. To learn about measure of central tendency and measures of dispersion
3. To learn about correlation and regression

Expected Course Outcomes

On the successful completion of the course, student will have knowledge on theoretical as well as practical approach on

1. various techniques used in summarization, presentation and analysis of different types of Statistical data
2. Simple and rank correlation, Partial and Multiple correlation coefficients.
3. Fitting of linear and quadratic regressions using principle of least squares, Association Analysis

Unit:1

Introduction: Definition and scope of Statistics, concepts of statistical population and sample. Scales of measurement -nominal, ordinal, interval and ratio. Variables and attributes, Diagrammatical Representation of Data, Summarization of Data: Frequency Distribution and Graphical Presentation.

Unit:2

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, measures of skewness and kurtosis.

Unit:3

Bivariate data: Definition, scatter diagram, simple correlation, rank correlation. Trivariate Data: Partial and Multiple correlation coefficients.

Unit:4

Fitting of linear and quadratic regression using principle of least squares. Theory of attributes and consistency of data, independence and association of attributes, measures of association and contingency for 2 x 2 and r x s contingency tables.

Total Lecture Hours | **60 Hours**

Books for Study

1	Goon, A.M., Gupta, M.K. and Dasgupta, B. (2013). Fundamental of Statistics, Vol I, , World Press, Kolkata.
2	Mood, A.M. Graybill, F.A. and Boes, D.C. (2017). Introduction to the Theory of Statistics, 3rd Edn., (Indian Edition), Tata McGraw-Hill Pub. Co. Ltd.
3	Rohatgi, V.K. and Saleh, A.E. (2008). An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

Course Code	STAT 114	DATA ANALYSIS USING EXCEL-I	L	T	P	Credits
Core	Skill Enhancement (SEC 1)	Semester I	3	1	-	3
Pre-requisite			Syllabus Version		2023-24	

Course Objectives:

The main objectives of this course are:

1. To train the students to handle and present the data with various statistical measures in excel
2. To improve the analytical skills of students using built in statistical functions and routines of excel
3. To perform relational and association analysis for the given data.

Expected Course Outcomes:

Students will be able to:

1. Carry out the basic level statistical analysis using the statistical functions in excel
2. Will be able to present the data graphically in a meaningful manner
3. Will be getting acquaintance with many statistical techniques and functions in excel

Unit:1	Introduction to Excel	

File Operations – Open, Save, close – Data operations – Creating forms to enter data – concatenation of text, numbers – Splitting of data into columns – Sort and reverse sort – Grouping and ungrouping of data

Unit:2	Graphical statistics using Excel	

One dimensional, two dimensional data presentation – Histogram, line diagram – Box plots – Scatter plots. Bar charts – stack, subdivided, pie charts, radar graphs

Unit:3	Measures of Central Tendency	

Arithmetic Mean, Median, Mode, Geometric mean and Harmonic mean, Range, Quartile Deviation,

Unit:4	Statistical measures using Excel	

Mean Deviation, Standard Deviation, Coefficient of Variation. Central and Non-Central moments and their interrelationship. Sheppard's correction for moments. Skewness and kurtosis.

Total Lecture Hours	45 Hours

Books for Study:

1	Sarma KVS (2010), Statistics Made Simple: Do it Yourself on PC, PHI, India, 2/e
2	Wayne, W L (2019), Microsoft Excel: Data Analysis & Business Model, PHI

Reference Books:

1	Nelson, S.L and Nelson, E C (2018), Microsoft data analysis for dummies, Wiley
2	Berk, K. N and Carey, P (2000), Data Analysis with Microsoft Excel, S.Chand (G/L) & Company Ltd, 3/e

FIRST YEAR – SEMESTER II

Course Code	STAT 121	PROBABILITY THEORY	L	T	P	Credits
Core	MAJOR 2	Semester II	4	1	-	4
Pre-requisite		Knowledge in Numbers(Real, Integer), Set theory, Bounds, Sequence, Convergence	Syllabus Version		2023-24	

Course Objectives

The main objectives of this course are to:

1. Review the basic concepts of Random experiments, Trials and Events, and Sample Space
2. Study about properties of Probability and obtaining event probability
3. Study Conditional events and probability

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1. Understand the basic concepts of probability theory
2. Study addition and multiplication theorem, moment generating function
3. Learn about various types of Convergence and Central Limit theorem

Unit:1

Introduction to probability theory – Random experiments, Events, Sample space, Operations on events and types of events – Mathematical, Statistical and Axiomatic definitions of Probability – Simple problems.

Unit:2

Addition and Multiplication law of probability - Boole's inequality- Conditional probability – Bayes Theorem - Simple problems - Random variable - Discrete and Continuous – Probability Mass function and Probability Density Function – Bivariate random variables

Unit:3

Expectation – Variance - Moments: Raw and central moments and their relations, Moment Generating Functions and Probability Generating Functions–Simple problems.

Unit:4

Chebychev's inequality - Cauchy – Schwartz inequality – Definition of convergence in probability and distribution - Weak Law of Large numbers (WLLN) - Central Limit theorem for i.i.d case (statement only)

Total Lecture Hours **60 Hours**

Books for Study

1. Hogg, R.V. , Mc Kean J W and Craig, A.T.(2005): Introduction to Mathematical Statistics, 6/e Pearson Edition
2. Gupta,S.C. and Kapoor, V.K. (2000): Fundamentals of Mathematical Statistics, 10/e, Sultan Chand and sons.

Reference Books

1. Mood, A.M., Graybill, F.A and Boes, D.C.(1974): Introduction to the Theory of Statistics, McGraw Hill.

Course Code	STAT 122	MATHEMATICS FOR STATISTICS -II	L	T	P	Credits
Core	MINOR 2	Semester II	4	1	-	4
Pre-requisite		Knowledge in Mathematics (higher secondary level)	Syllabus Version	2023-24		

Course Objectives

To learn the basic concepts of matrices, Linear Equations**,** partial differentiation, Gamma Integral and Laplace transform

Expected Course Outcomes

On completion of the course, students will be able to apply mathematical techniques for deriving statistical distributions.

Unit:1

Matrices: Elementary, scalar, Hermitian, skew-Hermitian, symmetric, skew-symmetric, Unitary, triangular, equivalent and similar matrices- Transpose and conjugate of a matrix – Rank of a matrix

Unit:2

System of Linear Equations- Consistency-Different types of solutions – Inverse of a Matrix. Characteristics Equation – Eigen values and Vectors –Cayley Hamilton Theorem.

Unit:3

Partial differentiation – Maxima and Minima of functions of two variables- Integration – Properties of Definite Integrals – Reduction formula – Bernoulli's formula - Double Integrals – Evaluation in simple cases only – Use of Jacobian transformation

Unit:4

Definitions of Beta and Gamma Integrals – Recurrence Formula for Gamma Integral Properties of Beta Integral– Application of Beta Gamma Integrals – Relation between Beta and Gamma Integrals. Laplace Transform: Introduction – definition – properties – Laplace transforms ofstandard functions – derivatives and integrals of transforms – transform of derivatives and integrals

Total Lecture Hours **60 Hours**

Books for Study

1. M.K. Venkataraman (1965): Engineering Mathematics, National Publishing Company, Chennai
2. T.K. Manicavachagom Pillay, T. Natarajan, K.S. Gnanapathy, Calculus, Vol I, II & III, S. Viswanathan Printers & Publishers Pvt.Ltd., Chennai
3. T.K. Manicavachagom Pillay, T. Natarajan, K.S. Gnanapathy (1999), Algebra, Volume II, S. Viswanathan Printers & Publishers Pvt.Ltd., Chennai

Reference Books

1. B.S. Grewal (2014): Higher Engineering Mathematics, Khanna Publishers

Course Code	STAT123	INTRODUCTION TO PROBABILITY THEORY	L	T	P	Credits
Core	MD 2	Semester II	3	1	-	3
Pre-requisite		Knowledge in Mathematics (at higher secondary level)	Syllabus Version		2023-24	

Course Objectives:

This course will lay the foundation to probability theory and Statistical modelling of outcomes of real-life random experiments through various Statistical distributions.

Expected Course Outcomes:

The students will get to know about

1. Writing of sample space, events and algebra of events and finding Probability of events.
2. Conditional Probability and applications of Bayes' theorem.
3. Discrete and continuous random variables, probability mass function and probability density function cumulative distribution function.

Unit:1

Probability: Introduction, random experiments, sample space, events – Types of events - Definitions of Probability – classical, statistical and axiomatic - Conditional Probability - Addition and Multiplication theorem of probability - Bayes' theorem – Simple problems.

Unit:2

Random Variables: Discrete and continuous random variables, Probability mass function , Probability density function , Cumulative distribution function their properties. Expectation, variance, moments and moment generating function.

Unit:3

Discrete probability distributions: Binomial, Poisson, Geometric, Negative Binomial, Hyper geometric – properties and applications.

Unit:4

Continuous Probability distributions: Uniform, Normal, Exponential, Beta, Gamma - properties and applications

Total Lecture Hours **45 Hours**

Books for Study

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2013). Fundamental of Statistics, Vol I, , World Press, Kolkata.
2. Mood, A.M. Graybill, F.A. and Boes, D.C. (2011). Introduction to the Theory of Statistics, 3rd Edn., (Indian Edition), Tata McGraw-Hill Pub. Co. Ltd.
3. Rohatgi, V.K. and Saleh, A.E. (2008). An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

Reference Books

1. Goon, A.M., Gupta, M.K. and Das Gupta,B. (2016): Fundamentals of Statistics, Vol. II, World Press, Calcutta.
2. Miller, I. and Miller, M. (2006). John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

Course Code	STAT124	DATA ANALYSIS USING EXCEL-II	L	T	P	Credits
Core	SEC 2	Semester II	3	1	-	3
Pre-requisite			Syllabus Version		2023-24	

Course Objectives:

The main objectives of this course are:

1. To train the students to handle and present the date with various statistical measures in excel
2. To improve the analytical skills of students using built in statistical functions and routines of excel

Expected Course Outcomes:

Students will be able to:

1. Perform basic problems on probability
2. Will be able to generate random numbers and compute basic measures

Unit:1	Basic Probability using Excel	

Addition and Multiplication law of probability - Conditional probability – Bayes Theorem - Simple problems.

Unit:2	Random Number Generation using Excel	

Generation of random numbers for discrete and continuous random variables - Expectation – Variance - Moments: Raw and central moments

Unit:3	Relational Analysis using Excel	

Curve fitting: Bi-variate data, fitting of straight line, Second-degree parabola, power curve and exponential curves. Correlation: Meaning, Types of Correlation, Measures of Correlation: Scatter diagram, Goodness of fit and association of attributes.

Unit:4	Tabulation Analysis using Excel	

Cross tabulation, summaries and basic calculations using Pivot Tables, Pivot charts – Matrix Operations – Addition, multiplication, subtraction, inverse and transpose

Total Lecture Hours	45 Hours

Books for Study:

1	Sarma KVS (2010), Statistics Made Simple: Do it Yourself on PC, PHI, India, 2/e
2	Wayne, W L (2019), Microsoft Excel: Data Analysis & Business Model, PHI

Reference Books:

1	Nelson, S.L and Nelson, E C (2018), Microsoft data analysis for dummies, Wiley
2	Berk, K. N and Carey, P (2000), Data Analysis with Microsoft Excel, S.Chand (G/L) & Company Ltd, 3/e

SECOND YEAR – SEMESTER III

Course Code	STAT231	DISTRIBUTION THEORY	L	T	P	Credits
Core	MAJOR 3	Semester III	4	1	-	4
Pre-requisite		Basic Probability Theory	Syllabus Version		2023-24	

Course Objectives

The main objectives of this course are:

1. To learn the concepts of discrete and continuous distributions.
2. To learn about sampling distributions like Chi-Square, Student's t (Fisher's t) and Snedecor's F distributions and their applications.

Expected Course Outcomes

On the successful completion of the course, student will acquire:

1. Knowledge of important discrete distributions such as Binomial, Poisson, Geometric, Negative Binomial and Hyper-geometric and their interrelations (if any)
2. To apply standard discrete probability distribution to different situations.
3. Knowledge of important continuous distributions such as Uniform, Normal, Exponential, Beta and Gamma and relations with some other distributions and their applications.

Unit:1

Discrete Distributions: Bernoulli, Binomial - Poisson - Geometric – Uniform distributions - Definition, properties, characterizations and simple problems.

Unit:2

Negative Binomial - Multinomial – Hypergeometric distributions - Definition, properties, characterizations and simple problems.

Unit:3

Continuous Distributions: Uniform - Exponential – Normal - Cauchy - Gamma - Beta distributions (First and Second kind) - Definition, properties, characterizations and simple problems.

Unit:4

Definition of Sampling distributions and standard error - Sampling distributions: central t, central F and central chi-square distributions – derivation of pdf and their characteristics.

Total Lecture Hours **60 Hours**

Books for Study:

1. Hogg, R.V. , Mc Kean J W and Craig, A.T.(2021): Introduction to Mathematical Statistics, 8/e Pearson Edition.
2. Mood, A.M., Graybill, F.A and Boes, D.C. (2017): Introduction to the Theory of Statistics, 3/e, McGraw Hill.
3. Rohatgi, V.K. and Saleh, A.E. (2008). An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

Reference Books:

1. Goon, A.M., Gupta, M.K. and Das Gupta,B. (2016): Fundamentals of Statistics, Vol. II, World Press, Calcutta.
2. Irwin Miller and Marlyees Miller (2013): John E Freund's Mathematical Statistics, 8/e, PHI.

Course Code	STAT232	APPLIED STATISTICS	L	T	P	Credits
Core	MAJOR 4	Semester III	4	1	-	4
Pre-requisite		Basic Statistics	Syllabus Version		2023-24	

Course Objectives:

The main objectives of this course are:

1. To learn the concepts of time series, evaluation, measurement of trend and seasonal variations by various methods.
2. To learn about Index numbers.
3. To learn about the various measures of mortality and fertility.

Expected Course Outcomes:

On the successful completion of the course, student will acquire:

Students will gain the knowledge about Analysis of time series, index numbers and vital statistics.

Unit:1

Index Numbers: Construction of index numbers; fixed and chain base index numbers; weighted index numbers; standard index numbers; Tests for index numbers; cost of living index number and its construction.

Unit:2

Time Series Analysis: Components of a time series – methods for measurement of trend and Seasonal variations – moving average, ratio to trend, ratio to moving average, exponential smoothing

Unit:3

Vital Statistics: Methods of obtaining Vital Statistics, Methods of measuring population - Measures of mortality – Crude and specific rates, standardized rates, Infant mortality rate - Complete life table - its construction and uses. Abridged life tables.

Unit:4

Measures of Fertility: Crude Birth Rate (CBR), Age Specific Fertility Rate (ASFR), General Fertility Rate (GFR) and Total Fertility Rate (TFR) - Crude, Specific and standardized rates - Measures of migration, Population growth rates - Gross Reproduction Rate and Net Reproduction Rate.

Total Lecture Hours **60 Hours**

Books for Study

1	Kapoor.V.K. and Gupta.S. (2014): Fundamentals of Applied Statistics, Sultan Chand and Sons.
2	Parimal Mukhopadhyay (2022): Applied Statistics, Books and Allied (P) Ltd, Kolkata.
3	B L Agarwal (2013): Basic Statistics, New Age International Publishers.

Reference Books

1	Goon.A.M., Gupta.M.K. and Das Gupta .B (2016) : Fundamental of Statistics , Vol. II, World Press , Calcutta.
2	Bogue.D.J. (1969) : Principles of Demography , John Wiley.
3	Misra.B.D. (1982): An Introduction to the Study of Population, South Asian Publishing.

Course Code	STAT 233	REAL ANALYSIS	L	T	P	Credits
Core	MINOR 3	Semester III	4	1	-	4
Pre-requisite		Knowledge in Mathematics (higher secondary level)	Syllabus Version	2023-24		

Course Objectives

To learn Real number system, convergence and divergence, functions, algebra of functions and Riemann integration.

Expected Course Outcomes

On the successful completion of the course, student will be able to:

Students will learn the mathematical concepts pertaining to sequences and series, functions, its derivative and integration.

Unit:1

Real valued functions – Equivalence – Countability – Real numbers – Least upper bound – Greatest lower bound. Sequence of real numbers: Limit of a sequence – Convergent sequences, Divergent sequences - Bounded sequences - Monotone sequences – Cauchy's first and second theorem on limits – Cauchy's general principle of convergence

Unit:2

Series of real numbers : Convergence and divergence - series with non-negative terms – comparison test – p-test, D'Alembert's ratio test, Cauchy's Root test – Alternating series – Conditional convergence and absolute convergence – Leibnitz test (proof of the test can be omitted, only problems).

Unit:3

Functions : Limit of real valued function in one variable, continuity – types of discontinuities – algebra of continuous functions – Extreme value theorem – Intermediate value theorem – Uniformly Continuous functions – Increasing and Decreasing functions – Differentiability – Darboux'sTheorm – Rolle's Theorem – Mean value theorem for derivatives – Taylor's Series expansion

Unit:4

Riemann Integration – Definition and existence of the integral – refinement of partitions – Darboux's theorem – Conditions of Integrability – Integrability of sum and modulus of integrable functions – Integration and Differentiation – Fundamental Theorem of Calculus

Total Lecture Hours **60 Hours**

Books for Study

1. Malik S.C. and Savita Arora (2010): Mathematical Analysis, 4/e, New Age International Publishers
2. D. Somasundaram and B. Choudhary (2002) : A first course in Mathematical Analysis, Narosa Publishing house
3. R. R. Goldberg (1970) : Methods of Real Analysis, Oxford & IBH.

Reference Books

1. T. M. Apostol(1985): Mathematical Analysis, Narosa Publishing House.
2. W. Rudin(1976): Principles of Mathematical Analysis, 3/e, McGraw Hill Company.

Course Code	STAT 234	STATISTICAL METHODS	L	T	P	Credits
Core	MD 3	Semester III	3	1	-	3
Pre-requisite			Syllabus Version		2023-24	

Course Objectives:

The main objectives of this course are:
To focus attention on various statistical methods and to apply them for basic data analysis

Expected Course Outcomes:

On the successful completion of the course, student will have
Knowledge of Index numbers, Time Series, Vital Statistics, Official Statistics
.

Unit:1

Index Numbers: Construction of index numbers; fixed and chain base index numbers; weighted index numbers; standard index numbers; Tests for index numbers; cost of living index number and its construction.

Unit:2

Vital Statistics: Methods of obtaining Vital Statistics, Methods of measuring population - Measures of mortality – Crude and specific rates, standardized rates, Infant mortality rate - Complete life table - its construction and uses. Abridged life tables.

Unit:3

Time Series Analysis: Components of a time series – methods for measurement of trend – Fitting of linear, quadratic and exponential trend – Method of moving averages

Unit:4

Official Statistics: History of Indian Statistical System - Present Indian Statistical System – Statistical system at the Central and State levels. Flow chart of Indian Statistical System – Ministry of Statistics and Programme Implementation (MOSPI) – Central Statistical Office (CSO) – National Sample Survey Organization (NSSO)

Total Lecture Hours	45 Hours

Books for Study:

1	Freedman, D., Pisani, R. and Purves, R. (2014). Statistics. 4th Edition. Norton & Comp.
2	Medhi.J. (1992) : Statistical Methods an Introductory Text , Wiley Eastern Ltd.,.
3	Kapoor.V.K. and Gupta.S. (1978): Fundamentals of Applied Statistics,Sultan Chand and Sons.

Reference Books:

1	Anderson.R, Sweeney.J and Williams.A (2002): Statistics for Business and Economics, 8/e, Thomson.
2	Sheldon M.Ross (2006): Introductory Statistics, 2/e, Elsevier Publications.
3	Murray R. Spiegel and Larry J. Stephens (2005): Schaum's Outline of Theory and Problems of Statistics, 3/e, Tata Mc Graw Hill Publishing Company Ltd, New Delhi.

Course Code	STAT 235	EXPLORATORY DATA ANALYSIS USING R	L	T	P	Credits
Core	SEC 3	Semester III	3	1	-	3
Pre-requisite		Knowledge in Basic Statistics	Syllabus Version		2023-24	

Course Objectives

This course is intended to train students to get knowledge in performing statistical data analysis using R language

Expected Course Outcomes

Students will be able to write program in R language for a various data analytic technique which will help them in getting placed in analytic companies.

Unit:1	

R language Essentials: Expressions and objects, Assignments, creating vectors, vectorized arithmetic, creating matrices, operations on matrices, lists, data frames – creation, indexing, sorting and conditional selection ; examples

Unit:2	

Descriptive Statistics and Graphics: Obtaining summary statistics; generating tables; Bar plots, Pie charts, Box plots, Histogram; exercises - Graphic libraries in R like GGally, RGL, ggplot2; curve fitting, performance analytics package

Unit:3	

Working with Text Data: Fundamental of Text data analysis – Basic Character functions : nchar, grep, sub and gsub functions, strsplit functions – Regular expression basics and functions -

Unit:4	

Detection of anomalies in the Data : Outliers and their Influence – Detecting univariate outliers – Inliers and detection – Metadata errors – Mosaic plots: Categorical scatter plots – Missing data and its Imputation

Total Lecture Hours	45 Hours

Books for Study

1	Tukey, J; EDA ; Book on R with examples
2	Ronald K Pearson (2018): Exploratory Data Analysis using R, CRC Press

Reference Books

1	Jared P Lander (2014): R for Everyone: Advanced Analytics and Graphics, Pearson Education Inc.
2	Navarro OT (2017); R programming by Example, Packt Publishing.
3	Wickham H and Grolemund G (2017): R for Data Science.

SECOND YEAR – SEMESTER IV

Course Code	STAT241	SAMPLING THEORY	L	T	P	Credits
Core	Major 5	Semester IV	4	1	-	4
Pre-requisite		Knowledge in Elements of Probability Theory and Probability Distributions	Syllabus Version		2023-24	

Course Objectives

The main objectives of this course are to:

1. To study Sample and Population and Sample survey and Census
2. To study about drawing random sample in different scenario with various sampling technique
3. Estimation of parameters (mean and variance).

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1	Understand the concepts and importance of properties of estimators	
2	Obtain the optimal estimator for a given parametric function	
3	Study the different methods of point estimation	
4	Observe consistent and asymptotic behaviour of estimators	
5	Construct confidence intervals for population parameters	

Unit:1

Need for sampling – population and sample – sampling unit and sample frame – Types of Population – Basic properties of population – sample survey and census – Principal steps in a Sample survey – Notion of sampling and non-sampling errors.

Unit:2

Simple Random Sampling with and without replacement – Estimation of Population mean and Proportion and their variances- Determination of sample size.

Unit:3

Stratified sampling – Principles of stratification – Estimation of population mean and its variance – Allocation techniques: optimum, proportional and Neyman – Estimation of gain due to stratification

Unit:4

Linear and Circular systematic sampling – Estimation of population mean and variance, Equal Cluster Sampling- Estimation of population mean and variance, Comparison of cluster and random sampling, Comparison of systematic, simple random and stratified

Unit:5

Illustrative numerical problems on :Use of random numbers and Simple random sampling - Stratified random sampling – Proportional allocation and Optimum allocation - Systematic sampling - Cluster sampling (equal size)

Total Lecture Hours **60 Hours**

Books for Study

1	Cochran, W.G. (1977): Sampling Techniques, 3/e, Wiley.
2	Singh D and Choudhary F.S. (1986): Theory and Analysis of Sample Survey and Designs, New Age International.
3	A.K. Swain (2003), Finite Population Sampling, South Asian Publishers

Reference Books

1	Desraj (2000): Sample survey theory, Narosa Publishing House.
2	Parimal Mukhopadhyay(2009): Theory of Sample Surveys, Prentice Hall of India

Course Code	STAT242	ESTIMATION THEORY	L	T	P	Credits
Core	MAJOR 6	Semester IV	4	1	-	4
Pre-requisite		Knowledge in Probability and Distribution Theory	Syllabus Version		2023-24	

Course Objectives

This course focuses on point and interval estimation techniques.

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1	Summarize the various dimensions of quality and quality improvement methods	
2	Obtain the optimal estimator for a given parametric function	
3	Study the different methods of point estimation	
4	Observe consistent and asymptotic behavior of estimators	
5	Construct confidence intervals for population parameters	

Unit:1

Basic problem of statistical Inference: Point estimation - Properties of estimators: Unbiasedness and consistency - Conditions for consistency –Sufficiency -Factorization theorem (without proof) –Simple problems

Unit:2

Efficiency -Minimum Variance Unbiased Estimators (MVUE) and their properties - Cramer-Rao Inequality - Rao - Blackwell Theorem – Simple Problems

Unit:3

Methods of Estimation: Methods of moments – Simple problems - Method of least squares – Method of minimum chi-square; Method of maximum likelihood estimation (MLE) – Properties of maximum likelihood estimators - Asymptotic properties of MLE (without proof)

Unit:4

Confidence intervals: Basic Notions - Confidence Intervals for the mean, proportion, variance (for the case of one and two populations) - Large sample Confidence Intervals

Unit: 5

Illustrative Numerical problems: Method of Moments - Method of Maximum Likelihood - Confidence Intervals

Total Lecture Hours | **60 Hours**

Books for Study

1	Hogg, R.V. , Mc Kean J W and Craig, A.T.(2005): Introduction to Mathematical Statistics, 6/e Pearson Edition
2	Rohatgi,V.K. and Saleh, A.K.(2002): An Introduction to Probability and Statistics , 2/e, John Wiley.
3	Mood,A.M., Graybill, A.M. and Boes, D.C. (2011): Introduction to theory of Statistics , McGraw Hill.

Reference Books

1	Bansilal, Sanjay Arora and Sudha Arora (2006): Introducing Probability and Statistics, 2/e, Satya Prakashan Publications, New Delhi
2	Miller, I and Miller.M (2012): Mathematical Statistics, 8/e, Pearson Education.
3	Goon, A.M., Gupta, M.K.and Das Gupta,B. (2016): An Outline of statistical theory , Vol. II , World Press, Calcutta.

Course Code	STAT243	OFFICIAL STATISTICS	L	T	P	Credits
Core	MAJOR 7	Semester IV	4	1	-	4
Pre-requisite			Syllabus Version		2023-24	

Course Objectives

To learn about Indian Statistical System

Expected Course Outcomes

Students will get the awareness about the Indian Statistical System, Indian Administrative System in Central and States. Student will obtain the awareness about Subordinate Service and Indian Statistical Service.

Unit:1

Indian Statistical System: History of Indian Statistical System - Present Indian Statistical System – Statistical system at the Central and State levels. Flow chart of Indian Statistical System – Ministry of Statistics and Programme Implimentation (MOSPI) – Central Statistical Office (CSO) – National Sample Survey Office (NSSO)

Unit:2

Administrative Statistical System: Centralised and Decentralised Systems of Collection of Administrative Statistics – Failure of Administrative Statistical System – Weak Lateral Coordination. National Commission of Statistics (NCS) – Functions of the NCS – Constitution of NCS – National Statistical Organisation (NSO) – Functions of NSO. National Sample Survey Office (NSSO) & its Divisions.

Unit:3

The States Statistical System: Improving the Administrative Statistical System (AdSS) – Statistics for Decision Making – Operational Aspects – Computerisation of Administrative Statistics.

Directorate of Economics and Statistics (DES): Role of DES – Common Statistical Cadre – Statistical Divisions in Departments – Block Statistical Organisation.

Unit:4

Human Resource Development: Staffing Pattern at the Centre. Training Aspects – Training Courses Organised by the National Sample Survey Organization – Training arrangements at State Statistical Organisations – Subordinate Staff – Indian Statistical Service (ISS).

Total Lecture Hours | **60 Hours**

Books for Study

1. e-publication of MOSPI https://mospi.gov.in/documents/213904/0/Ch+14+30.8.2001.pdf/
2. Saluja, M.R., (1972), 'Indian Official Statistical Systems', Statistical Pub. Society.

Reference Books

1. Government of India (1999), 'Guide to Official Statistics', CSO, MOSPI.

Course Code	STAT244	NUMERICAL METHODS	L	T	P	Credits
Core	MINOR 4	Semester III	4	1	-	4
Pre-requisite		Knowledge on Basics of Calculus (at plus 2 level)	Syllabus Version	2023-24		

Course Objectives

To learn the solution of Algebraic and transcendental equations, Finite differences, interpolation techniques

Expected Course Outcomes

On the successful completion of the course, student will be able to:

Students will gain sufficient knowledge in using interpolation techniques for finding roots of polynomial equations and evaluating integrals of functions.

Unit:1

Solution of Algebraic and Transcendental Equations: Bisection method – Regula Falsi method – Iteration method - Newton Raphson method – Horner's Method Simultaneous equations: Direct methods; Gauss Elimination method – Gauss-Jordan method – Iterative methods: Gauss-Jacobi method - Gauss Siedal iterative method.

Unit:2

Finite differences: Forward and backward differences – Differences of a polynomial – Relation between the Operators E, D, δ, μ and backward difference operator, and their basic properties – Application to summation of series.

Unit:3

Interpolation with equal intervals: Newton's forward and backward differences formulae. Central differences: Gauss's forward and backward differences formulae – Stirling's, Bessel's and Laplace-Everett's formula – Simple problems only.

Interpolation with unequal intervals: Divided differences and their properties – Newton's divided difference formula – Lagrange's formula – simple problems only.

Unit:4

Inverse interpolation: Iteration or successive approximation method – Lagrange's method — simple problems. Numerical Integration: Trapezoidal rule – Simpson's 1/3 and 3/8 rules – Weddle's rule – Euler's summation formula.

Total Lecture Hours **60 Hours**

Books for Study

1	S.S.Sastry (1998): Introductory Methods of Numerical Analysis, Prentice Hall of India.
2	B. S. Grewal (1997): Numerical Methods in Engineering and Science, Khanna Publishers, India
3	M. K. Venkatraman (1999): Numerical Methods in Engineering and Science, 5/e, National Publishing company, India.

Reference Books

1	Scarborough B (2005): Numerical Mathematical Analysis, Oxford University Press.

THIRD YEAR – SEMESTER V

Course Code	STAT351	TESTING STATISTICAL HYPOTHESES	L	T	P	Credits
Core	MAJOR 8	Semester V	4	1	-	4
Pre-requisite		Theory of Estimation and Distribution Theory	Syllabus Version		2023-24	

Course Objectives: The main objectives of this course are:

1. To learn the concepts of hypotheses, Type I and Type II errors, and power of a test
2. To understand the working principle of Neyman-Pearson lemma and likelihood ratio test
3. To Formulate parametric testing problems and deriving appropriate test statistic
4. To impart knowledge on large, small sample tests based on single and two populations
5. To understand the philosophy of non-parametric test procedures.

Expected Course Outcomes: On the successful completion of the course, student will be able to:

1. Compute error probabilities, size and power of test and depict the power curve.
2. Apply Neyman-Pearson lemma to find most powerful critical region for various parametric models.
3. Use likelihood ratio test principle to derive test statistics for parametric testing problems.
4. Provide decision rules for testing hypothesis related to single and two populations.
5. Derive test statistic for non-parametric test.

Unit:1

Concept of hypothesis testing- Types of errors and power – computing error probabilities, and power – notion of most powerful tests – Statement and proof (sufficient part) of Neyman-Pearson fundamental Lemma for testing simple hypotheses on continuous distributions – Examples of Neyman-Pearson lemma to find most powerful critical region for various probability distributions.

Unit:2

Likelihood Ratio (LR) tests - Description and property of LR tests - Application to testing the mean and variance of normal distribution – testing the equality of means and variances of two independent normal distributions - small sample properties – asymptotic properties (statement only).

Unit:3

Test for single mean and variance for small and large samples – Test for specified proportion - Test for equality of means and variances of two independent populations (large and small samples) – Test for equality of proportions. Chi-square test for goodness of fit and test for independence of attributes.

Unit:4

Non-Parametric Tests - Sign test, Wilcoxon signed rank test, Median test, Mann-Whitney test, Run test, one sample Kolmogorov –Smirnov test, Chi-square test for goodness of fit (Description, properties and applications only).

Unit:5

Illustrative numerical problems on : Parametric tests – z test, t test, chi-square test - Non-Parametric Tests - Sign test, Wilcoxon signed rank test, one sample Kolmogorov –Smirnov test

Total Lecture Hours **60 Hours**

Books for Study:

1. Rohatgi,V.K. and Saleh, A.K.(2002): An Introduction to Probability and Statistics , 2/e, John Wiley.
2. Hogg, R.V., Mc Kean J W and Craig, A.T.(2005): Introduction to Mathematical Statistics, 6/e Pearson Edition.
3. Manoj Kumar Srivastava and Namita Srivastava (2009): Statistical Inference – Testing of Hypotheses, Prentice Hall of India.

Reference Books:

1. Bansilal, Sanjay Arora and Sudha Arora (2006): Introducing Probability and Statistics, 2/e, Satya Prakashan Publications, New Delhi.
2. Gupta, S.C. and V.K. Kapoor (2000): Fundamentals of Mathematical Statistics, Sultan Chand and Co.
3. Mood,A.M., Graybill, A.M. and Boes, D.C.(1974): Introduction to Theory of Statistics , Mc Graw Hill.

Course Code	STAT352	DEMOGRAPHY	L	T	P	Credits
Core	MAJOR 9	Semester IV	4	1	-	4
Pre-requisite			Syllabus Version		2023-24	

Course Objectives:

The main objectives of this course are to provide basics of demography and official statistics

Expected Course Outcomes:

On the successful completion of the course, student will be able to construct life tables and measures of population dynamics**.**

Unit:1

History of Demography, Sources, significance and errors of demographic Data, Concepts and Definitions of terms; Population census of India and Dependency Ratio; Migration; Measures of Age and Sex Composition of the Population. Rates and Ratios, Crude and Specific Rates, Standardization – Direct and Indirect Methods.

Unit:2

Introduction, Concepts, Types of Analysis: Period and Cohort Measures - Crude and Specific Rates, Standardized Rates, different Fertility Rates, Gross Reproduction Rates, Net Reproduction Rate, Replacement Index.

Unit:3

Models for population growth and their fitting to population data. – Linear, exponential, logarithmic, modified Logarithmic, logistic and gompertz.

Unit:4

Introduction, Sources and Quality of Nuptiality Data, General, Specific, Total and Standardized Marriage rates, Mean Age at Marriage, Measures of Migration: Concept of mobility and migration, sources of data, types of migration, Internal & international migrations; measures of internal migration.

Total Lecture Hours **60 Hours**

Books for Study:

1. K. Srinivasan (2011)**:** Training Manual on Demographic Techniques, United Nations Population Fund, Institute for Social and Economic Change, Bangalore.
2. Srinivasan, K. (1997): Basic demographic techniques and applications, New Delhi: SAGE.
3. Pathak, K.B. and F.Ram, (1998): Techniques of Demographic Analysis, Himalaya Publishing House, Mumbai.

Reference Books:

1. Bhende, Asha and Tara Kanitkar (1992), Principles of Population Studies – 5th Nov. ed. New Delhi, Himalaya.
2. Shryock, Henry S. Jacob S. Siegel and Associate (1980): The Methods and Materials of Demography Vol.1 & 2, U.S. Bureau of the Census, Washington D.C.
3. Preston, Samuel H, Patrick Heuveline and Michel Guillot (2000): Demography –Measuring and Modeling Population Processes.

Course Code	STAT353	STATISTICS USING R	L	T	P	Credits
Core	MAJOR 10	Semester V	4	1	-	4
Pre-requisite			Syllabus Version		2023-24	

Course Objectives:

The main objectives of this course are:

1. To Impart training in R programming, create different types of R objects and perform operations
2. To detail the construction of plots, various discrete and continuous probability distributions
5. To impart skills in analyzing univariate and bivariate data.

Expected Course Outcomes:

On the successful completion of the course, student will be able:

1. To Impart training in R programming.
2. To create different types of R objects and perform operations, construction of plots.
3. To work on various discrete and continuous probability distributions.

Unit:1

R language Essentials: Expressions and objects - creating vectors - vectorized arithmetic -creating matrices - operations on matrices – lists - data frames – creation, indexing, sorting and conditional selection – importing and exporting data files.

Unit:2

Data Visualization and Descriptive Statistics: generating tables - Bar plots - Pie chart - Box plot – Histogram – Scatter plot – line plots (single, multiple) – partitioning graphics window – adding title, labels and legends to plots - obtaining measures of central tendency, measures of location and moment based measures.

Unit:3

Probability and Distributions: sampling with and without replacement and computing combinatory - obtaining density, cumulative density and quantile values for discrete and continuous distributions - generating samples from discrete and continuous distributions - Plotting density and cumulative density curves - Q-Q plot.

Unit:4

Analyzing univariate and bivariate data: Correlation analysis - Pearson, Spearman and Kendall measures; Testing hypothesis: one and two sample tests for mean and variance, , test of significance for correlation coefficient; Regression analysis – fitting, obtaining residuals and fitted values of simple linear regression model;. Chi Square test for goodness of fit and Independence of attributes.

Total Lecture Hours **60 Hours**

Books for Study:

1. Pierre-Andre Cornillon et al. (2012): R for Statistics, CRC Press.
2. Randall E. Schumacker (2014): Learning Statistics using R, SAGE Publications, Inc.
3. Purohit, Sudha G., Gore, Sharad D. and Deshmukh, Shailaja R. (2008): Statistics using R, Alpha Science International Limited.

Reference Books:

1. Jared P Lander (2014): R for Everyone: Advanced Analytics and Graphics, Pearson Education Inc.
2. Michael J.Crawley (2007): The R Book, John Wiley and Sons Ltd.
3. Peter Dalgaard (2008): Introductory Statistics with R, 2nd edition, Springer.

Course Code	STAT 354	OPERATIONS RESEARCH	L	T	P	Credits
Core	MINOR 5	Semester V	4	1	-	4

Pre-requisite	Knowledge in Mathematics (higher secondary level)	Syllabus Version	2023-24

Course Objectives

To learn about decision theory and optimization techniques. To learn about game theory and network analysis

Expected Course Outcomes

On the successful completion of the course, student will be able to:

Students will gain knowledge to allocate resources in an optimal manner and also plan the time-line of projects

Unit:1

Introduction to Operations Research – Various Models in O.R. – Scope and limitations of O.R.– Phases of Operations Research study - Linear Programming Problem (LPP) –Formulation. Graphical solution of LPP – Simplex method – Big M-method and Two Phase method - Concepts of Duality – Conversion of Primal to Dual – Problems

Unit:2

Transportation Problem- Initial Basic Solution- North West Corner Rule, Least Cost Method and Vogel's Approximation Method – Optimal Solution by Modified Distribution Method (MODI) - Assignment problem - Simple Problems

Unit:3

Game Theory – Pure and Mixed strategies, saddle point - Dominance rule - Optimal Solution of two person zero sum games – Graphical solution of (2 x n) and (m x 2) games

Unit:4

Network analysis by CPM / PERT: Basic concepts: Construction of network - concepts of slack and float in network analysis - Determination of the floats and critical path.

Total Lecture Hours	**60 Hours**

Books for Study

1	Kanti Swarup, P.K. Gupta and Manmohan (2010): Operation Research, Sultan Chand and Sons.
2	S.D. Sharma (2003): Operations Research, Kedarnath Ramnath and Co.
3	Taha H.A. (2008): Operational Research: An Introduction,8/e, Pearson.

Reference Books

1	Hillier F.S. and Libermann G.J. (2004): Introduction to Operations Research, 7thEdition, McGraw Hill

Course Code	**STAT 355**	**INTERNSHIP**	**L**	**T**	**P**	**Credits**
Core	**MAJOR 11**	**Semester V**		**2**	**3**	**4**

Syllabus Version: 2023-24

Course Objectives

A course requiring students to participate in professional employment related activity or work experience, or cooperative education activity with an entity external to the education institution, normally under the supervision of an employee of the given external entity.

Expected Course Outcomes

On the successful completion of the course, student will be able to:

Students will gain skilled knowledge to allocate resources in an optimal manner and also plan the time-line of projects

THIRD YEAR – SEMESTER VI

Course Code	STAT 361	PRINCIPLES OF EXPERIMENTAL DESIGN	L	T	P	Credits
Core	MAJOR 12	Semester VI	4	1	-	4
Pre-requisite		Knowledge in Distribution Theory and Statistical Inference	Syllabus Version		2023-24	

Course Objectives

The main objectives of this course are to:

1. To learn the basic principles of design of statistical experiments and models.
2. To learn about basic designs CRD, RBD, LSD and factorial design with suitable real-life examples.

Expected Course Outcomes

On the successful completion of the course, student will be able

1 To carry out one way and two-way Analysis of Variance (ANOVA)

2 To understand the basic terms used in design of experiments

3 To use appropriate experimental designs to analyze the experimental data

4 To apply Multiple range tests, the LSD test or the multiple t–test, Student-Newman-Keuls test, Duncan's multiple range test, Tukey's test, Multiple F tests, Fisher's least significant difference test

5 To analyze 2^2 and 2^3 factorial experiments and give statistical interpretation of the experimental results

Unit:1

Analysis of variance: Definition, assumption for ANOVA test, one-way and two-way classifications for fixed effect model with one observation per cell. Introduction to design of experiments: terminology, experiment, treatment, experimental units, blocks, experimental error, replication, precision and accuracy, need for design of experiment, size and shape of plots and blocks.

Unit:2

Fundamental principles of design of experiments: Randomization, Replication and Local control, Completely randomized design (CRD), Randomized Complete Block Design (RCBD), Latin square design (LSD) and their layout and analyses.

Unit:3

Missing plot technique for RCBD and LSD, missing plot techniques for one observation per cell in RCBD. Multiple Comparison tests: Least Significant Difference (LSD), Tukey's test, Duncan's Multiple Range test (DMRT), Student Newman Keul Test (SNK)

Unit:4

Factorial Experiments: 2^2, 2^3 designs -Estimation of main effects and interactions and their standard errors – Analysis of 2^2, 2^3 designs

Unit:5

Illustrative numerical problems on Completely Randomized Design - Randomized Block Design - Latin Square Design - 2^2 Factorial Design - 2^3 Factorial Design

Total Lecture Hours | **60 Hours**

Books for Study

1. Das, M.N. and Giri.N.C. (1986): Design and Analysis of Experiments, Wiley eastern.
2. Montgomery, C.D (2017): Design of Experiments, 9/e, John Wiley and Sons.
3. Cochran .W.G. and Cox .G.M. (1995): Experimental designs, 4/e, Wiley.

Reference Books

1. Goon.A.M, Gupta and Dasgupta.B.(2001): An Outline of statistical Theory, Vol. II, 6/e World Press Calcutta.
2. Gupta .S.C. and Kapoor.V.K.(2000): Fundamentals of Applied Statistics, Sultan Chand.
3. ParimalMukhopadhyay(2005):Applied Statistics, 2/e, Books and Allied (P) Ltd, Kolkata.

Course Code	STAT362	ACTUARIAL STATISTICS	L	T	P	Credits
Core	MAJOR 13	Semester VI	4	1	-	4
Pre-requisite			Syllabus Version		2023-24	

Course Objectives:

1. modelling of individual and aggregate losses.
2. fitting of distributions to claims data, deductibles and retention limits, proportional and excess-of-loss reinsurance.
3. finding distribution of aggregate claims, compound distributions and their applications

Expected Course Outcomes: On the successful completion of the course, student will be able to:

1. handling problems on joint life and last survivor status and multiple decrement model
2. calculation of various payments from life tables using principle of equivalence, net premiums, prospective and retrospective provisions/reserves
3. real illustrations for the concepts mentioned above through laboratory assignments.

Unit:1

Probability Models and Life Tables, Loss distributions: modelling of individual and aggregate losses, moments, fitting distributions to claims data, deductibles and retention limits, proportional and excess-of-loss reinsurance. Risk models models for individual claims and their sums, Distribution of aggregate claims, Compound distributions and applications, Introduction to credibility theory

Unit:2

Survival function, curtate future lifetime, force of mortality. Multiple life functions, joint life and last survivor status. Multiple decrement model. Life Contingencies: Principles of compound interest: Nominal and effective rates of interest and discount, force of interest and discount, compound interest, accumulation factor.

Unit:3

Assurance and annuity contracts: definitions of benefits and premiums, various types of assurances and annuities, present value, formulae for mean and variance of various continuous and discrete payments.

Unit:4

Calculation of various payments from life tables: principle of equivalence, net premiums, prospective and retrospective provisions/reserves

Total Lecture Hours | **60 Hours**

Books for Study

1. Boland, P. (2007). Statistical and Probabilistic Methods in Actuarial Science. Chapman and Hall/CRC.
2. Borowaik, D.S. and Shapiro, A. F. (2013). Financial and Actuarial Statistics: An Introduction. 2nd Edition. Marcel Dekker Inc., New York-Basel.
3. Bowers, N. L., Gerber H. U., Hickman, J. C., Jones, D. A. and Nesbitt, C. J. (1997). Actuarial Mathematics, 2nd Edition, Society of Actuaries, USA.

Reference Books

1. Deshmukh, S.R. (2005). Actuarial Statistics: In Introduction Using R. Narosa Publishing House, New Delhi
2. Promislow, S. D. (2014). Fundamentals of Actuarial Mathematics. 3rd Edition. Wiley

Course Code	STAT363	INTRODUCTORY STATISTICS USING PYTHON	L	T	P	Credits
Core	MAJOR 14	Semester VI	4	1	-	4
Pre-requisite			Syllabus Version		2023-24	

Course Objectives

The main objectives of this course are to:

1. To learn about basics of python.
2. To learn visualizing the data.
3. To know about the data handling and performing inferential tests

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1	Understand how to install, perform basic operations	
2	To visualize data using various codes and filters	
3	Inferential aspects of testing means and variances	
4	Model fit and residual analysis	
5	Carry out analyses of multivariate techniques using various datasets	

Unit:1 Introduction to Python

Introduction to Python – Installation – Basic Object types and Operators: Arithmetic, relational, logical, membership, identity – Control Structure: Selection and iteration – Lists – Tuple – sets – Dictionary – creation, deletion, updation – file I/O operations

Unit:2 Data Handling Tools

Data Analysis Packages: NumPy- creating NumPy array- indexing – slicing- arithmetic operations – Pandas: Creating series and Data frame – reading and writing from csv, text, excel files – summary statistics – merging, join and grouping – pivot tables

Unit:3 Data Visualization Tools

matplotlib: line plots - multiple lines on same axis and different axis, scatter plots, histograms, customize 37abelling – bar charts: simple, stacked and multiple -Pie charts. Perspectives in Data: creating a dummy variables, normalizing and scaling data

Unit:4 Inferential Procedures and Model Fitting

Hypothesis Testing procedures: t, F and Chi-square – construction of confidence intervals – simple linear fitting and residual analysis – prediction intervals

Total Lecture Hours **60 Hours**

Books for Study

1	Manohar Swamynathan (2017), Mastering Machine Learning with Python in Six Steps, Apress
2	Tom M. Mitchell (2017), Machine Learning, Tata McGraw Hill

Reference Books

1	William McKinney (2017), Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Ipython, O'Rilley

Course Code	STAT 364	STATISTICAL QUALITY CONTROL	L	T	P	Credits
Core	MAJOR 15	Semester VI	4	1	-	4
Pre-requisite		Knowledge in Elements of Probability Theory and Probability Distributions	**Syllabus Version**			2023-24

Course Objectives

The main objectives of this course are to:

1. To Impart knowledge on the concepts of quality improvement and process control techniques
2. To make learners understand the working principle of control charts for variables and attributes
3. To detail the construction of control charts
4. To impart skills in drawing and analyzing control charts
5. To understand the operating procedure and analysis of acceptance sampling plans

Expected Course Outcomes

On the successful completion of the course, student will be able to apply quality control tools and techniques to observe the change in the process and product control.

Unit:1

Concept of quality of a product and quality improvement – Dimensions of quality – Statistical methods for quality control and improvement – acceptance sampling, process control and designed experiments – link between quality and productivity – Modelling variation – Stem and leaf plot, histogram and box plot

Unit:2

Statistical process control – chance and assignable causes of variations – seven magnificent tools of statistical process control – general theory of control charts – statistical basis of control charts – basic principles and choice of control limits – 3-Sigma control limits, warning limits and specification limits – OC function of control chart and average run length – sensitizing rules for control charts.

Unit:3

Control chart for variables – $\bar{X}$, R and S – chart – their construction and analysis – Control charts for attributes – p, np, c and u charts – their construction and analysis

Unit:4

Lot by lot acceptance sampling for attributes – acceptance-sampling problem – advantages and limitations – types of acceptance sampling plans – Single sampling plan, Double sampling plans – derivation and construction of OC – rectifying inspection plan – construction of AOQ, AOQL, ATI and ASN functions – notion of sequential sampling plan, Solve problems using Excel.

Unit:5

Illustrative numerical problems on : $\bar{X}$, R, p, c charts - Single sampling plan, Double sampling plans – OC function, AOQ, ATI and ASN

Total Lecture Hours | **60 Hours**

Books for Study

1. Montgomery, C. Douglas (2019): Introduction to Statistical Quality Control, 8/e, John Wiley and Sons.
2. S.C.Gupta and V.K.Kapoor (2014), Fundamentals of Applied Statistics, Sultan Chand and Sons.

Reference Books

1. Duncan, A.J. (1986). Quality Control and Industrial Statistics, 5th Edition, Irwin
2. Grant.E.L. and Leavenworth.R.S. (2017), Statistical Quality Control, 7/e, McGraw Hill.

Course Code	STAT365	BASIC ECONOMETRICS	L	T	P	Credits
Core	MINOR 6	Semester VI	4	1	-	4
Pre-requisite			Syllabus Version		2023-24	

Course Objectives

To learn the concepts in Econometrics

Expected Course Outcomes

On the successful completion of the course, student will be able to deal with various consequences and issues that arise in econometric models.

Unit:1

Nature and Scope of Econometrics - Review of General Linear Model (GLM), Ordinary Least Squares (OLS), Generalized Least Squares (GLS) and Multicollinearity – Sources, consequences and detection

Unit:2

Heteroscedasticity - consequences and detection: Graphical methods – Tests: Park test – Glejser's test – Spearman's rank Correlation test – Goldfeld-Quandt test – Breusch-Godfrey-Godfrey test and White's General Heteroscedasticity test – remedial measures for Heteroscedasticity – Weighted Least Squares approach

Unit:3

Autocorrelation – consequences and tests: Run's test –Durbin-Watson test - - Autoregressive linear regression - Distributed lag models – Finite and Infinite Distributed lag models – Koyck's approach, Almons' Model, Cagan's approach, Arithmetic Lag, Geometric Lag model

Unit:4

Simultaneous linear equations model - Identification problem - Restrictions on structural parameters - rank and order conditions - Restrictions on variances and covariances - Estimation in simultaneous equations model

Total Lecture Hours **60 Hours**

Books for Study

1. Gujarati, D.N. , Dawn C Porter and Manoranjan Paul (2019): Basic Econometrics, 6/e, McGraw Hill.
2. Johnston, J. (1996): Econometric methods, Third edition, McGraw Hill.

Reference Books

1. Apte, P.G. (1990): Text book of Econometrics. Tata McGraw Hill.
2. Intrulligator, M.D. (1980): Econometric models - Techniques and Applications, Prentice Hall of India.
3. Kleiber, C. and Zeileis, A. (2008): Applied Econometrics with R, Springer, NY.

FOURTH YEAR – SEMESTER VII

Course Code	STAT471	ADVANCED PROBABILITY THEORY	L	T	P	Credits
Core	MAJOR 16	Semester VII	4	1	-	4
Pre-requisite		Basic Probability Theory	Syllabus Version		2023-24	

Course Objectives

The objective for this course is to learn the theory and methods of probability theory, and be able to apply and communicate them in practice.

Expected Course Outcomes

A student will be able to: Recognize the role of probability theory in the sciences, communicate the ideas and results of probability; Graduate students will also be able to formulate and apply the definitions of convergence in distribution and in probability, formulate scientific problems involving randomness in mathematical terms, and use probability in their careers.

Unit:1

Algebra of sets - fields and sigma-fields, Inverse function – Measurable function – Probability measure on a sigma field – simple properties - Probability space - Random variables and Random vectors – Induced Probability space – Distribution functions – Decomposition of distribution functions.

Unit:2

Expectation and moments – definitions and simple properties – Moment inequalities – Holder, Jenson, Chebyshev, Markov Inequalities– Characteristic function – definition and properties – Inversion formula.

Unit:3

Convergence of a sequence of random variables - convergence in distribution, convergence in probability, almost sure convergence and convergence in quadratic mean - Weak convergence of distribution functions – Slustky theorem - Helly-Bray theorem. Definition of product space – Fubini's theorem (statement only) - Independence of two events – Independence of classes – Independence of random variables – properties – Borel zero –one law.

Unit:4

Law of large numbers - Khintchin's weak law of large numbers, Kolmogorov strong law of large numbers (statement only) – Central Limit Theorem – Lindeberg – Levy theorem, Linderberg – Feller theorem (without proof), Liapounov theorem (without proof) – Relation between Liapounov and Linderberg – Feller forms – Radon Nikodym theorem and derivative (without proof) – Conditional expectation – definition and simple properties.

Total Lecture Hours | **60 Hours**

Books for Study

1. Bhat, B. R. (2007): Modern Probability Theory, 3rd edition, New Age International Pvt. Ltd.
2. Ash, R.B. (1972): Real Analysis and Probability, Academic Press.
3. Rohatgi, V.K. and Saleh (2002): An Introduction to Probability Theory and Mathematical Statistics, John Wiley
4. Athreya K B and Lahiri S N (2005):Measure Theory, Hindustan Book Agency.

Reference Books

1. Basu A K. and A Bandopadhyay (2012): Measure Theory and Probability, PHI Learning Pvt. Ltd.
2. Tucker, H.G. (1967): A Graduate course in Probability, Academic Press
3. Chow, Y.S. and Teicher, H. (1979): Probability Theory, Springer
4. Billingsley P (1995): Probability and Measure, Wiley.

Course Code	STAT472	ADVANCED DISTRIBUTION THEORY	L	T	P	Credits
Core	MAJOR 17	Semester VII	4	1	-	4
Pre-requisite		Knowledge in Probability Theory	Syllabus Version		2023-24	

Course Objectives

The main objectives of this course are to:

1. To learn the theory and applications of some important univariate and bivariate distributions
2. To learn advanced distribution theory concepts like Compound, Truncated, Mixture, Non-central sampling distributions, about Quadratic forms and its distribution and Order Statistics

Expected Course Outcomes:

1 Knowledge to understand the concepts and importance of univariate and bivariate distributions

2 Knowledge of Compound, Truncated, Mixture distributions and their applications

3 To know Multivariate Normal distribution and no-central sampling distributions

4 The ability to learn about distribution of quadratic forms and its applications

5 To learn the concept of order statistics, its distribution and properties

Unit:1

Distribution of functions of random variables - Cauchy, Inverse Gaussian, Lognormal, Logarithmic series and Power series distributions - Multinomial distribution

Unit:2

Bivariate Binomial – Bivariate Poisson – Bivariate Normal- Bivariate Exponential of Marshall and Olkin; Compound, Truncated distributions - Binomial, Poisson, Normal and Exponential

Unit:3

Multivariate normal distribution (Definition and Concept only) - Sampling distributions: Non-central chi-square, t and F distributions and their properties - Distributions of quadratic forms under normality-independence of quadratic form and a linear form - Cochran's theorem

Unit:4

Order statistics, their distributions and properties- Joint and marginal distributions of order statistics - Distribution of range and mid range – Simple problems

Total Lecture Hours | **60 Hours**

Books for Study

1	Johnson, N.L,Kotz, S. and Balakrishnan, N. (1994): Continuous Univariate Distributions, Vol.1 &2, Wiley Series in Probabilty and Statistics.
2	Johnson, N.L , Kemp A.W. &Kotz, S. (1994): Univariate Discrete Distributions, Wiley Series in Probabilty and Statistics
3	Rohatgi, V.K. and Saleh, A.E. (2008). An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
4	David H. A. and Nagaraja H.N.(2003): Order Statistics, 3/e, John Wiley & Sons.
5	Kocherlakota S and Kocherlakota K(1992): Bivariate Discrete distributions, M. Dekker.

Reference Books

1	Goon, A.M., Gupta, M.K. and Das Gupta,B. (2013): Fundamentals of Statistics, Vol. II, WorldPress, Calcutta.
2	Parimal Mukhopadhyay(2006):Mathematical Statistics, 3/e, Books and Allied (P) Ltd, Kolkata.
3	Balakrishnan N and Lai C.D.(2009): Continuous Bivariate Distributions, Springer.

Course Code	STAT473	STATISTICAL INFERENCE-I	L	T	P	Credits
Core	MAJOR 18	Semester VII	4	1	-	4
Pre-requisite			Syllabus Version		2023-24	

Course Objectives

To provide a systematic account of Neyman Pearson theory of testing and closely related theory of point estimation and confidence sets, together with their applications

Expected Course Outcomes

On the successful completion of the course, student will be able to learn estimation and testing techniques

Unit:1

Estimation: Concept of unbiasedness, sufficiency, consistency, efficiency, completeness – Exponential and Pitman family of distributions - Minimum and uniformly minimum variance unbiased estimator - Fisher information measure - Cramer- Rao inequality - Chapman-Robin inequality - Bhattacharya bounds (univariate and multivariate case)

Unit:2

Rao-Blackwell and Lehmann-Scheffe theorems - Ancillary statistic - Basu's theorem and its applications - Methods of estimation: method of moments, maximum likelihood estimation, minimum chi-square method, method of scoring.

Unit:3

Consistent Asymptotic Normal (CAN) estimators and their properties – Delta method - Invariant estimation - Location and scale invariant estimators - Pitman's method for obtaining location and scale invariant estimators.

Unit:4

Interval estimation: Construction of confidence intervals using pivots - Shortest expected length confidence interval – Large sample confidence intervals - Concept of Bayes estimation and Minimax estimator – Loss and risk functions – Simple problems.

Total Lecture Hours | **60 Hours**

Books for Study

1	Rajagopalan M and Dhanavanthan P (2012): Statistical Inference, PHI
2	Casella G and Berger R L (2007): Statistical Inference, 2/e, Duxbury Press, Belmont. USA
3	Kale B.K. and Muralidharan (2005), A first Course on Parametric Inference, Narosa Publishing House.

Reference Books

1	Lehmann, E.L. (1986) : Theory of Point Estimation (Student Edition). John Wiley & Sons.
2	Zacks, S.(1971) : Theory of Statistical Inference, John Wiley and Sons. New York
3	Goon, A.M., Gupta, M.K. & Dasgupta, B (2016): An Outline of Statistical Theory, Vol-II.
4	Srivastava MK, Khan AH and Srivastava N (2014): Statistical Inference: Theory of Estimation. PHI

Course Code	STAT474	ADVANCED SAMPLING THEORY	L	T	P	Credits
Core	MINOR 7	Semester VII	4	1	-	4
Pre-requisite		Knowledge of Introduction to sampling theory	Syllabus Version		2023-24	

Course Objectives

The objectives of this course are to teach basic ideas of sampling from an applied perspective and to provide uses in real life problems. To introduce the methods of drawing samples using random sampling and probability proportional to size sampling. To introduce methods of sampling for small and large scale surveys. To introduce randomize techniques for response and non-response sample survey. Estimation of population parameters.

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1	Needs of basic and advance concepts and importance of sampling methods	
2	Apply the existing ideas of sampling methods to draw samples or sample surveys	
3	To understand unbiased / biased properties of estimators and unbiased estimate of sampling variance	
4	Applying these methods for real life problems and Analyze the estimator behaviours to real data sets	

Unit:1

Review of Preliminary Sampling Techniques, Cluster Sampling (equal / unequal) – Estimators of mean and variance – Multistage Sampling Technique: Two stage (equal / unequal) – variance of the estimated mean – Double Sampling for stratification and Ratio estimator.

Unit:2

Probability Proportional to Size (PPS) sampling- Procedure for selecting PPS sample (WR and WOR) - Inclusion Probabilities – PPSWOR- Des-Raj's ordered estimator and Horvitz-Thompson, Yates –Grundy Form and Murthy's unordered estimators.

Unit:3

Ratio estimators and their properties in Simple Random Sampling – Ratio estimators in Stratified Random sampling – Regression Estimators, Regression estimators in Stratified Random Sampling – Multivariate Ratio estimators and Multivariate Regression Estimators

Unit:4

Randomized response methods – Warner's, Simmon's and Two Stage response methods – Sources of errors in Surveys –Mathematical model for the effects of call-backs and the errors of measurement – Non-sampling errors – Sources, types and their components

Total Lecture Hours | **60 Hours**

Books for Study

1	Cochran, W.G. (1977): Sampling Techniques, 3/e, Wiley Eastern Ltd,
2	Singh, D. and Choudhary, F.S (1986): Theory and Analysis of Sample Survey Designs, Wiley Eastern Ltd,
3	Sukhatme PV., Sukhatme BV., Sukhatme S. and Asok C. (1984): Sampling Theory of Surveys with Applications, Iowa State University Press and ISARI Publications, New Delhi

Reference Books

1	Desraj and Chandhok P.(1998): Sampling Theory, Narosa Publications, New Delhi
2	Steven K Thompson (2012): Sampling, 3/e, Wiley
3	Murthy, M.N (1979): Sampling Theory and Methods, Statistical Publishing Society, Calcutta
4	Sarjinder Singh (2004): Advanced Sampling – Theory with Applications, Kluwer Publications

Course Code	STAT475	REGRESSION ANALYSIS	L	T	P	Credits
Core	MINOR 8	Semester VII	4	1	-	4
Pre-requisite		Statistical Inference	Syllabus Version		2023-24	

Course Objectives

1. To describe multiple linear regression model and estimation of the parameters involved.
2. To imbibe theoretical skills in deriving results
3. To understand model diagnostics and validation techniques
4. To disseminate the diagnostic and remedial measures of collinearity
5. To provide a conceptual understanding of non-linear and robust regression

Expected Course Outcomes : On the successful completion of the course, student will be able to:

1	Derive estimators of the model parameters and perform hypothesis testing	
2	Compute prediction and confidence intervals.	
3	Learn about residual diagnostics and identify influential observations	
4	Explain the cause, consequences and remedial measures of collinearity	
5	Conceptualize non-linear, robust and non-parametric regression.	

Unit:1

Multiple linear model - assumptions – least square estimators of the parameters and their properties – Gauss-Markov theorem – Model in centered form – Likelihood estimation of the regression under normality assumption and their properties – measures of model fit – Generalized least squares – misspecification of the error structure – model over- and under- fitting – its consequences.

Unit:2

Test for overall regression and for a subset of the slope parameters – test in terms of R2 – General Linear Hypothesis testing – special cases – confidence interval for the parameters – prediction intervals – hat matrix and its properties – study of residuals, outliers and influential observations

Unit:3

Model building and variable selection – Criteria for evaluating subset regression model – Variable selection algorithms – Stepwise regression, Forward selection and backward elimination – Collinearity diagnostics – Causes, Consequences and Remedy.

Unit:4

Introduction to general non-linear regression – Least squares in non-linear case – Estimating the parameters using Linearization - Non-linear growth models – Concept of non-parametric regression – nearest neighbour method - Robust regression – Least absolute deviation regression – M estimator and its properties.

Total Lecture Hours | **60 Hours**

Books for Study

1	Alvin C. Rencher (2000): Linear Models in Statistics, John Wiley & Sons, New York (Chapters 7,8 & 9 for Unit I & II)
2	Draper, N and Smith, H (1998): Applied Regression Analysis, 3rd Edition, Wiley-Interscience.
3	Montgomery, D. C., Peck, E. A. and Vining, G. G. (2013): Introduction to Linear Regression Analysis, 5thEditio,.Wiley

Reference Books

1	Chaterjee, S, Ali S. Hadi (2013): Regression Analysis by Example, 5thEdition, John Wiley and Sons.
2	Searle, S.R. (1997): Linear Models, John Wiley
3	Thomas P.Ryan(2006): Modern Regression Methods, John Wiley and Sons.
4	Seber G.A.F and Wild C.J. (2003): Nonlinear Regression, John Wiley and Sons

FOURTH YEAR – SEMESTER VIII

Course Code	STAT481	STATISTICAL INFERENCE II	L	T	P	Credits
Core	MAJOR 19	Semester VIII	4	1	-	4
Pre-requisite			Syllabus Version	2023-24		

Course Objectives

1. To learn Neyman – Pearson principle and derive most and uniformly most powerful tests
2. To obtain test procedures for distributions under exponential class of family
3. To formulate tests in the presence of nuisance parameters
4. To impart knowledge on invariant and likelihood ratio test methods
5. To understand the philosophy of non-parametric test procedures

Expected Course Outcomes: On the successful completion of the course, student will be able to

1	Derive critical regions for tests involving simple and composite hypotheses using Neyman-Pearson lemma
2	Obtain test statistics under unbiased and similar tests
3	Use likelihood ratio test principle to derive test statistics for parametric testing problems
4	Derive maximal invariant test functions
5	Conceptualize the working principles of various non-parametric tests

Unit:1

Test function - Randomized and non-randomized tests - Most powerful test - Neyman – Pearson fundamental lemma – examples - Uniformly most powerful test - Uniformly most powerful test for distributions with monotone likelihood ratio, Generalization of fundamental lemma (statement only) and its applications

Unit:2

Unbiasedness in hypothesis testing - Uniformly most powerful unbiased tests - Unbiased tests for one parameter exponential family – examples - Similar test and complete sufficient statistic - Similar tests with Neyman structure - Locally most powerful tests

Unit:3

Maximal statistic and Invariant tests - Uniformly most powerful invariant tests - Likelihood ratio (LR) test - properties - asymptotic distribution of LR statistic - Applications of the LR tests.

Unit:4

Non-parametric tests - Kolmogorov Smirnov one and two sample tests - Wald-Wolfowitz run test, Mann-Whitney U test - Kruskal Wallis test - Friedman's test - Sequential tests - structure of sequential tests – Sequential Probability Ratio Test - determination of the boundary constants – examples.

Total Lecture Hours: 60 Hours

Books for Study

1	Rajagopalan M and Dhanavanthan P (2012): Statistical Inference, PHI Learning, New Delhi.
2	Lehmann, E.L and Joseph P. Romano (2005): Testing Statistical Hypotheses, 3rd Edition, Springer
3	Manoj Kumar Srivastava and Namita Srivastava (2009): Statistical Inference – Testing of Hypotheses, Prentice Hall of India
4	Gibbons, J.D. (1985): Non Parametric Statistical Inference, 2nd Edition , Marckel Decker

Reference Books

1	Casella, G & Berger, R.L (2007): Statistical Inference, Duxubury Press, Belmont. USA
2	Ghosh, B.K (1970): Sequential Tests of Statistical Hypotheses, Addison Wesley
3	Parimal Mukhopadhyay (2006): Mathematical Statistics, 3rd Edition, Books & Allied (P) Ltd, Kolkata

Course Code	STAT482	MULTIVARIATE STATISTICAL ANALYSIS	L	T	P	Credits
Core	MAJOR 20	Semester VIII	4	1	-	4
Pre-requisite			Syllabus Version		2023-24	

Course Objectives

The main objectives of this course are to:

1. To learn about multivariate normal distribution and its characterizations.
2. To study the multivariate tests for mean vectors and covariance matrices.
3. To know the concepts and applications of multivariate statistical methods like Discriminant Analysis, Principal Component Analysis, Canonical Correlation Analysis & Factor Analysis

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1	Understand the concepts and applications and multivariate normal distribution	
2	Inferential aspects of testing mean vectors and covariances matrices	
3	Perform modelling to classify the data into k populations	
4	Perform dimensionality reduction of data into meaningful components	
5	Carry out analyses of multivariate techniques using various datasets	

Unit:1 Multivariate Data and Multivariate Normal Distribution

Multivariate normal distribution– Marginal and conditional distributions – characteristic function. Maximum likelihood estimation (MLE) of the parameters of Multivariate Normal and their sampling distributions – Inference concerning the mean vector when covariance matrix is known

Unit:2 Testing of Mean Vectors and Covariance Matrices

Hotelling T^2 statistic - derivation and its distribution – Uses of T^2 statistic –Mahalanobis D^2 statistic and its distribution - Relation between T^2 and D^2- Generalized variance – Wishart distribution (statement only) – Properties of Wishart distribution – Test for single covariance matrix – Test for equality of covariance matrices – One way Multivariate Analysis of Variance (MANOVA)

Unit:3 Classification Models

Classification problems – Classification into one of two populations (known and unknown dispersion matrix) – Classification into one of several populations – Fisher's Linear discriminant function

Unit:4 Dimensionality Reduction Techniques

Principal components – Properties - Extraction of Principal components and their variances Canonical correlation – Estimation of canonical correlation and variates - Factor analysis – Mathematical model - Estimation of Factor Loadings – Concept of factor rotation – Varimax criterion

Total Lecture Hours 60 Hours

Books for Study

1	Anderson, T.W. (2009): An Introduction to Multivariate Statistical Analysis, 3/e, Wiley.
2	Johnson, R. A and. Wichern D.W (2015): Applied Multivariate Statistical Analysis, 6/e, Pearson Education India.
3	Alvin C. Rencher (2012): Methods of Multivariate Analysis, 3/e, Wiley.

Reference Books

1	Narayan C. Giri (2003): Multivariate Statistical Analysis: Revised and Expanded, 2/e, CRC Press
2	K.C. Bhuyan (2008): Multivariate Analysis and Its Applications, New Central Book Agency

Course Code	STAT483	DESIGN OF EXPERIMENTS	L	T	P	Credits
Core	MAJOR 21	Semester VIII	4	1	-	4
Pre-requisite		Knowledge in Distribution Theory & Statistical Inference	Syllabus Version			2023-24

Course Objectives

The main objectives of this course are to:

1. Understand the need of experimental design, understand the link between linear models and design of experiments.
2. Understand the basic designs, factorial designs, incomplete block designs and their analysis

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1	To know the General Linear Hypothesis model, design matrix, C matrix and its properties
2	To estimate the missing values in RBD, LSD and carry out the analysis
3	To learn the analysis of confounded 2n and 3nfactorial experiments and fractional factorial experiments
4	To know the analysis of incomplete block designs : BIBD, PBIBD(2), Split plot and Strip plot designs
5	To understand and use appropriate experimental designs to analyze the experimental data.

Unit:1

Notion of design matrix - General analysis of design models (Intra Block analysis)- C Matrix and its properties - Expected Mean Squares (EMS) and its uses - Algorithm for calculating EMS - Two-way elimination of heterogeneity - Block Designs: Connectedness, balancing, Orthogonality, Efficiency, Resolvable designs

Unit:2

Basic Designs: Overview of Completely Randomized Design (CRD), Randomized Block Design (RBD) with more than one observation per cell and Latin Square Design (LSD) – Derivation of one and two missing values, Iterative and non-iterative methods – Loss of Efficiency due to missing values - Factorial experiments: 2n and 3n experiments and their analysis

Unit:3

Confounding - Complete and Partial Confounding in 2n and 3n experiments - Fractional Replication in Factorial Experiments – Split plot and strip plot designs and their analysis

Unit:4

Incomplete Block Designs - Balanced Incomplete Block Design (BIBD)- Types of BIBD - Simple construction methods - Inter and Intra Block analysis of BIBD – Partially Balanced Incomplete Block Design with two associate classes – intra block analysis only

Total Lecture Hours | **60 Hours**

Books for Study

1	Das, M.N. and Giri.N.C. (1986): Design and Analysis of Experiments, Wiley Eastern.
2	Montgomery, C.D (2017): Design of Experiments, 9/e, John Wiley and Sons.
3	Cochran .W.G. and Cox .G.M. (1995): Experimental designs, 4/e, Wiley.
4	Searle, S.R(1987) : Linear Models, John Wiley and Sons.

Reference Books

1	Kabe D. G. and Gupta A. K. (2007): Experimental Designs: Exercises and Solutions, Springer-Verlag, New York
2	Klaus Hinkelmann and Kempthorne, O. (1994): Design and Analysis of Experiments, John Wiley and Sons.
3	ParimalMukhopadhyay(2005): Applied Statistics, 2/e, Books and Allied (P) Ltd, Kolkata.

Course Code	STAT484	STOCHASTIC PROCESSES	L	T	P	Credits
Core	MAJOR 22	Semester VIII	4	1	-	4
Pre-requisite			Syllabus Version		2023-24	

Course Objectives

The main objectives of this course are to

1. Explain the concept of stochastic process which students need for their experiment and research.

Provide the classification and properties of stochastic processes, discrete and continuous Markov chains, Brownian motion, renewal process, stationary processes and branching process.

2. Focus on theoretical concepts pertaining to handling various stochastic models.
3. Impart the application of various stochastic models for forecasting and prediction

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1	Apprehend the concept of stochastic process, its specifications, and analyze the classification of states; construct Markov Chain for real world situations
2	Understand Continuous time Markov processes and obtain the birth and death processes; explore their applications to various practical problems.
3	Explore the concept of Stationary processes in univariate and multivariate scenarios; derive the properties of auto-covariance and autocorrelation functions.
4	Determine renewal process, renewal function, distribution of arrival and inter arrival times and renewal policy under varied conditions

Unit:1

Introduction of Stochastic Processes- Specifications of a stochastic processes - Classification of stochastic processes - Markov chains -Classification of states and chains - Higher transition probabilities and its limiting behaviour -Chapman Kolmogorov's equations - Stationary distribution - Ergodic theorem - One dimensional random walk and Gambler's ruin problems.

Unit:2

Continuous Time Markov Processes- Poisson processes and related distributions - Birth and death processes – Kolmogorov-Feller differential equations of birth and death processes - Applications to queues and storage problems and Wiener process

Unit:3

Stationary Processes- Weakly stationary and strongly stationary processes - Properties of auto covariance and auto correlation functions - Autoregressive and Moving average processes - Spectral density function - Spectral representation of moving average processes

Unit:4

Renewal Theory- Renewal equation - Stopping time - Wald's equation - Elementary renewal theorem and its applications - Renewal reward processes - Residual and Excess life times - Markov renewal and Semi Markov processes.

Total Lecture Hours | **60 Hours**

Books for Study

1	Medhi, J. (2020): Stochastic Processes, New Age International Publishing Limited, New Delhi.
2	Karlin, S. and Taylor, H.M (1975): A First Course in Stochastic Processes – Vol. I. Academic Press, New York.

Reference Books

1	Cinlar, E. (2013): Introduction to Stochastic Processes, Courier Dover Publications.
2	Cox, D.R. and A.D. Miller (1984): The Theory of Stochastic Processes, Chapman & Hall
3	Linda J.S. Allen (2011). An Introduction to Stochastic Processes with Applications to Biology, Second Edition, Chapman & Hall/CRC
4	Papoulis, A. and Pillai, U.S. (2006). Probability, Variables and Stochastic Processes (Fourth Edition). Tata McGraw-Hill.
5	Resnick, S. (1992): Adventures in Stochastic Processes, Birkhauser, Boston. (Reprint 2005).
6	Tjims, H.C. (2003): A First course in Stochastic Models, John Wiley & Sons, New Delhi.

Course Code	STAT485	RELIABILITY THEORY	L	T	P	Credits
Core	MAJOR 23	Semester VII	4	1	-	4
Pre-requisite		Knowledge in Probability Distributions	Syllabus Version		2023-24	

Course Objectives

The main objectives of this course are to:

1. To study components and system and its structure
2. Measures of Reliability and Life time experiments and deriving life testing data
3. Construction of Reliability models
4. Estimation of reliability parameters and predictions

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1	To aware the objectives, needs and applications of reliability and ideas of structural reliability.
2	To understand the statistical measures and life distributions in reliability
3	To Study different ageing properties and deriving life distribution for reliability operation.
4	Estimation of reliability parameters and other associated concepts.
5	To analyze the concepts of reliability data

Unit:1 Structural Reliability

Introduction of reliability; Structural properties of coherent system: components and systems, coherent structures, representation of coherent systems in terms of paths and cuts, relevant & irrelevant structure; Modules of coherent systems; Reliability of a coherent systems; Reliability importance of components; Bounds on System Reliability.

Unit:2 Measures of Reliability and Common Life distributions

Definition of reliability function-measures of reliability-pdf, cdf and, hazard or failure rate function, MTTF, MTBF, Mean Residual life and Bathtub hazard function-simple problems. Concept of Lifetime and Life distributions- Some common life distributions-Exponential-Weibull-Rayleigh-Gamma-lognormal-simple problems for reliability measures

Unit:3 Ageing Properties of Life Distribution

Notions of Ageing: Classes of life distributions and their duals - preservation of life distribution classes for reliability operation - Formation of coherent systems, convolutions and mixtures, Hollander –Proschan and Despande tests for exponentiality

Unit:4 Estimation of lifetime and other related techniques

Concepts of life time data-complete and censored (left and right)-type-I and type-II samples, Likelihood Formulation for censoring, MLE of reliability parameters using common life distribution referred in unit-II, Probability plotting technique, Total time of test, basic concepts of accelerated life testing

Total Lecture Hours **60 Hours**

Books for Study

1	Barlow, R.E. and Proschan F. (1985) Statistical Theory of Reliability and Life Testing; Rinehart and Winston.
2	Lawless, J.F. (2003): Statistical Models and Methods of Life Time Data; John Wiley.
3	Michael S. Hamada, Alyson G. Wilson, C. Shane Reese, Harry F. Martz(2008): Bayesian Reliability, Springer
4	Deshpande JV and Purohit SG (2015): Lifetime Data: Statistical Models and Methods, World Scientific Publishing Co. Pte Ltd, Singapore

Reference Books

1	Bain L.J. and Max Engelhardt (1991): Statistical Analysis of Reliability and Life Testing Models; Marcel Dekker.
2	Nelson, W (1982): Applied Life Data Analysis; John Wiley
3	Zacks, S(1992): Introdcution to Reliability Analysis, Springer Verlag.
4	Marshall, A.W. and Olkin I(2007): Life Distributions, Springer

Syllabus for Pre Ph.D.-Examination in Statistics
STAT 901: Research Methodology

UNIT-I:

Research Methodology: An Introduction - Meaning of Research, Objectives of Research**,** Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. **Defining the Research Problem** - What is a Research Problem? Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem.

UNIT-II:

Interpretation and Report Writing - Meaning of Interpretation, Techniques of Interpretation, Precautions in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

UNIT-III:

Law of large Numbers (IID and Non-IID cases)-Distribution function and methods of transformations of random variables, Generating Function: Probability, Moment and Characteristic functions for univariate set up. Probability distributions: Exponential; Multinomial, Multivariate normal, Weibull distributions-properties and characterizations.

UNIT-IV:

Estimation-Classical and Bayesian Approach, Methods of Estimation-Moment, Likelihood and EM Algorithm-Properties and related problems- Prior distribution: Conjugate , informative and non-informative priors, Loss function-SELF, LINEX Loss function, Risk functions-Problems.

UNIT-V:

Generating random samples using probability integral transformation – accept/reject algorithm – metropolis algorithm, Gibbs sampling, Monte Carlo integration, MCMC principle – Metropolis Hasting algorithm, Bootstrap methods.

Books for Study:

For Unit-I and II

Kothari, C.R. and Gaurav Garg(2024). Research Methodology: Methods and Techniques. 5th ed. New Age International Publishers. [Relevant sub-titles under Chapters 1, 2 and 19].

For Unit-III and IV

Rohatgi, V. K. and Md. Ehsanes Saleh, A. K. (2015). An introduction to probability theory and mathematical statistics, John Wiley & Sons. [Relevant sub-titles under Chapters 2, 3, 7and 8].

For Unit-V

Robert, C.P., and Casella, G. (2004), Monte Carlo Statistical Methods, Springer. [Relevant sub-titles under Chapters 2, 3, 7 and 9]

Syllabus for B. Tech. courses under NEP programme

PROBABILITY AND STATISTICS

Unit I – Basic Statistics

Measures of Central Tendency and Dispersion in Frequency Distributions – Summary Statistics – Measure of Central Tendency – Arithmetic mean – Weighted Mean – Geometric Mean – Median – Mode – Dispersion – Average Deviation Measures - Coefficient of Variance (CV).

Unit II –Basic Probability

Introduction, random experiments, sample space, events – Types of events - Definitions of Probability – classical, statistical and axiomatic - Conditional Probability - Addition and Multiplication theorem of probability - Bayes' theorem – simple problems.

Unit-III: Random variables and its implications

Random Variables: Discrete and continuous random variables, Probability mass function, Probability density function, Cumulative distribution function their properties. Expectation, variance, moments and moment generating function- simple problems.

Unit IV: Discrete and Continuous Distributions

Discrete probability distributions: Binomial, Poisson, Geometric,– properties and applications. Continuous Probability distributions: Uniform, Normal, Exponential, Beta, Gamma - properties and applications-simple problems.

Unit V- Correlation and Regression

Bivariate data: Definition, scatter diagram, simple correlation, rank correlation. Trivariate Data: Partial and Multiple correlation coefficients. Regression, regression coefficient, Estimation using the Regression Line, Fitting of linear and quadratic regression using principle of least squares-simple problems.

Books for study:

1. Sheldon M. Ross: Introduction to Probability and Statistics for Engineers and Scientists, Academic Press, Elsevier (2014).
2. Gupta,S.C. and Kapoor, V.K. (2000): Fundamentals of Mathematical Statistics, 10/e, Sultan Chand and sons.
3. Gupta. S.P 'Statistical Methods' Sultan Chand & Sons, ^{48h} Edition, 2022.
4. Hooda, R. P. Statistics for business and economics. Vikas Publishing House, 2013.
5. Anderson D R, Sweeney D J and Williams T A: Statistics for Business and Economics, Thomson Publisher, 2005.
6. Levin. Richard. I and Rubin. David. S 'Statistics for Management' Prentice-Hall, 8^{th} Edition. 2017.

PONDICHERRY UNIVERSITY

RAMANUJAN SCHOOL OF MATHEMATICAL SCIENCES

DEPARTMENT OF MATHEMATICS

M.Sc. MATHEMATICS PROGRAMME

SYLLABI

WITH EFFECT FROM THE ACADEMIC YEAR

2023-24

(APPROVED)

PREAMBLE AND OBJECTIVES:

The Choice Based Credit System (CBCS) is being introduced for M. Sc Mathematics from the academic year 2023-2024 in accordance with the directives of University Grant Commission (UGC). The system provides an opportunity to students to design curriculum to self- individual needs.

CBCS in M.Sc Mathematics is aimed at

- Offering courses on credit mode and enrich the quality of teaching – learning at higher education level.

- Encouraging faculty to design and develop newer soft core courses.

- Enabling students to make a choice between different streams of soft core courses.

M.Sc. MATHEMATICS

List of Hard Core Courses (to be) offered from the Academic Year 2023-2024

SL. NO.	COURSE CODE	COURSE TITLE
1	MATH-411	Advanced Algebra
2	MATH-412	Real Analysis – I
3	MATH-414	Topology
4	MATH-424	Ordinary Differential Equations
5	MATH-421	Linear Algebra
6	MATH-422	Lebesgue Measure Theory
7	MATH-423	Complex Analysis
8	MATH-425	Real Analysis – II
9	MATH-513	Functional Analysis
10	MATH-516	Theory of Numbers
11	MATH519	Galois Theory
12	MATH- 537	Partial Differential Equations

M.Sc. MATHEMATICS

List of Soft Core Courses to be offered from the Academic Year 2023 -24

SL. NO.	COURSE CODE	COURSE TITLE
1.	MATH 413	Discrete Mathematics
2.	MATH 415	Continuum Mechanics
3.	MATH 416	Graph Theory
4.	MATH 417	Scilab Practical
5.	MATH-511	Fluid Mechanics
6.	MATH-512	Differential Geometry
7.	MATH-514	Analytical Dynamics
8.	MATH-515	Fuzzy Sets and its Applications
9.	MATH-522	Algebraic Graph Theory
10.	MATH-523	Algorithmic Graph Theory
11.	MATH-527	Algebraic Number Theory
12.	MATH-528	Advanced Algebraic Number Theory
13.	MATH 529	Theory of Fuzzy sets
14.	MATH-531	Cryptography
15.	MATH-533	Advanced Topics in Topology and Analysis
16.	MATH-534	Approximation Theory
17.	MATH-536	Difference Equations
18.	MATH-538	Lie Groups of Transformations and Differential Equations
19.	MATH-539	Numerical Analysis for Ordinary Differential Equations
20.	MATH-540	Advanced Fluid Mechanics
21.	MATH-541	Integral Equations
22.	MATH-542	Advanced Mathematical Analysis
23.	MATH-544	Elements of Harmonic Analysis
24.	MATH-545	Linear Lie Groups
25.	MATH-547	Advanced Functional Analysis
26.	MATH-549	Commutative Algebra
27.	MATH-551	Functional Analysis- II
28.	MATH-552	Operator Theory
29.	MATH-554	Non-Commutative Rings and Representations
30.	MATH-555	Advanced Complex Analysis
31.	MATH-559	Mathematical Practical
32.	MATH-560	Mathematical Software
33.	MATH-562	Numerical Analysis
34.	MATH-563	Integral Transforms
35.	MATH-564	Discrete Dynamical Systems
36.	MATH-565	Dynamical Systems
37.	MATH-566	Advanced Topology
38.	MATH- 567	Special Functions in Number Theory
39.	MATH- 568	Theory of Partitions
40.	MATH - 570	Introduction to Fuzzy Set
41.	MATH- 571	Calculus of Variations
42.	MATH- 572	Probability and Statistics

M.Sc. MATHEMATICS
HARD CORE : MATH 411- ADVANCED ALGEBRA (4 credits)

	Course Outcome	**Level**
CO 1	have a thorough introduction to the subject	Understand
CO 2	appreciate Sylow's theorems and its applications	Apply
CO 3	solve problems on conjugacy classes, Sylow's theory, field extensions and solvable groups	Analyze
CO 4	Find the dimension of the constructed extension fields	Evaluate
CO 5	have a detailed knowledge on Group theory	Create

Objectives:
To study Group Actions, The Sylow theorems, Direct and semi-direct products, Ring Homomorphism and Polynomial rings.

Unit I: The isomorphism theorems -Composition Series - Transpositions and Alternating groups-

Unit II: Group Actions: Group Actions and Permutation representations-Group acting on themselves by left multiplication-Cayley's theorem

Unit III: Group acting on themselves by conjugation -The class equation- Automorphisms- The Sylow theorems- The simplicity of A_n.

Unit IV: Direct and semi-direct products and abelian groups: Direct products- The fundamental theorem of finitely generated abelian groups - p-groups, Nilpotent Groups, and Solvable Groups

Unit V : Polynomial Rings - Definitions and Basic Properties - Polynomial Rings over Fields I - Polynomial Rings that are Unique Factorization Domains - Irreducibility Criteria.

Text Book:
Abstract Algebra (Third Edition) by David S. Dummit and Richard M. Foote,
Chapter 3 (Section 3.3 to 3.5, except Holder program), Chapter 4, Chapter 5 (Sections 5.1 and 5.2 only), Chapter 6 (Section 6.1), Chapter 10 (Section 10.1 to 10.3).

Reference books
1 M. Artin: Algebra, Prentice-Hall of India, 1991.
2. I.N.Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
3. N.Jacobson: Basic Algebra, Volumes I & II, W.H.Freeman, 1980.
4. S.Lang: Algebra, 3rd edition, Addison-Wesley, 1993.

Mapping of Program Specific Outcomes with Course Outcomes

CO / PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**
CO 1	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**0**
CO 2	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**0**
CO 3	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**0**
CO 4	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**0**
CO 5	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**0**

M. Sc. MATHEMATICS

HARD CORE: MATH-412: REAL ANALYSIS – I (4 credits)

	Course Outcome	**Level**
CO 1	explain the concepts of infimum, supremum and metric spaces	Remember & Understand
CO 2	demonstrate the convergence of series and power series using various tests	Apply
CO 3	analyze the topological properties of continuous functions	Analyze
CO 4	determine the interior point, limit point, closure of subsets of various metric spaces and also the limits of functions, sequences and subsequences	Evaluate
CO 5	construct functions that have various combination of the properties continuity, uniform continuity and differentiability	Create

Objectives:

To study basic definitions on countability, compactness and connectedness, convergence of sequence and series, limits, continuous functions, derivatives, Riemann- Stieltjes integral.

Unit-I : Finite, countable and uncountable sets - Metric spaces - Compact sets - Perfect sets - Connected sets - Convergent sequence - Subsequences - Cauchy sequences - Upper and lower limits – Some special sequences.

Unit- II : Series- Series of non- negative terms - The number e – The root and ratio tests - Power series - Summation by parts - Absolute convergence – Addition and multiplication of series - Rearrangements of series.

Unit- III : Limits of functions - Continuous functions - Continuity and compactness - Continuity and connectedness - Discontinuities - Monotonic functions - Infinite limits and limits at infinity.

Unit- IV : The derivative of a real function - Mean value theorems – The continuity of derivatives - L'Hospital's rule - Derivatives of higher order - Taylor's theorem - Derivatives of vector – valued functions.

Unit- V : The Riemann- Stieltjes integral- Definition and existence of the integral - Properties of the integral - Integration and differentiation - Integration of vector- Valued functions - Rectifiable curves - Improper Riemann Integrals.

Text Book

Walter Rudin, Principles of Mathematical Analysis- McGraw Hill International Editions, Mathematics series, 1976 (Chapters 2-6)

Reference Books

1. Patrick M. Fitzpatrick, Advanced Calculus, AMS, Pure and Applied Undergraduate Texts, Indian Edition,2nd edition, 2009.
2. Tom Apostol, Mathematical Analysis, Narosa Publishing House, Indian edition, 1985.
3. N.L.Carothers, Real Analysis, Cambridge University Press, 2000.
4. Karl.R.Stormberg, An Introduction to Classical Real Analysis, AMS Chelsea Publishing, 2015.
5. Richard R Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Co. 1970.

M.Sc. MATHEMATICS

HARD CORE: MATH-414: TOPOLOGY (4 Credits)

	Course outcome	Level
CO 1	understand the concepts of topology, basis, sub basis, subspace topology, open set, closed set, interior, closure, continuous function, homeomorphism, and open map.	Remember Understand
CO 2	find the applications of topology.	Apply
CO 3	identify the differences among the various separation axioms	Analyze
CO 4	discuss the proofs Urysohn's lemma, Tietze's extension theorem, Urysohn's metrization theorem, Tychnoff's theorem	Evaluate
CO 5	construct examples and counter examples of various topological properties	Create

Objectives:

To study Topological spaces, Bases, Compactness, Regular space, Normal Space and Connected space.

Unit-I : Revision of sets - Functions - Product of sets – Relations – Countable sets – Uncountable sets – Partially ordered sets and lattices – Metric spaces – Definition and examples – Open sets and closed sets in metric spaces – Open subsets of real line.

Unit -II : Topological spaces -- Definitions and examples - Closure and related concepts – Open bases and open sub bases – Separability and second countability - Lindloff's Theorem

Unit-III : Compactness – Basic results -- Continuous maps on compact sets - Characterization of compactness by basic and sub basic open covers – Tychonoff's theorem - Generalized heine – Borel theorem.

Unit – IV : Compactness for metric spaces – Sequential compactness - Lebesgue covering lemma - Sequential compactness and compactness coincide on metric spaces - T_1 spaces - Hausdorff spaces.

Unit -V : Completely regular spaces and normal spaces – Urysohn's lemma and Tietze extension theorem- –Connected spaces – Components of a space.

Text Book

G. F. Simmons, an Introduction to Topology and Modern Analysis, McGraw-Hill Kogakusha, Tokyo, 1963 (Chapter 1 – Revision of Sections 1—3, Section 4—8. Chapter 2 – Sections 9 - 12 Chapter 3 – Sections 16, 17 and 18. Chapter 4 – Sections 21 – 24. Chapter 5 – Sections 26 - 28 Chapter 6 – Sections 31 and 32)

Reference Books

1. J. R. Munkres, Toplogy, Pearson Edcation Inc., Second Edition, 2000.
2. Stephen Willard, General Topology, Dover Publication 2004.
3. J. Dugundgi, Toplogy, Allyn and Bacon, Boston, 1966.
4. Fred.H.Croom, Principles of Topology, Dover publications, 2016.

M.Sc. MATHEMATICS

HARD CORE: MATH-421 LINEAR ALGEBRA (4 Credits)

	Course Outcome	**Level**
CO 1	understand the concepts of vector spaces, subspaces and linear transformations	Understand
CO 2	appreciate the geometry of vector spaces using parallelogram law, Pythagorean theorem and triangle in equality	Apply
CO 3	know the relation between matrices and linear transformations	Analyse
CO 4	know the concepts of diagonlization, Jordan form and rational canonical form	Evaluate
CO 5	know the difference between various kind of operators like self-adjoint operators, Normal operators etc.	Create

Objectives:

To study Linear Transformation, Nilpotent Transformation, Cannonical forms, Trace, Transpose, Determinants, Quadratic forms.

Unit-I (Sections – 6.1, 6.2 and 6.3) **:** The Algebra of linear transformations-Characteristic roots-Similarity of linear transformations, Invariant subspaces and matrices.

Unit-II (Sections – 6.4 and 6.5**) :** Reduction to triangular forms- Nilpotent transformations - Index of nil potency and invariant of nilpotent transformation.

Unit-III (Sections – 6.6 and 4.5**):** Jordan blocks and Jordan forms- Modules - Cyclic modules - Fundamental theorem on modules over PID.

Unit-IV (Sections - 6.7, 6.8 and 6.9**):** Rational canonical form- Trace- Transpose and Determinants.

Unit-V (Sections – 6.10 and 6.11**):** Hermitian - Unitary and Normal transformations - Real quadratic forms.

Text Book: I.N.Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.

Reference Books

1. M.Artin, Algebra, Prentice-Hall of India, 1991
2. N.Jacobson, Basic Algebra, Volumes I & II, W.H.Freeman, 1980.
3. S.Lang, Algebra, 3rd edition, Addison-Wesley, 1993
4. P. B. Bhattacharya, S. K. Jain and S.R. Nagpaul, Basic Abstract Algebra (2nd Edition) Cambridge University Press, Indian edition, 1997
5. Kenneth Hoffmann and Ray Kunze, Linear Algebra, (Second edition), Pearson, 2015
6. S. Friedberg, A.Insel and L.Spence, Linear Algebra, (4^{th} Edition) Pearson, 2015.

M.Sc MATHEMATICS

HARD CORE: MATH422 - LEBESGUE MEASURE THEORY (4 Credit)

Objectives:

To introduce Algebras and σ – algebras, Measurable sets, Measurable functions, Integrable functions, Functions of bounded variation, Lebesgue integrability and Characterization of absolutely continuous functions as indefinite integrals.

Unit-I (Sections: 3.1, 3.2, 3.3, 3.6 from [1] and 2.1, 2.2 from [2]**)**

Motivation to Lebesgue Measure Theory – General extension Theory – Algebra of sets – Examples – Finitely/Countably additive set functions – Ulam's Theorem – Continuity from below/above of measures – The Lebesgue outer measure m^* - Examples – Properties

Unit-II (Sections: 2.3, 2.4, 2.5, 2.6, 2.7 from [2]**)**

Lebesgue measurable sets – Examples – The set of all Lebesgue measurable sets $\mathcal{M}$ is an algebra - $m^*$is finitely additive over $\mathcal{M}$ – $\mathcal{M}$ is a sigma algebra – m^* is a measure on $\mathcal{M}$ – Outer and inner approximation of Lebesgue measurable sets by open and closed sets respectively –Continuity of the Lebesgue measure – Example of a nonmeasurable set – The Cantor Lebesgue function

Unit-III (Sections: 3.1, 3.2, 3.3 from [2]**)**

Lebesgue measurable functions – Examples – Pointwise limit of sequence of measurable functions – Simple functions – The simple approximation Lemma – The simple approximation Theorem – Egoroff's Theorem – Lusin's Theorem

Unit-IV (Sections: 4.2, 4.3, 4.4, 4.5,5.3 from [2]**)**

The Lebesgue integral of a simple function – The Lebesgue integral of a bounded measurable function over a set of finite measure – Properties – The Bounded Convergence Theorem - The Lebesgue integral of a nonnegative measurable function – Properties – Chebychev's inequality – Fatou's Lemma – Monotony Convergence Theorem – The general Lebesgue integral – The Lebesgue dominated Convergence Theorem – Characterization of Riemann integrable functions – Improper Riemann integrals and their Lebesgue integrals

Unit-V (Sections: 6.1, 6.2, 6.3(upto6.3.6) of [1]**)**

Review of functions of bounded variation –Absolutely continuous functions – Lebesgue's Theorem on differentiability of monotony functions – The Lebesgue singular function – Fundamental Theorem of Calculus [I and II] for the Lebesgue integral

Text Books:

1. InderK.Rana, *An Introduction to Measure Theory and Integration ,(2e)*, Narosa (2007)
2. H.L. Royden, P.M.Fitzpatrick, *Real Analysis –Fourth Edition*, Prentice Hall of India (2013)

Reference books:

1. De Barra.G, *Measure Theory and Integration*, 2e, New Age International Publishers (2013).
2. Howard J.Wilcox, *An Introduction to Lebesgue Integration and Fourier Series*, Dover (1995).
3. Paul R. Halmos, *Measure Theory*, Springer (1976).
4. N.L.Carothers, *Real Analysis*, Cambridge University Press(2000).
5. C.D. Aliprantis and O.Burkinshaw, *Principles of Real Analysis*,3e, Academic Press(Elsevier).
6. Edwin Hewitt and Karl Stromberg, *Real and Abstract Analysis*, Springer, 1975.

M. Sc. MATHEMATICS

HARD CORE: MATH 423 COMPLEX ANALYSIS [4-Credits]

	Course Outcome	**Level**
CO 1	understand the concepts of complex integration, series expansion of a meromorphic function, infinite product expansion of an entire functions.	Remember Understand
CO 2	solve problems on complex integration.	Apply
CO 3	examine the proofs of Cauchy's theorems for rectangle for disc, Cauchy's integral formula.	Analyze
CO 4	discuss the proofs of Morera's theorem, Liouville's theorem, fundamental theorem of algebra.	Evaluate
CO 5	find the complex integrals and infinite sums and series using the Cauchy's residue theorem, Weierstrass theorem and Mittag-Leffler theorem.	Create

Objectives: To study Abel's Limit theorem, Elementary conformal mappings, Line integrals, The general form of Cauchy's theorem and Harmonic functions

Unit I: Analytic functions- Cauchy Riemann equations-Luca's Theorem-Rational functions-Elementary theory of power series- Abel's Limit theorem-Exponential and trigonometric functions-The Logarithm. *[Capter-2, Sections 1,2 and 3]*

Unit II: Conformality-Linear transformations-Cross ratio- Elementary conformal mappings. *[Chapter-3, Sections:2,3 and 4]*

Unit III: Line integrals-Cauchy's theorem for a rectangle- Cauchy's theorem in a disc-Cauchy's integral formula. *[Chapter:4, Sections: 1 and 2]*

Unit IV: Local properties of analytic functions-Zeros and poles- the Maximum principle- The general form of Cauchy's theorem. *[Chapter: 4, Sections:3and 4.]*

Unit V: The Residue Theorem- Argument principle-Evaluation of Definite integrals- Harmonic functions- Poisson's formula- Schwarz's theorem- Taylor series expansion-Laurent's series. *[Chapter: 4, Sections:5,6, Chapter:5, Sections: 1]*

Text Book: L.V.Ahlfors, Complex analysis, Third Edition, McGraw Hill Book Company,1979.

References:

1. John. B. Conway, Functions of one Complex Variable, Second Edition, Narosa Publishing House, 2002.
2. B.C.Palka, An Inroduction to the Complex function Theory, Springer, 1991.
3. H.A. Priestley, Introduction to Complex Analysis, Second Edition, Oxford University Press, 2003.
4. Donald sarason, Notes on Complex Function Theory, Hindustan Book agency ,1994.

Mapping of Program Specific Outcomes with Course Outcomes

CO / PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**
CO1	1	1	1	1	1	1	1	1
CO2	1	1	1	1	0	1	1	1
CO3	1	1	0	1	0	0	1	1
CO4	1	1	0	1	0	0	1	0
CO5	1	1	1	1	1	1	1	1

M. Sc. MATHEMATICS HARD CORE:

MATH-424 ORDINARY DIFFERENTIAL EQUATIONS (4 Credits)

	Course Outcome	**Level**
CO 1	recognize the relation between linear algebra, analysis and differential equations	Remember Understand
CO 2	Apply various methods to solve ordinary differential equations	Apply
CO 3	analyze the qualitative properties of solutions of differential equations	Analyze
CO 4	Evaluate the solutions using separation of variables and Fourier series	Evaluate
CO 5	Develop a method to distinguish singular and ordinary points in thehigher order ordinary differential equations	Create

Objectives:

This course introduces the Qualitative properties of solutions, Series solutions of first and second order equations, Legendre polynomials, Linear systems, The method of successive approximations.

Unit-I: Qualitative properties of solutions – The Sturm comparison theorem – Eigen values and Eigen functions and vibrating string.

Unit-II : Series solutions of first order equations – Second order linear equations – Ordinary points - Regular singular points – Gauss Hyper Geometric equations.

Unit-III: Legendre polynomials – Properties of Legendre polynomials – Bessel functions- The Gamma function - Properties of Bessel Function.

Unit-IV: Linear systems – Homogeneous linear system with constant coefficients. Autonomous systems. Types of Critical Points and their Stability

Unit-V: The existence and uniqueness of solutions – The method of successive approximations – Picards's theorem.

Text Book: G. F. Simmons, Differential Equations with Applications and Historical Notes, McGraw Hill Book Company, 1972. (Sec: 22-30, 32-35, 37-38, 40-42, 55-56)

References: Earl Coddington and Norman Levinson, Theory of ordinary Differential equations, TATA McGraw Hill, 2017.

Mapping of Program Specific Outcomes with Course Outcomes

CO / PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**
CO1	1	0	1	1	1	0	1	0
CO2	1	1	1	1	1	1	1	1
CO3	1	1	1	1	1	1	1	1
CO4	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	1

M. Sc. MATHEMATICS
HARD CORE- MATH-425: REAL ANALYSIS – II (4 credits)

	Course outcome	**Level**
CO 1	understand the concepts of Riemann-Stieltjes integrals, and their properties.	Remember Understand
CO 2	solve problems using the Gauss, Stokes, and Divergence theorems	Apply
CO 3	examine the relations among the partial derivatives and total derivative, interchanging the order of the derivatives, interchanging the order of integrations.	Analyze
CO 4	discuss the proofs of Green's theorem, Stoke's theorem and Gauss divergence theorem.	Evaluate
CO 5	find examples to explain the differences between point-wise and uniform convergence of sequences of functions, to know what are the properties that are preserved under uniform convergence.	Create

Objectives:
To study Sequence and Series of functions, Power Series, Functions of Several Variables.

Unit-I (Chapter:6 and Sections: 8.20 to 8.23 and 8.26 of [2]) : Functions of bounded variation-Double sequences-Double series-Rearrangement theorem for double series-A sufficient condition for the equality of iterated series - Infinite products.

Unit-II (Chapter: 7 of [1], Subsections 7.1 to 7.25) : Sequence and Series of functions - Examples - Uniform convergence and Continuity - Uniform convergence and Integration - Uniform convergence and Differentiation - Double sequences and series - Iterated limits-Equicontinuous Families of Functions - Arzela – Ascoli Theorem

Unit- III (Chapter: 7 of [1] subsections: 7.26 to7.33 and chapter 8 of [1]) : The Weierstrauss theorem for algebraic polynomials- The Stone - Weierstrauss Theorem - Power Series - The Exponential and Logarithmic Functions - The Trigonometric Functions - Fourier Series - The Weierstrauss theorem for the Trigonometric polynomials.

Unit- IV (Chapter:9 of [1], Subsections: 9.6 to 9.23) : Functions of Several Variables - Linear Transformation - Differentiation - The Contraction Principle.

Unit- V (Chapter: 9 of [1], Subsections:9.24 to 9.38) : The inverse function Theorem - The implicit Function Theorem - The Rank Theorem – Determinants.

Text Books

1. Walter Rudin, Principles of Mathematical Analysis- McGraw Hill International Editions, Mathematics series, 1976.
2. Apostol, Mathematical Analysis, Narosa Publishing House, Indian edition,2002.

Reference Books

1. Patrick M. Fitzpatrick Advanced Calculus, Amer. Math. Soc. Pine and Applied Undergraduate Texts, Indian Edition, 2009.
2. Kenneth A. Ross, Elementary Analysis, The Theory of Calculus, Springer-Verlag,1980.
3. N.L.Carothers, *Real Analysis*, Cambridge University Press(2000)
4. G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill, 2017.

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M.Sc MATHEMATICS

HARD CORE: MATH 513 - FUNCTIONAL ANALYSIS

	Course Outcome	Level
CO 1	explain the concepts of normed linear space (NLS), continuity of alinear map, L_p-space, Banach, Hilbert spaces, four pillars	Remember &Understand
CO 2	demonstrate the convergence in the different types of spaces	Apply
CO 3	analyze the properties of different types NLS	Analyze
CO 4	determine the linear functional in terms orthonormal basis	Evaluate
CO 5	Obtain the open mapping theorem from closed graph theorem and vice-versa	Create

Objectives:

To study Normed Linear Spaces, Continuity, Equivalent norms, Hahn-Banach theorem for real vector spaces, Closed and open maps, Separable Hilbert spaces, Orthogonal projections.

Unit-I (Sections: 1.2.3, 1.2.5, 2.1, 2.1.1, 2.1.2, 2.1.4) : Review of linear spaces – Linear functionals – hyperspaces – projections – Cauchy Schwarz inequality – Holder's inequality –Minkowski inequality – Normed linear spaces – Definition and examples – Basic properties – Semi norms and quotient spaces – product spaces and the graph norm.

Unit-II (Sections:3.1, 3.1.1, 3.2, 3.2.1, 3.4.1, 2.2, 2.2.1, 2.2.2, 2.2.3, 2.4**) :** Bounded linear Maps – Properties – Norm of a bounded linear Map – Banach spaces – Completeness of $l_p(1 \leq p \leq \infty), L_p[a,b], C[a,b], BV[a,b]$ – Completeness of the space of all bounded linear Maps – The completeness of the quotient space – The completion of a normed linearspace – Completeness and absolutely convergent series – Finite dimensional normed linear spaces – Riesz Lemma.

Unit-III (Sections: 5.1, 5.2, 5.3, 5.4, 3.4, 6.1**) :** The Hahn – Banach Extension Theorem anditscorollaries – The Hahn Banach Separation Theorem – Convergence of sequence of operators – The uniform Boundedness principle – The Banach Steinhauss Theorem – Weakly bounded sets – Schauder basis and separability.

Unit-IV (Sections: 7.1, 7.2, 7.3, 8.1, 8.1.2**) :** The closed graph Theorem – The bounded inverse theorem – The open mapping Theorem – The dual of $l_p(1 \leq p < \infty)$, the dual of $(C_{00}, ||.||_p)$ when $(1 \leq p < \infty)$ - The dual of $(C, \|.\|_\infty)$.

Unit-V (Sections: 2.1.5, 4.1, 4.2, 4.3, 4.4, 2.5, 2.6, 3.3**) :** Inner product spaces – Orthonormal sets – Gram Schmidt Orthogonalization process – Bessel's inequality – Hilbert spaces - Parseval's Theorem – Example of a nonseparable Hilbert space – Best approximation Theorems – Projection Theorem – Riesz Fischer Theorem – The Riesz representation Theorem.

Text Book: M.Thamban Nair, *Functional Analysis: A First Course*, Prentice Hall of India, 2002.

Reference Books:

1. Joseph Muscat, *Functional Analysis*, Springer(2008).
2. BalmohanV.Limaye, *Functional Analysis*, New Age International Publishers (2014).
3. Erwin Kreyszig, *Introductory Functional Analysis with Applications*, John Wiley(2007).
4. Martin Schecter, *Principle of Functional Analysis*, American Mathematical Society (2009)
5. BelaBollobas, *Linear Analysis:An Introductory Course*,2e, Cambridge Univ. Press (1999).
6. Bryan P. Rynne and Martin.AYoungson, *Linear Functional Analysis*, Springer (2008).

M. Sc. MATHEMATICS

HARD CORE: MATH-516 Theory of Numbers (4 Credits)

Objectives:
This course aims to explore primes, Power residues, Quadratic reciprocity, functions of number theory.

UNIT-I : Divisibility: Introduction -Divisibility- Primes.

UNIT-II: Solution of congruences – Congruences of higher degree – prime power moduli.

UNIT-III: Quadratic Residues, Quadratic reciprocity law, Jacobi Symbol.

UNIT-IV: Arithmetic functions-Recurrence functions, Mobious Inversion Formula, Irrational numbers, Irrationality of nth root of N, e and pi.

UNIT-V: Continued fractions and its convergence, representation of an irrational number by an infinite continued fraction. Some special quadratic surds.

Text Book

Treatment as in I. Niven, H.S. Zuckerman and H.L. Montgomery – An Introduction to the Theory of Numbers, New York, John Wiley and Sons, Inc., 2004, 5th Ed.

Unit I Section : 1.1-1.3

Unit II Section: 2.1-2.11

Unit III Section :3.1-3.3

Unit IV Section :4.1-4.3

Unit V Section: 5.6-5.11

Books for Reference:

1. **T.M. Apostol** – Introduction to Analytic Number Theory, Narosa Publishing House, New Delhi.
2. **G.H. Hardy and E.M. Wright**- An Introduction to the Theory of Numbers, Oxford University Press, 1979, 5th Ed.

M.Sc. MATHEMATICS
HARD CORE- MATH- 519- GALOIS THEORY (4 credits)

Objectives:
To study Polynomial rings, Field theory, Splitting fields and Algebraic closures, Galois Theory and Composite extension and simple extensions.

Unit I: Field theory: Basic theory of field extensions-Algebraic Extensions.

Unit II: Splitting fields and Algebraic closures - Separable and inseparable extensions - Cyclotomic polynomials and extensions.

Unit III: Galois Theory: Basic definitions- The fundamental theorem of Galois Theory - Solvable by radicals.

Unit IV: - Galois groups over the rationales. Finite Fields- Wedderburn's theorem(First proof only)

Unit V: Classical straightedge and compass constructions, Cyclotomic extensions and Abelian extensions, Galois group of polynomials.

Text Book:
1. Abstract Algebra (Second Edition) by David S. Dummit and Richard M. Foote, Wiley Student Edition (1999) for Units I to III, (Chapter 13), (Sections 14.1 to 14.3 and 14.5-14.6).

2. Topics in Algebra by I.N. Herstin (Section 5.6 - 5.8), and (Section 7.1 -7.2).

Reference books
1. M. Artin: Algebra, Prentice-Hall of India, 1991.
2. N.Jacobson: Basic Algebra, Volumes I & II, W.H.Freeman, 1980.
3. S.Lang: Algebra, 3rd edition, Addison-Wesley, 1993.

M. Sc. MATHEMATICS

HARD CORE – MATH-537: PARTIAL DIFFERENTIAL EQUATIONS – (4 Credits)

	Course Outcome	Level
CO 1	understand the relation between the theory and modelling in the problems arising in various fields, such as, economics, finance, applied sciences and etc	Remember Understand
CO 2	Enhance their mathematical understanding in representing solutions of partial differential equations.	Apply
CO 3	classify the partial differential equations and transform into canonical form	Analyze
CO 4	determine the solution representation for the three important classes of PDEs, such as Laplace, Heat and wave equation by various methods.	Evaluate
CO 5	Formulate fundamentals of partial differential equations, like Green's function, maximum principles, Cauchy problem, to take a research career in the area of partial differential equations	Create

Objectives:

To study first order PDEs, Non-linear first order PDEs, Classification of second order PDEs, Wave Equations**,** Laplace equations, Heat Equations.

Unit – I: First Order PDEs : Surfaces and their Normals, Curves and tangents - Genesis of first order PDE- Classification of Integrals- Linear equations of first Order - Integral surface passing through a curve – Cauchy problem for first order PDE – Orthogonal Surfaces- Non-linear first order PDEs : Compatible systems- Solutions of Quasi linear equations- Charpit's method- Special Types of Charpits Method, -Integral surfaces through a given curve-The Cauchy problem for Quasi Linear case and nonlinear first order PDEs

Unit – II: Second Order PDEs : Genesis of Second order PDEs- Classification of second order PDEs- Canonical forms of Hyperbolic- Elliptic and parabolic type PDEs, Linear PDE with constant coefficients – Method of finding CF and particular integral- Homogeneous linear PDE

Unit – III **Hyperbolic PDEs / Wave Equation :** Derivation of One –dimensional wave equations- Initial Value Problem – D'Alembert Solution, Method of separation of variables, Forced Vibration, Solution of non-homogeneous equation Uniqueness of solution of wave equation.

Unit – IV: Elliptic PDEs/Laplace Equations: Derivation of Laplace equations & poisson equation- Boundary value problems- Properties of Harmonic functions- Spherical Mean, Mean value theorem- Maximum and minimum principles- Separation of variables- Dirichlet problem and Neumann problems for a rectangle and circle (Upto 2.10 in Text Book 1). Application - Irrotational Flow of an Incompressible Fluid (Section 2.13)

Unit – V: Heat Equations: Diffusion Equation, Boundary Conditions - Elementary solution- Solution by separation of variables- Classification in n-variables- Families of equipotential surfaces.

Text Books

1. K. Shankara Rao, Introduction to Partial Differential Equations, PHI Publications, 3rd Edition. 2011.
2. T. Amarnath, An Elementary Course in Partial Differential Equations, Narosa Publishing House, 2010.

Reference Books

1. I. N. Sneddon, Elements of Partial DifferentiaI Equations, McGraw Hill, International Edition, 1986.
2. F. John, Partial Differential Equations, Springer Verlag, 1975.
3. Lawrence C. Evans, Partial Differential Equations, Graduate Studies in Mathematics, 1998.

M.Sc. MATHEMATICS
SOFT CORE: MATH-413 DISCRETE MATHEMATICS – (4 Credits)

Objectives:

This course aims to explore Posets, Lattices, Boolean Lattices, Boolean Algebra, Boolean expressions, Logic gates, Karnaugh maps, Directed Graphs.

Unit- I:
Posets and lattices - Lattices as partially ordered sets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product – Homomorphism.

Unit – II:
Special lattices (Complete lattices, Bounded lattices, Complemented lattices, Distributive lattices, Modular lattices) and their properties – Boolean algebra – Switching algebra – Sub algebra – Direct product of Boolean algebra – Boolean homomorphism.

Unit - III:
Join irreducible elements – Atoms – Stone theorem – Boolean forms and their equivalence – Min terms – Sum of products canonical form – Free Boolean algebra – Max terms and product of sums canonical form – Values of Boolean expressions – Boolean functions – Symmetric Boolean expressions.

Unit – IV:
Logic gates – Combination of gates – Adders – Karnaugh maps – Representation and Minimization of Boolean functions.

Unit –V:
Directed graphs – In and out degrees – Connectedness - – Directed paths and cycles – Moon theorem.

Text Books

1. J.P Trembly and R. Manohar: Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw – Hill Publishing Company Ltd, New Delhi 1997.
   For Units– I, II, III, IV: Relevant portions of Chapter - 4.
2. J.A. Bondy and U.S.R. Murthy: Graph Theory with Applications, Macmillan Press Ltd, New Delhi-1976.
   For Unit –V: Relevant portions of Chapter 10.

Reference Books

1. J. Johnsonbaurgh, Discrete Mathematics, MacMillan Publishing company, New York 1989.
2. R.P. Grimaldi, Discrete and Combinatorial Mathematics (An Applied Introduction), Pearson Edition Asia, New Delhi – 2002.
3. B. Kolman, R.C. Busby and S.C Ross, Discrete Mathematical Structures, Pearson Editionn Pvt Ltd, New Delhi –2003.

M. Sc. Mathematics

SOFT CORE- MATH-415: CONTINUUM MECHANICS (4 Credits)

Objectives:

To study the basics of Vectors, Equations of equilibrium, Analysis of deformation and Derivation of field equations.

UNIT I

Vectors – summation convention – translation and rotation of coordinates – coordinate transformations in general – analytical definitions of scalars , vectors , and Cartesian tensors

UNIT II

Stress components –Cauchy's formula – equations of equilibrium – change of stress components in transformation of coordinates – stress components in orthogonal curvilinear coordinates – stress boundary conditions.

UNIT III

Plane rate of stress – Mohr's circle – principal stresses – shearing stresses - stress deviation tensor – Lame's stress ellipsoid.

UNIT IV

Analysis of deformation – strain – strain components in rectangular Cartesian coordinates – infinitesimal rotation – finite strain components.

UNIT V

Derivation of field equations – material description of the motion of a continuum – spatial description – equation of motion – equation of motion - moment of momentum – balance of energy.

Text Book:

1. Y.C.FUNG , "A First Course in Continuum Mechanics "Second Edition , Prentice Hall.

Reference Book:

1. L.A.Segel and G .H.Handelman Mathematics Applied to Continuum Mechanics SIAM (2007)

M. Sc. MATHEMATICS
SOFT CORE: MATH-416 GRAPH THEORY (4 Credits)

Objectives:
To study basic of Graphs and Trees, Counting the Number of Spanning Trees, Matchings, Chromatic Number and Planarity of Graphs.

Unit -I
Graphs – Subgraphs – Isomorphism of graphs – Degrees of Vertices – Paths and Connectedness – Autumorphism of a Simple Graph – Operations on Graphs – Trees – Centers and Centroid.

Unit -II
Counting the Number of Spanning Trees – Cayley's Formula – Vertex Cuts and Edge Cuts – Connectivity and Edge-connectivity – Blocks – Cyclical Edge-connectivity of a Graph.

Unit -III
Vertex Independent sets and Vertex Coverings – Edge-Independent Sets – Matchings and Factors – M-Augmenting Paths – Matchings in Bipartite Graphs – Halls Theorem on Bipartite graphs – Tutte's 1-Factor Theorem.

Unit –IV
Vertex Coloring – Chromatic Number – Critical Graphs – Brooks' Theorem – Girth – Triangle-Free Graphs – Mycielski's Construction – Edge Colorings of Graphs – Vizing's Theorem – Chromatic Polynomials.

Unit –V
Planar and Nonplanar Graphs – Euler's Formula and its Consequences – K_5 and $K_{3,3}$ are Nonplanar graphs – Dual of a Plane Graph – The Four Color Theorem and the Heawood Five-Color Theorem – Kuratowski's Theorem (without proof).

Text Book:-

1. R. Balakrishnan and K. Ranganathan, A Textbook of Graph Theory (Universitext), Second Edition, Springer New York 2012.
Chapter 1: 1.1-1.6, 1.8
Chapter 3: 3.1-3.5
Chapter 4: 4.1-4.5
Chapter 5: 5.1-5.5
Chapter 7: 7.1,7.2,7.3.1, 7.5,7.6.2,7.9
Chapter 8: 8.1-8.7

Reference Books:-

1. J.A. Bondy and U.S.R. Murty, Graph Theory, Springer 2008.
2. Douglas B. West, Introduction to Graph Theory, Second Edition, PHI Learning Private Ltd, New Delhi-2011.
3. G. Chartrand, Linda Lesniak and Ping Zhang, Graphs and Digraphs, Fifth Edition, CRC press 2011.

M.Sc. MATHEMATICS
SOFT CORE: MATH-417 SCILAB PRACTICALS (4 Credits)

Unit-I: SCILAB Basics: Overview of SCILAB – Get started – Basic elements of the language – Matrices

Unit-II: SCILAB Programming: Looping and Branching – Functions – Plotting

Unit-III: Application into Basic Statistics: Measures of Central Tendency – Descriptive Statistics – Measures of Dispersion

Unit-IV: Application into Advanced Statistics, Cumulated distribution function – Data with missing values – Hypothesis Testing

Unit-V: Optimization Toolbox: FOSSEE SCILAB Optimization Toolbox – fminsearch – fsolve – fminbnd – fmincon – linprog – intlinprog – intfmincon – quadprog – intquadprog, Genetic Algorithm (optim_ga)

Unit-I: Chapter 1, 2, 3, 4 of Text Book 1
Unit-II: Chapter 5, 6, 7 of Text Book 1
Unit-III: Text Book 2
Unit-IV: Text Book 2
Unit-V: Text Book 3 and 4
Text Books:

1. Introduction to SCILAB – Michael Baudin From SCILAB Consortium, 2010
2. SCILAB Online Help – https://help.scilab.org/docs/5.5.2/en_US/section_33491857221a48388b878311e9f4b67e.html
3. FOSSEE SCILAB Toolbox – Optimization Toolbox https://scilab.in/fossee-scilabtoolbox/optimization-toolbox/functions
4. SCILAB Online Help – optim_ga – https://help.scilab.org/docs/5.5.2/en_US/optim_ga.html.

Reference Books:

1. https://www.scilab.org/tutorials
2. SCILAB help documentation – Statistics
3. Basic Statistics and Probability with SCILAB – Gilberto E. Urroz infoclearinghouse.com https://www.scilab.org/sites/default/files/Basic%20Statistics%20and%20Probability%20with%20SCILAB%20-%20Gilberto%20E.%20Urroz%20-%202001.pdf

Objectives:
To study the basics of SCILAB operations for Matrices, Looping, Plotting of graphs and Solving Ordinary Differential Equations.

M. Sc. MATHEMATICS

SOFT CORE: MATH-511 FLUID MECHANICS (4 Credits)

Objectives:

This course aims to explore Conservation of mass and energy, Rotations and vorticity, Stokes equations, Potential flow, Boundary layers

Unit-I

Equations of motion - Euler's Equation – Conservation of mass – Balance of momentum – Transport theorem - Conservation of energy – Incompressible Flows – Isentropic Fluids – Bernoulli's theorem.

Unit-II

Rotations and vorticity – Kelvin's circulation theorem – Helmboltz's theorem.

Unit-III

Navier- Stokes equations – Scaling properties – Decomposition theorem - Stokes equations – Poiseuille flow .

Unit-IV

Potential flow – Complex potential – Blasius theorem - Kutta-Joukowski theorem – D'Alembert's paradox – Stokes paradox.

Unit-V

Boundary layers – Prandt boundary layer equations –Steady boundary layer flow on a flat plate of infinite width.

Text Book

A. J. Chorin and J. E Marsden, A Mathematical Introduction to Fluid Mechanics, Texts in Applied Mathematics 4, Springer Verlag, 1990.

References:

1. D.J.Acheson, Elementary Fluid Dynamics, Oxford University Press, 1990.

M. Sc. MATHEMATICS

SOFT CORE: MATH 512: DIFFERENTIAL GEOMETRY (4 Credits)

Objectives:

This course aims to explore Curves, Torsion, surface, Isometrics of surfaces, Curvature of curves on a surface.

Unit-I

Curves- arc length- Repara metrization -Level curves - Curvature - Plane curves.
[Sections: 1.1 to 1.4 and Sections 2.1,2.2.]

Unit-II

Space curves-Torsion- Serret Frenet equations- Simple closed curves- The Isoperimetric Inequality- The Four vertex Theorem.
[Sections 2.3 and Sections 3.1 to 3.3.]

Unit-III

Smooth surface- Tangents, normal and orientability- Examples of surfaces- Quadratic surfaces- Triple orthogonal systems- Applications of Inverse function theorem.[Sections 4.1 to 4.7]

Unit-IV

Lengths of curves on surfacesa- First fundamental form- Isometries of surfaces- Conformal mapping of surfaces-Surface area- Equiareal maps and a theorem of Archimedes.
[Sections: 5.1 to 5.5]

Unit-V

The Second Fundamental form- The Curvature of curves on a surface- The normal and principal curvature- Euler's theorem- The geometric interpretation of principal curvatures.
[Sections: 6.1 to 6.4]

Text Book:

1. Andrew Pressley, *Elementary Differential Geometry*, Springer, 2004.

Reference Books:

1.

1. Christian Bar, *Elementary Differential Geometry*, Cambridge University Press, 2011.
2. Thomas F. Banchoff and Stephen T. Lovett, *Differential Geometry of Curves and Surfaces*, A.K Peters/CRC press, 2010.
3. W. Klingenberg, *A course in Differential Geometry*, Springer-Verlag, New York, 1978.

M. Sc. MATHEMATICS

SOFT CORE: MATH-514 ANALYTICAL DYNAMICS (4 Credits)

Objectives:

To study the basics of Generalized coordinates, Lagrange equation for non-holonomic constraints, Hamilton's equation and Harmonic oscillator.

Unit- I

Generalized coordinates-Virtual displacements-D'Alembert's principle and derivation of the Lagrange equations.

Unit -II

Lagrange equation for non-holonomic constraints-Method of Lagrange multipliers-Velocity dependent potentials-Non-conservative forces and dissipation function- Non-holonomic systems and Lagrange multipliers.

Unit- III

Hamilton's equation-The Hamilton principle - Variational principle- Catenary- Brachistochrone-Derivation of the Hamiltonian equation- Liouville's theorem.

Unit- IV

Canonical transformations – Generating functions- Harmonic Oscillator.

Unit- V

Hamilton – Jacobi theory- Harmonic oscillator- action – Angle variables- Kepler problem- particle motion in a potential with azimuthal symmetry – Slant throw.

Text Book

Walter Greiner, Classical Mechanics, Systems of Particles and Hamiltonian Dynamics, Springer, ISE, 2004.

Unit I: Sections 14-15; Unit II: Sections 16-17; Unit III: Sections 18 ; Unit IV: Sections 19;
Unit V: Sections 20.

Reference Books

1. H. Goldstein, Classical Mechanics, Narosa Publishing House, New Delhi, 1985.
2. F. Scheck, Mechanics, From Newton's Laws to Deterministic Chaos, Springer, 1999.

M. Sc. Mathematics

SOFT CORE: MATH-515: FUZZY SETS AND ITS APPLICATIONS

(4 Credits)

Objectives:

To study the basics of Crisp sets, Fuzzy relation, Fuzzy control structure and Fuzzy Decision making.

Unit-I: Crisp Sets

Basic Definitions - Operations on crisp sets – Properties of crisp set – Crisp relations- Operations on crisp relations – Properties of Crisp relations – Composition of Crisp relations - Characteristic Function-Exercises

Unit – II: Fuzzy Sets

Definition of Fuzzy sets - examples - Fuzzy numbers- Characteristics of a Fuzzy Set- Basic operations on fuzzy sets- Properties of Fuzzy sets- Membership functions-Algebraic product and Sum of Fuzzy Sets – Power and related operations on Fuzzy Sets – The extension Principle-Exercise

Unit-III: Fuzzy Relations

Definition of Fuzzy relation – Basic operations on Fuzzy relations – Direct product – Projections of a Fuzzy relation – Max-Min and Min-Max compositions – Fuzzy relations and approximate Reasoning – Exercise- Fuzzy relational equation-Problem partitioning – Solution method – Use of Neural network in Fuzzy relation

Unit-IV: Fuzzy control systems

Introduction – Fuzzy control structure - Modelling and control parameters – If….and….then rules – Rule evaluation – Conflict resolution – Defuzzification – Fuzzy controller with matrix Representation - Exercises.

Unit-V: Applications

Fuzzy Control in Washing Machine – Fuzzy Decision making in forecasting – Fuzzy decision Making in industrial problems – Fuzzy control in traffic control – Fuzzy relational equation in medicine.

Text Books

1. George J. Klir/Bo Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India (2000).
2. George Bojadziev and Maria Bojadziev, Fuzzy Sets, Fuzzy Logic, Applications, World Scientific Publishing Co.Pte.Ltd, Singapore, 1996.

Reference Books

1. George J. Klir and Tina A. Folger, Fuzzy Sets, Uncertainty and Information, Prentice-Hall of India 1993.
2. Witold Pedrycz & Fernando Gomide, An introduction to Fuzzy Set, Prentice-Hall of India, New Delhi.2005.
3. James J. Buckely, Esfandiar Eslami, An introduction to Fuzzy Logic and Fuzzy Sets, Springer 2002.
4. Abraham Kandel and Gideon Langholz, Fuzzy Control Systems, CRC Press, USA 1994.

M. Sc. MATHEMATICS

SOFT CORE : MATH-522 ALGEBRAIC GRAPH THEORY (4 Credits)

Objectives:

To study the objectives of Linear Algebra in Graph Theory, Spanning Trees and Associated Structures, The Multiplicative Expansion and Chromatic Polynomial.

Unit -I: Linear Algebra in Graph Theory – The Spectrum of a Graph – Characteristic polynomial – Adjacency Algebra - Reduction Formula for χ – Regular Graphs and Line Graphs – Circulant Graph – Spectrum of the Strongly Regular Graph – Cycles and Cuts – The Incidence Matrix – The Laplacian Spectrum.

Unit -II: Spanning Trees and Associated Structures – Kirchhoff's Law – Thomson's Principle – The Tree-Number – A Bound for the Tree Number of Regular Graphs – Determinant Expansions – Elementary Graphs.

Unit -III: Vertex-Partition and the Spectrum – Color Partition – Wilf's Theorem on the Chromatic Number of a Graph – Coloring Problems – The Chromatic Polynomial – Recursive Relation for the Chromatic Polynomial – Quasi-Separable Graphs – Subgraph Expansions – The Rank Polynomial.

Unit -IV: The Multiplicative Expansion – Whitney's Theorem on Counting Subgraphs – The Induced Subgraph Expansion – Baker's Theorem.

Unit -V: The Tutte Polynomial – The λ-operator – The Deletion-Contraction Property – Chromatic Polynomial and Spanning Trees – The Chromatic Invariant.

Text Book:-

1. Norman Biggs, Algbraic Graph Theory, Second Edition, Cambridge University Press, 1993.

Reference Books:-

1. Chris Godsil and Gordon Royle, Algebraic Graph Theory, Springer 2009.
2. R. Balakrishnan and K. Ranganathan, A Textbook of Graph Theory (Universitext), Second Edition, Springer New York 2012.

M.Sc. MATHEMATICS
SOFT CORE: MATH - 523 -ALGORITHMIC GRAPH THEORY – (4 Credits)

Objectives:

To study Graphs and notations, Spanning trees and Search methods, finding all spanning trees of a graph, matrix in graphs and algorithm for finding spanning tree.

Unit- I

Graphs and notations – Null, complement and complete graphs – Degrees – Isomorphism – Subgraphs – Paths and cycles – Connectedness - Components – Operations on graphs - Distance, Radius, Diameter, Centers and medians in graphs - Rooted and m ary trees.

Unit – II

Binary trees – and their search – Spanning trees - Search methods: Breadth first search and depth first search algorithms – Introduction to groups, fields and vector spaces – Vector spaces of graphs – Dimensions, Relationships, orthogonality of cycle and cutset subspaces.

Unit – III

Fundamental cycles – Finding all spanning trees of a graph - Cutsets and their properties – Fundamental cutsets – Relation in fundamental cycles and cutsets – On Connectivity and separability – Network flows - (1) isomorphism.

Unit – IV

Incidence matrix and its sub matrics – Cycle matrix – Fundamental cycle matrix and its rank and nullity – Cutset and fundamental cut set matrices – Relationship theorem – Path matrix – Adjacency matrix.

Unit –V

The connector problem – Kruskal algorithm – Prim algorithm – The shortest path problem – Dijlstra algorithm – Network models – Flows – cuts – Maximum flow algorithm – The max. flow, min. cut thorem.

Text Books

1. K. Thulasiraman and M.N.S. Swamy, Graphs : Theory and Algorithms – John Wiley and Sons, Inc., New York (1992).
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India Ltd (1974).
3. J. A. Bondy and U.S.R. Murthy: Graph Theory with Applications, Elsevier Science North Holland (1982).

Reference Books

1. G. Chartrand and O. R. Oellermann, Applied and Algorithmic Graph Theory, McGraw Hill New York (1993).
2. W. Kocay and D. L. Kreher, Graphs, Algorithms and Optimization, Chapman and Hall – CRC Press, London (2005).
3. J. Johnsonbaurgh, Discrete Mathematics, Macmillan Publishing Company, New York (1989).

M. Sc. MATHEMATICS
SOFT CORE : MATH-527 ALGEBRAIC NUMBER THEORY (4 Credits)

Objectives:
To study the basics of Primes, Principal ideal domain, Euclidean domain, Algebraic number and The Norm and the Trace.

Unit-I Elementary Number Theory
Integers – Greatest common divisor – Infinitude of primes – Unique factorization in Z – Fermat's little theorem – Euler's Φ function and Euler's theorem – Multiplicative property of Φ function – Applications of unique factorization – The equation $x^2 + y^2 = z^2$ – The equation $x^4 + y^4 = z^2$ – The equation $x^4 – y^4 = z^2$ – Fermat numbers and their properties.

Unit-II Euclidean Rings
Preliminaries: Units, Associates, Irreducible elements, Norm map, Unique factorization domain, Principal ideal domain, Euclidean domain – Gauss' lemma – Gaussian integers – Units and primes in the ring of Gaussian integers – Eisenstein integers – Units in the ring of Eisenstein integers – Factorization of 3 – Order of $Z[\rho] / (\lambda)$.

Unit-III Algebraic Numbers and Integers
Basic concepts – Algebraic number – Algebraic integer – Minimal polynomial Countability of algebraic numbers – Liouville's theorem for R – Algebraic number fields – Theorem of the primitive element –Liouville's theorem for C – Characterization of algebraic integers.

Unit-IV Integral **Bases**
The norm and the trace – Integral basis for an algebraic number field – Algebraic integers of $Q(\sqrt{-5})$ – Existence of an integral basis – Discriminant of an algebraic number field – Index – Determination of an integral basis for the ring of integers of a quadratic number field.

Unit-V Dedekind Domains
Integral closure – Integrally closed ring – Noetherian ring – Dedekind domain – Characterizing Dedekind domains.

Text Book
J.E.Smonde and M.Ram Murty, Problems in Algebraic Number Theory,
Graduate Texts in Mathematics, Volume 190, Springer Verlag, New York, 1999.
Sections 1.1 and 1.2
Sections 2.1, 2.2 and 2.3
Sections 3.1, 3.2 and 3.3
Sections 4.1, 4.2 and 4.3
Sections 5.1 and 5.2

Reference Books:
1. Pierre Samuel and Allan J Silberger, Algebraic Theory of Numbers, Dover Pub. Inc, 2008.

M. Sc. MATHEMATICS

SOFT CORE: MATH-528 ADVANCED ALGEBRAIC NUMBER THEORY(4 Credits)

Objectives:

To study the basics of Euclidean rings, Quadratic residues and quadratic non-residues, Units in real quadratic fields and The Riemann and Dedekind zeta functions.

Unit-I The Ideal Class Group

Euclidean rings – Hurwitz constant – Fractional ideals – Finiteness of the ideal class group – The class number of an algebraic number field – The class number of $Q(\sqrt{-5})$ – The Diophantine equation $x^2 + 5 = y^3$.

Unit-II Quadratic Reciprocity

Preliminaries – Quadratic residues and quadratic non residues – The Legendre symbol – The quadratic character of -1 and 2 – Gauss sums – The law of quadratic reciprocity.

Unit-III The Structure of Units

Discrete subgroup of R^m – Dirichlet's unit theorem – Units in real quadratic fields – Pell's equation.

Unit-IV Higher Reciprocity Laws

Cubic reciprocity – Eisenstein reciprocity.

Unit-V Analytic Methods

The Riemann and Dedekind zeta functions – Zeta functions of quadratic fields – Dirichlet's hyperbola method.

Text Book

J. E. Smonde and M. Ram Murty, Problems in Algebraic Number Theory,
Graduate Texts in Mathematics, Volume 190, Springer Verlag, New York, 1999.

Sections 6.1, 6.2 and 6.3
Sections 7.1, 7.2 and 7.3
Sections 8.1 and 8.2
Sections 9.1 and 9.2
Sections 10.1 and 10.2

Reference Books:

1. Pierre Samuel and Allan J Silberger, Algebraic Theory of Numbers, Dover Pub. Inc, 2008

M. Sc. MATHEMATICS
SOFT CORE: MATH-529 THEORY OF FUZZY SETS (4 Credits)

Objectives:

To study the basics of Fuzzy sets, Fuzzy complements, Fuzzy numbers, Crisp and fuzzy relations and Fuzzy propositions.

Unit-I Fuzzy sets
Basic definitions – Types of fuzzy sets – Basic concepts – α cuts and their properties – Representations of fuzzy sets – first and second decomposition theorems.

Unit-II Operations on fuzzy sets
Types of operations – Fuzzy complements – Fuzzy intersections: t norms – Fuzzy unions: t conorms – Combinations of operations.

Unit-III Elements of fuzzy arithmetic
Fuzzy numbers – Linguistic variables – Arithmetic operations on intervals – Arithmetic operations on fuzzy numbers – Fuzzy equations.

Unit-IV Fuzzy relations
Crisp and fuzzy relations – Projections and cylindric extensions – Binary fuzzy relations – Binary relations on a single set – Fuzzy equivalence relations – Fuzzy compatibility relations.

Unit-V Fuzzy logic
An overview of classical logic – multi valued logics – Fuzzy propositions – Fuzzy quantifiers – Linguistic hedges – Inference from conditional fuzzy propositions.

Text Book

George J. Klir and Bo Yuan, Fuzzy sets and Fuzzy Logic,Theory and Applications,

Prentice – Hall of India Private Limited, New Delhi, 2000.

Reference Book

H. J. Zimmermann, Fuzzy set theory and its Applications, Allied Publishers Limited,

New Delhi,1991.

M. Sc. MATHEMATICS

SOFT CORE: MATH -531 CRYPTOGRAPHY (4 Credits)

Objectives:

To study the basics of Public and Secret Key Encryption, Digital Signatures and Network Security.

Unit I

Introduction: Overview of course- Classical cryptography [parts of Chapter 1].

Unit II

Secret Key Encryption : Perfect Secrecy - One time pads [Chapter 2.1], Stream ciphers and the Data Encryption Standard (DES) [Chapter 3 (excluding 3.6)], The Advanced Encryption Standard (AES) - adopted September 2000.

Unit III

Public Key Encryption : Factoring and the RSA encryption [Chapter 4.1 -4.4],
Discrete log- Diffie-Hellman Key Exchange [Chapter 8.4 (only pages 270-273)].

Unit IV

ElGamal encryption [Chapter 5 (only pages 162-164)] , Digital Signatures [Chapter 6 (excluding 6.5 - 6.6)], One-time signatures- Rabin and ElGamal signatures schemes- Digital Signature Standard (DSS).

Unit V

Hashing : Motivation and applications- Cryptographically Secure Hashing. [Chapter 7.1-7.3,7.6], Message Authentication Codes (MAC)- HMAC- Network Security - Secure Socket Layer (SSL)- I Psec.,Secret Sharing- Definition. Shamir's threshold scheme [Chapter 11.1], Visual secret sharing schemes.

Text Book

D. R. Stinson,s Cryptography, Theory and Practice,CRC Press, 1995.

Reference Books

1. Richard A. Mollin, An Introduction to Cryptography, Chapman & Hall / CRC, Boca Raton, 2000
2. Dominic Walsh, Codes and Cryptography, Oxford Science Publications, Clarendon Press, Oxford, 1988

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M. Sc. MATHEMATICS
SOFT CORE: MATH-533 ADVANCED TOPICS IN TOPOLOGY AND ANALYSIS
(4 Credits)

Objectives:
To study the basics of Quotient topology and quotient maps, One point compactification, Local finiteness and Stricly convex spaces.

Unit-I
Quotient topology and quotient maps - Examples of quotient spaces - Path connectedness - Standard results - Example of a connected but not path connected space- Locally connected spaces.

Unit-II
The Uryshon's metrization theorem - One point compactification - Stone- Cech compactification - The Arzela - Ascoli theorem.

Unit-III
Local finiteness- Countably locally finite refinement of open coverings of metric spaces – Paracompactness - Standard results - Metric spaces are paracompact.

Unit-IV
Partition of unity - Lp- spaces – Completeness - Dual of Lp[a, b] for $1 \leq p < 1$.

Unit-V
Extreme points - Caratheodory's theorem - Krein- Milman theorem - Milman converse Theorem - Extreme points of the closed unit ball of c, $l\infty$, C(Q), Q compact, Hausdorff and the dual of C(Q) - Stricly convex spaces - Examples.

Text Books:

1. James R. Munkres, Topology by James R. Munkres, Pearson, 2nd edition, 2000.
2. H.L.Royden, and P.M.Fitzpatrick, Real Analysis, (Fourth Edition) PHI Learning Private Limited, 2011.
3. M. Fabian, P.Habala, P. Hajek, V.M. Santalucia, J.Pelant and V. Zizler: Functional Analysis and Infinite dimensional geometry, CMS Books in Mathematics, Springer-Verlag, 2001.

Reference Books:

1. James Dugundji, General Topology, Allyn and Bacon, Inc.(1966).
2. Joseph Conway, A course on Functional Analysis, Springer, 2nd edition, 1997.
3. B.V.Limaye, Functional Analysis, Wiley Eastern, New Delhi, 1981

M. Sc. MATHEMATICS

SOFT CORE : MATH-534 APPROXIMATION THEORY (4 Credits)

Objectives:

To study the basics of Interpolation by polynomials, Approximation of continuous, periodic functions by trigonometric polynomials, Uniqueness of polynomials of best approximation and Approximation from finite dimensional subspaces.

Unit-I

Interpolation by polynomials - Lagrange interpolation - Vander Monde's determinant- Bernstein polynomials - Weierstrass approximation theorem.

Unit-II

Stone- Weierstrass theorem (Real and complex versions) - Weierstrass theorem as corollary - Approximation of continuous, periodic functions by trigonometric polynomials - Best approximation in C[a, b] with sup norm - Chebychev's Alternation theorem - Theorem of de La Vallee Poussin.

Unit-III

General linear families - Haar system and its characterizations - Uniqueness of polynomials of best approximation - Strong unicity theorem - Harr's unicity theorem.

Unit-IV

An algorithm of Remes and convergence under Haar condition - Strictly convex and uniformly convex Banach spaces - Approximation in inner product spaces – Approximation from closed, convex subsets - Approximation from subspaces of Hilbert spaces - Uniform convexity and continuity of metric projection.

Unit-V

Approximation from finite dimensional subspaces - Normal equations and Gram's determinant - approximation in L2[a, b] - Orthogonal polynomials - Legendre and Chebychev polynomials.

Best approximation by subspaces of Banach spaces - Duality formula - Spaces in which all closed subspaces are proximinal or Chebychev-proximinality of weak* Closed subspaces - Approximation by closed hyperplanes.

Text Book:

1. E.W.Cheney, An Introduction to Approximation theory, McGraw-Hill, 1st edition, 1966.

Reference Books:

1. B.V. Limaye, Functional Analysis, New Age International pvt. Ltd., 2008.
2. Frank Deutsch, Best approximation in inner product spaces, spinger,2001.
3. Serge Lang, Real Analysis, Addison- Wesley, 1983.
4. Ivan Singer, Best approximation in normed linear spaces by elements of linear Subspaces, Springer-Verlag, 1970.

M. Sc. MATHEMATICS
SOFT CORE : MATH-536 DIFFERENCE EQUATIONS (4 Credits)

Objectives:
To study the basics of Difference Calculus, First order difference equation, General Linear equation, Linear Difference equations, Inhomogeneous equations, Linear Difference equation with constant coefficients.

Unit-I
The Difference Calculus Definition, Derivation of difference equation- Existence and uniqueness theorem- Operators and E- Elementary difference operators. Factorial polynomials- Operators and the sum calculus- Examples.

Unit-II
First order difference equation General Linear equation- Continued fraction. A general first-order equation – Expansion Techniques.

Unit-III
Linear Difference equations Introduction- Linearly dependent functions- Fundamental theorem for homogeneous equations.

Unit-IV
Inhomogeneous equations In homogeneous equations- Second order equations. Sturn Liouville Difference equations.

Unit-V
Linear Difference equation with constant coefficients introduction- Homogeneous equation- Construction of a difference equation having specified solution- Relationship between Linear difference and differential equation.

Text Book
Ronald E. Mickens, Difference equation - Theory and Application, Chapman & Hall, Second Edition, New York – London, 1990.

Unit 1: Chapter 1: (Sections 1.2-1.8)
Unit 2: Chapter 2: (Sections 2.1-2.8)
Unit 3: Chapter 3: (Sections 3.1-3.3)
Unit 4: Chapter 3: (Sections 3.5-3.6)
Unit 5: Chapter 4: (Sections 4.1-4.4)

M. Sc. MATHEMATICS

SOFT CORE: MATH-538 LIE GROUPS OF TRANSFORMATIONS AND DIFFERENTIAL EQUATIONS (4 Credits)

Objectives:

To study the basics of Lie groups of transformation, Lie Algebras and Invariance of partial differential equations of first and second order.

Unit-I

Introduction–Lie groups of transformation – Infinitesimal transformations.

Unit-II

Extended group transformations and infinitesimal transformations (one independent – one dependent and two independent – two dependent).

Unit-III

Lie Algebras and Applications.

Unit-IV

Invariance of first and second order differential equations.

Unit-V

Invariance of partial differential equations of first and second order – elementary examples.

TextBook

Treatment as in G. W. Blueman and S. Kumei, Symmetries and Differential Equations, Springer – Verlag , 1980.

Unit 1 – Chapter 2 (Sections 2.1 – 2.2);
Unit 2 – Chapter 2 (Sections 2.3.1 – 2.3.3) ;
Unit 3 – Chapter 2 (Sections 2.4.1 – 2.4.4);
Unit 4 – Chapter 3 (Sections 3.1.1 – 3.3.3);
Unit 5 – Chapter 4 (Sections 4.4.1 – 4.2.2).

M. Sc. MATHEMATICS
SOFT CORE : MATH-539 NUMERICAL ANALYSIS FOR ORDINARY DIFFERENTIAL EQUATIONS (4 Credits)

Objectives:
To study various numerical methods to solve ordinary differential equations such as Euler's method, Gaussion quadrature and Error Control.

Unit-I
Euler's method - Trapezoidal rule - Theta method.

Unit-II
Adams - Bashforth method - Order and convergence - Backward differentiation formula.

Unit-III
Gaussion quadrature - Explicit Runge - Kutta scheme - Implicit Runge Kutta scheme - Collocation.

Unit-IV
Stiff equations - Linear stability domain and A- Stability -- A-stability of RK and multistep methods.

Unit-V
Error Control - Milne Device - Embedded Runge Kutta method.

Text Book

1. Arieh Iserles, A First Course in the Numerical Analysis of Differential Equations, Cambridge University press, 2nd edition, 2008.

Reference Books:

1. Richard L. Burden and J.Douglas faires, Numerical Analysis(9th Edition), Cengage Learning India, 2012.

M. Sc. MATHEMATICS
SOFT CORE : MATH-540 ADVANCED FLUID MECHANICS (4 Credits)

Objectives:

This course aims to explore Wave equation, Prandtl's relation and Compressive shocks, Riemann problem, conservation laws and Non convex systems of conservation laws, Numerical methods.

Unit-I
Characteristics - Wave equation - Examples - Riemann invariants - Hodograph transformation - Piston problem.

Unit-II
Shocks - Systems of conservation laws - Weak solution - Rankine - Hugoniot relations - Hugoniot relation - Prandtl's relation - Compressive shocks - Entropy condition.

Unit-III
Riemann problem - Centered waves - Solution of the Riemann problem - Courant – Fricdricts - Lewy condition.

Unit-IV
Combustion waves - Single conservation law - Convex conservation laws - Oleinik's condition – Non convex systems of conservation laws - Solution.

Unit-V
Numerical methods - Finite difference Methods- Forward Difference - Backward Difference - Central difference - Consistency - Order - Stability - Lax's Theorem – Von Neumann Analysis - Godunov scheme - l8 stability - l_2 stability - Lax – Fricdricks scheme - Lax Wendroff scheme - Crank - Nicolson scheme.

Text Books

1. Chorin and Marsden, A Mathematical Introduction to Fluid Mechanics, Texts in Applied Mathematics, Springer, Third Edition, 2009.
2. A Iserles , A First course in the Numerical Analysis of Differential Equations, Cambridge University Press, 2009.

Reference Books:

1. D.J.Acheson, Elementary Fluid Dynamics, Oxford University Press, 1990

SOFT CORE: MATH-541 INTEGRAL EQUATIONS (4 Credits)

Course Objectives:

The main objectives of this course are to:

1. Introduce the various types of integral equations.
2. Study the methods of successive approximations and Fredholm theory.
3. Acquire knowledge on applications to Ordinary Differential Equations.

Course Outcomes:

After successful completion of the course the student will be able to

CO1 Define the methods to solve integral equations.

CO2 Discuss the method of successive approximation and Fredholm theory.

CO3 Identify and Construct the solutions for real time applications.

Unit–I Introduction – Definition – Regularity conditions – Special kinds of Kernels – Eigen values and Eigen functions – Convolution integral – The Inner or Scalar Product of Two Functions - Integral Equations with Separable Kernels - Reduction to a system of algebraic equations – Examples
Chapter1: Sections 1.1 to 1.6 **Chapter2:** Sections 2.1 to 2.2

Unit–II Fredholm alternative–Examples – An approximation method - Fredholm Integral Equation of the First Kind - Method of successive approximations – Method Of Successive Approximations - Iterative scheme – Examples
Chapter2: Sections 2.3 to 2.6 **Chapter3:** Sections 3.1 to 3.2

Unit–III Volterra integral equations – Examples – Some results about the resolvent kernel – Classical Fredholm Theory - The method of solution of Fredholm equation – Fredholm first theorem – Examples.
Chapter 3: Sections 3.3 to 3.5 **Chapter 4:** Sections: 4.1 to 4.3

Unit–IV Applications to Ordinary Differential Equations-Initial value problems – Boundary value problems – Examples – Green's Function Approach-Examples
Chapter 5: Sections 5.1 to 5.3, 5.5, 5.6

Unit-V Singular integral equations – The Abel integral equations – Examples, Cauchy Principal Value for Integrals-The Cauchy-Type Integrals.
Chapter8: Sections 8.1 to 8.4

Text Book:

1. R. P. Kanwal, Linear Integral Equations, Theory and Techniques, Academic Press, NewYork,1997.

Reference Books:

1. Porter and Stirling, *Integral Equations*, Cambridge University press, 1996
2. M.D. Raisinghania, *Integral Equations and Boundary Value Problems*, S. Chand & Co., New Delhi, 2007.
3. Sudir K. Pundir and Rimple Pundir, *Integral Equations and Boundary Value Problems*, Pragati Prakasam, Meerut, 2005.
4. F. G. Tricomi, *Integral Equations*, Inter science Publishers, Inc Newyork, 1985

M. Sc. MATHEMATICS

SOFT CORE : MATH-542 ADVANCED MATHEMATICAL ANALYSIS (4 Credits)

Objectives:

To study the basics of Continuous functions, Uniform convergence, Hilbert spaces of holomorphic functions
and Fourier transform.

Unit-I Spaces of functions

Families of functions like periodic functions - Continuous functions- C1- functions- rapidly decreasing functions on Rn which separate points- closed subsets - Partition of unity.

Unit-II Topology on the spaces functions

Uniform convergence - Uniform convergence on compact on polynomials (with emphasis on power series)- Ck-functions- C1-functions on Rn – holomorphic functions on C - Completeness of various spaces of functions under uniform metric-Lp-metric and under uniformly on compact topology.

Unit-III Compact subsets

Arzela - Ascoli theorem - Normal families of holomorphic functions - Hilbert spaces of holomorphic functions - Reproducing kernels.

Unit-IV Fourier analysis

Convolutions - Fourier transform - Approximate identities in L1 (Rn) given by classical kernels like Fejer's kernel.

Unit-V Density

Approximation through convolutions - Density theorems of weierstrass and stone- Korovkin – Density of C1c -functions in Lp.

Text Books

1. R. Beals, Advanced mathematical analysis, Springer Verlag, New York, 1973.
2. J. B. Conway, Functions of one complex variable, Narosa Publishing House, 1980.
3. E. H. Lieb and M. Loss, Analysis, Narosa Book House, New Delhi, 1997.

Reference Books

1. W. Rudin, Real and complex analysis, 2nd ed., TMH Edition, 1962.
2. K. Yosida, Functional analysis, Springer - Verlag, New York, 1968.

M. Sc. MATHEMATICS

SOFT CORE : MATH-544 ELEMENTS OF HARMONIC ANALYSIS (4 Credits)

Objectives:

To study the basics of Topological groups, Connected groups, The Dual group of a locally compact abelian group and Classical kernels on R.

Unit-I

Basic properties of topological groups, subgroups, quotient groups - Examples of Various matrix groups.

Unit-II

Connected groups - Existence of Haar measure (without proof) - Computation of Haar measure on R, T, Z and some simple matrix groups - Convolution, the Banach algebra L1(G) and convolution with special emphasis on L1(R), L1(T) and L1(Z).

Unit-III

Fourier transform and its properties - Approximate identities in L1(G).

Unit-IV

The Dual group of a locally compact abelian group - Computation of dual groups for R, T, Z.

Unit-V

Classical kernels on R - The Fourier inversion Theorem - Plancherel theorem on R - Plancherel measure on R, T, Z - Discussion on Plancherel theorem on a general locally compact abelian group.

Text Books:

1. G. Folland, A course in abstarct harmonic analysis, CRC Press, 1994.
2. H. Helson, Harmonic analysis, Trim Series, Hindustan Book Agency, 2nd Edition, 1995.
3. Y. Katznelson, Introduction to harmonic analysis, J. Wiley and Sons, 1968.
4. L.H. Loomis, An introduction to abstract harmonic analysis, van Nostrand, New York, 1953.

Reference Books:

1. E. Hewitt & K.A. Ross, Abstract harmonic analysis, Vol. I, Springer – Verlag, 1963.
2. W. Rudin, Real and complex analysis, Tata Mc Graw Hill, 2nd Edition, 1962.

M. Sc. MATHEMATICS
SOFT CORE : MATH-545 LINEAR LIE GROUPS (4 Credits)

Objectives:
To study the basics of Topological groups, Unitary groups, Computation of Haar measure of the groups and Representations of a locally compact group.

Unit-I
Basic properties of topological groups, subgroups, quotient groups and connected groups.

Unit-II
Linear Lie groups like GL (n,R), GL(n,C), Orthogonal groups, Unitary groups, Motion groups, Heisenberg groups and various properties of them.

Unit-III
Computation of Haar measure for the above groups - The exponential map and the Lie algebras of the above groups.

Unit-IV
Representations of a locally compact group - Adjoint representation - Irreducible representations of SU (2) and SO(3).

Unit-V
Induced representation - Irreducible representations of Motion group M (2) and Heisenberg groups.

Text Books:

1. J. L. Clerc, Les repr´esentatios des groupes compacts, Analyse harmonique (J.L.Clerc et al., ed.), C.I.M.P.A., 1982.
2. G. Folland, A course in abstract harmonic analysis, CRC Press, 1994.
3. S. Kumaresan, A course in differential geometry and lie groups, Trim 22, Hindustan Book Agency, 2002.

Reference Books:

1. . M. Sigiura, Unitary representations and harmonic analysis, An introduction, John - Wiley, 1975.

M.Sc MATHEMATICS

SOFT CORE: MATH547 – ADVANCED FUNCTIONAL ANALYSIS

Objectives:

To study the basics of Canonical isometry, Compact operators, Eigen values and the eigen spectrum of a linear operator, The adjoint of an operator and Spectral results for Hilbert's space operators.

Unit-I

Duals of $\mathcal{C}[a,b]$ and $L_p[a,b]$– Separability – The Canonical isometry – The transpose of a bounded linear Map – Reflexivity – Weak convergence – Schur's Lemma – EberleinShmulyan Theorem – Best approximation in reflexive spaces.

Unit-II

Compact operators – Examples – Properties – The completeness of the space of compact operators – Compactness of the transpose.

Unit-III

Eigen values and the eigen spectrum of a linear operator – examples – spectrum and resolvent set – Spectral radius – Spectral Mapping Theorem – Resolvent Identity – The specrtral radius formula – The RieszSchauder Theory.

Unit-IV

The adjoint of an operator – Existence – Compactness of the adjoint operator – Sesquilinearfunctionals – Closed range Theorem.

Unit-V

Self-adjoint, normal, unitary operators – Numerical range and numerical radius – Spectral results for Hilbert's space operators – Properties of the Spectrum.

Text Book:

1. M.Thamban Nair, *Functional Analysis: A First Course*, Prentice Hall of India, 2002.

Unit-I Sections: 8.1.3, 8.1.4, 8.2.1, 8.2.2,8.2.3
Unit-II Sections: 9.1, 9.2, 9.3
Unit-III Sections: 10.1, 10.2, 10.2.1, 10.2.2, 10.2.3, 10.4
Unit-IV Sections: 11.1, 11.1.1, 11.1.2
Unit-V Sections: 11.2, 12.1, 12.1.1, 12.2

Reference Books:

1. Joseph Muscat, *Functional Analysis*, Springer (2008).
2. BalmohanV.Limaye, *Functional Analysis*,3e, New Age International Publishers (2014).
3. Erwin Kreyszig, *Introductory Functional Analysis with Applications*, John Wiley (2007).
4. Martin Schecter, *Principles of Functional Analysis*, American Mathematical Society (2009)
5. BelaBollobas, *Linear Analysis: An Introductory Course*,2e, Cambridge Univ. Press (1999).
6. Bryan P. Rynne and Martin.AYoungson, *Linear Functional Analysis*, Springer (2008).

M. Sc. MATHEMATICS
SOFT CORE: MATH-549 COMMUTATIVE ALGEBRA (4 Credits)

Objectives:

To study the basics of Prime ideals, Operation on sub-modules, Tensor product and Noetherian rings.

Unit-I
Prime ideals- Maximal ideas- Nil radical- Jacobson radical- Operation on ideals- Extension and contraction.

Unit-II
Operation on sub-modules- Direct sum and product- Finitely generated modules- Exact sequences- Tensor product- Restriction and extension of Scalars.

Unit-III
Rings and Modules of Faction and Primary decomposition Local properties extended and contracted Primary decomposition.

Unit-IV
Integral dependence and chain conditions.

Unit -V
Noetherian rings and Artinian rings

Text Book
M. K. Atiyah and I. G. Macdonald, Introduction to Commutative Algebra, Addison-Weseley, 1994.

Reference Books

1. H. Matsumura, Commutative Ring Theory, Cambridge University Press,1989.
2. I. Kaplansky, Commuatavie Rings, University of London press,1966.
3. O. Zariski and P. Samuel, Commutative Algebra, Springer 1976.

M. Sc. MATHEMATICS
SOFT CORE: MATH 551 FUNCTIONAL ANALYSIS – II (4 Credits)

Objectives:

To study the basics of Normed linear spaces, Weak topologies, Linear operators and Compact operators on Banach spaces

Unit-I: Normed linear spaces
Separation theorem and strict separation theorem in normed linear spaces-Applications-Weak and weak* topologies on normed linear spaces, both finite and infinite dimensional

Unit-II: Weak and weak* topologies
Conditions for metrizability of weak and weak* topologies on bounded sets-Weak and weak* continuous linear functionals-Separation theorem for spaces with weak or weak* topologies

Unit-III: Dual-polar set
Weak topology induced by a subset of the dual-polar set - Bipolar theorem - Goldstein's theorem- Banach -Alaoglu's theorem- Reflexivity and weak convergence.

Unit-IV: Operators - I
Linear operators-Examples-Integral operators- Inverse and adjoint operators- Range and null spaces- Adjoint operators in Hilbert spaces- Normal and unitary Operators

Unit-V: Operators - II
Compact operators on Banach spaces- Definition, examples and basic properties- Hilbert Schmidt operators

Text Books:

1. M. Fabian, P.Habala, P. Hajek, V.M. Santalucia, J.Pelant and V. Zizler, Functional Analysis and Infinite Dimensional Geometry, CMS Books in Mathematics, Springer-Verlag, 2001.
2. M. Thamban Nair, Functional Analysis - A First Course, Prentice-Hall of India Private Ltd, New Delhi,2002.
3. B. V. Limaye, Functional Analysis, New- Age International Pvt. Ltd. 1996.

Reference Books:

1. Joseph Conway, A Course on Functional Analysis, Springer- Verlag, 1990.

M. Sc. MATHEMATICS

SOFT CORE: MATH 552 OPERATOR THEORY (4 Credits)

Objectives:

To study the basics of Banach algebras, Maximal ideal space for commutative Banach algebras, Representations of C*- Algebras and Compact operators.

Unit-I

Banach algebras – Involutive Banach algebras – Various examples including
Group algebras – Spectrum – Spctral mapping theorem – Spectral radius formula.

Unit-II

Maximal ideal space for commutative Banach algebras – Gelfand - Naimark theory for commutative Banach algebras – C*- algebras, Examples- Commutative C*- algebras.

Unit-III

Representations of C*- Algebras – Von Neumann's density theorem – Double commutant theorem - GNS constructions.

Unit-IV

Functional calculus – The spectral theorem for normal operators – Spectral theorem for unitary operators – Polar decomposition.

Unit-V

Compact operators – Examples and properties – Spectral theorem for compact operators – Hilbert – Schmidt operators.

Text Books:

1. Sunder, V.S, Functional Analysis – Spectral Theory, Trim Series, Hindustan Book Agency, 1997.

Reference Books:

1. Takesaki, M, Theory of Operator Algebras I, Springer Verlag, 1979.
2. Yosida, K, Functional Analysis, Springer Verlag, 1968.

M. Sc. MATHEMATICS

SOFT CORE: MATH - 554 NON-COMMUTATIVE RINGS AND REPRESENTATIONS

(4 Credits)

Objectives:

To study the basics of Modules, Semi simple rings, Structure theory of ring and substantial study of Representations.

Unit-I Modules

Modules - Artinian and Notherian modules - Tensor products - Restricted and induced modules. - Indecomposable modules – Completely reducible module - Schur Lemma.

Unit-II Radical

Semi simple rings - The radical of a rings – The properties of Jacobson radical

Unit-III Group algebras - The Jacabson radical of Group Algebra – Maschke's Theorem.

Unit-IV Structure theory

Structure theory of ring - Density theorem - Widderburn-Artin theorem for semi simple rings.

Unit-V Representations

Representations - linear representation - Matrix representation - Equivalent representation - Invariant subspaces - Irreducible representations - Direct sum of representations - Induced representation – restricted representation - Tensor product of representations - Inner products of representation.

Text Book

1. I. N Herstein, Non-Commutative Rings, The Mathematical Association of America, 5th Edition, 2005 (Chapter 1: Units I-III, Chapter 2: Unit IV and Chapter 5: Unit V)

Reference Books:

1. William Fulton and Joe Harris, Representation Theory - A First Course, Springer International Edition, Springer-Verlag, New York, 2004.
2. Jacobson, Basic Algebra II, Hindustan Publishing Corporation (India), 1983.
3. Charles W. Curtis and Irving Reiner, Representation Theory of Finite Groups and Associative Algebras, Inter Science Publishers, 1962.

M. Sc. MATHEMATICS
SOFT CORE: MATH-555: ADVANCED COMPLEX ANALYSIS (4 Credits)

Objectives:
To study the basics of the space of continuous functions, Weierstrass factorization theorem and Schwarz Reflection Principle.

Unit-I
The space of continuous functions - Spaces of analytic functions – Spaces of meromorphic functions - The Riemann Mapping Theorem.[Chapter-7, Sections: 1,2 ,3 and 4.]

Unit-II
Weierstrass factorization theorem - Factorization of sine function – The gamma function - The Reimann zeta function. [Chapter-7, Sections: 5,6,7 and 8]

Unit-III
Runge's Theorem Simple Connectedness- Mittag Leeffler's Theorem[Chaper-8]

Unit-IV
Schwarz Reflection Principle - Analytic continuation along a path – Monmodromy theorem. [Chapter-9 Sections1, 2 and 3]

Unit-V
Jensen's formula - The genus and order of an entire function.[Chapter-11, Sections:1,2 and 3]

Text Book:

1. John. B. Conway, Functions of one Complex Variable, Second Edition, Narosa Publishing House, 2002.

Reference Books:

1. B.C.Palka, An Inroduction to the Complex function Theory, Springer, 1991.
2. H.A. Priestley, Introduction to Complex Analysis, Second Edition, Oxford University Press, 2003.
3. Donald sarason, Notes on Complex Function Theory, Hindustan Book agency ,1994.
4. L.V.Ahlfors, Complex analysis, Third Edition, McGraw Hill Book Company,1979.

M. Sc. MATHEMATICS

SOFT CORE: MATH-559: Mathematica Practical (4 Credits)

Objectives:

To study the basics of Mathematica Software for various operations such as for Strings, Graphics, Lists and solving problems of Differential calculus and Ordinary Differential Equations.

Unit-I

Basic concepts: Constants- Built-In Functions- Basic Arithmetic Operations Strings- Assignment, Replacement, and Logical relations - Loops.

Unit-II

Two dimensional graphics and three dimensional Graphics: Plotting Functions of Single variables and Two Variables - Graphic commands.

Unit- III

Lists: Generating Lists- List Manipulation - Set Theory - Tables and Matrices- Equations- Algebra and Trigonometry- Polynomials.

Unit- IV

Differential calculus - Integral calculus - Multivariable calculus

Unit-V

Ordinary Differential Equations - Linear Algebra.

Text Books :

1. Eugene Don, Mathematica, Schaum's Outlines, Tata McGraw-Hill Edition,2009.

Reference Books:

1. Bruce F. Torrence and Eve A. Torrence, Students Introductions to Mathematica, Cambridge University Press, 2008.

M. Sc. MATHEMATICS
SOFT CORE: MATH: 560 - MATHEMATICAL SOFTWARE
(Credits: 4)

Objectives:
To study the basics of Mathematical software such as LATeX, MATLAB and Maple.

Unit-I
LATeX introduction- Installation – Math symbols and tables – TeX symbol and tables – Matrix and lists – Typing Math and text – Text environments.

Unit-II
Document structure – Latex Documents – The AMS articles document class – Beamer Presentation and PDF documents – Long Documents – BibteX – Make index – Books in LateX-Colours and Graphics – TeXCAD – LATeX CAD.

Unit-III
Starting with MATLAB- Variables Vectors, Matrices – Creating Array in MATLAB –Menu, Workspace, working Directory, Command window, Diary, Printing- Built_in function, User defined functions, Script M-files- Complex Arithmatic, Figen values and Eigen vectors – Two and three dimensional Plots.

Unit-IV
Getting around with maple – Maple input and output - Programming in Maple.

Unit-V
Maple: Abstract algebra – Linear algebra – Calculus on numbers – Variables- Complex Arithmatic, Eigen values and Eigen vectors – Two and three dimensional plots.

Text Books

1. G. Gratzer, More Math Into LATEX, 4^{th} edition, Springer, (2007).
2. AMOS Gilat, MATLAB an introduction with application, WILEY India Edition, (2009).
3. Brain R Hunt, Ronald L Lipsman,A Guide to MATLAB for beginners and Experienced users, Cambridge University Press. (2003)
4. Ander Heck, Introduction in Maple, Springer, (2007)

M. Sc. MATHEMATICS

SOFT CORE- MATH-562: NUMERICAL ANALYSIS (4 Credits)

Objectives:

To study the basics of Convergence criterion, Consistency of system of equations and various methods to obtain numerical solutions of ordinary differential equations.

Unit-I: **Nonlinear Equations in One Variable**: Fixed point iterative method – convergence Criterion -Aitken's $\Delta 2$- process - Sturm sequence method to identify the number of real roots – Newton - Raphson's methods convergence criterion Ramanujan's Method - Bairstow's Method.

Unit-II: Linear and Nonlinear System of Equations: Gauss eliminations with pivotal strategy Jacobi and Gauss Seidel Itervative Methods with convergence criterion. LU - decomposition methods – (Crout's, Choleky and DeLittle methods) – consistency and ill conditioned system of equations - Tri-diagonal system of equations – Thomas algorithm. Iterative methods for Nonlinear system of equations, Newton raphson, Quasi newton and Over relaxation methods for Nonlinear system of equations. **Unit-III: Interpolation:** Lagrange- Hermite- Cubic-spline's (Natural, Not a Knot and Clamped)- with uniqueness and error term, for polynomial interpolation- Bivariate interpolation- Orthogonal polynomials Grams Schmidth Orthogoralization procedure and least square- Chebyshev and Rational function approximation.

Unit -IV: Numerical Integration:

Gaussian quadrature, Gauss-Legendre- Gauss-Chebeshev formulas- Gauss Leguree, Gauss Hermite and Spline intergation – Integration over rectangular and general quadrilateral areas and multiple integration with variable limits.

Unit-V: Numerical solution of ordinary differential equations**:**

Initial value problems- Picard's and Taylor series methods – Euler's Method- Higher order Taylor methods - Modified Euler's method - Runge Kutta methods of second and fourth order – Multistep method - The Adams - Moulton method - stability - (Convergence and Truncation error for the above methods). Boundary - Value problems – Second order finite difference and cubic spline methods.

Text books

1. M. K. Jain, S. R. K. Iyengar and R.K. Jain, Numerical methods for scientific and Engineering computation, Wiley Eastern Ltd. 1993, Third Edition.
2. C. F. Gerald and P.O. Wheatley, Applied Numerical Methods, Low- priced edition, Pearson Education Asia 2002, Sixth Edition.
3. M. K. Jain, Numerical solution of differential equations, Wiley Eastern (1979), Second Edition.

Reference books

1. S. C. Chapra and P.C. Raymond, Numerical Methods for Engineers, Tata McGraw Hill, New Delhi, 2000
2. S. S. Sastry , Introductory methods of Numerical analysis, Prentice - Hall of India, New Delhi, 1998.

2. Kendall E.Atkinson, An Introduction to Numerical Analysis(2^{nd} Edition), Wiley, 2008.

M.Sc. MATHEMATICS
SOFT CORE: MATH-563: INTEGRAL TRANSFORMS
(4 CREDITS)

Objectives:
To study the basics of Laplace transforms, Inversion Integral and Properties of Fourier transforms.

Unit- I
Laplace transforms -Important properties- Simple Applications- Asymptotic Properties- Watson's Lemma.

Unit- II
Inversion Integral- The Riemann- Lebesgue Lemma- Dirichlet Integrals- the Inversion- Watson's Lemma for loop integrals- Heaviside series expansion.

Unit- III
Application to ordinary differential equations- Elementary examples- Higher order equations-Partial differential equations- Heat diffusion integral equations.

Unit-IV
Fourier transforms- Exponential- Sine and Cosine transforms- Important properties- Spectral analysis.

Unit- V
Partial differential equations- Potential problems-Water waves-Basic equations-Waves generated by a Surface displacement.

Text Book

1. B. Davies, Integral Transforms and Their Applications,Springer, Texts in Applied Mathematics, 41 Third Edition,2009.

Reference Books:

1. Ian N. Snedden, The Use of Integral Transforms, McGraw Hill, 1972**.**

M.Sc MATHEMATICS

SOFT CORE: MATH: 565 - DYNAMICAL SYSTEMS (4 Credits)

Objectives:

To study the basics of Planar systems and its classifications, Nonlinear systems, Stability and Hamiltonian systems and Bifurcations.

Unit-I (Chapters 1, 2 and 3 of [1])

First order differential equations, The logistic population model, Second order differential equations, planar systems, Planar linear systems, Solving linear systems, The linearity principle, Phase portraits for planar systems.

Unit-II (Chapters: 4 and 6 of [1])

Classification of planar systems, higher dimensional linear systems- Harmonic oscillators -The exponential of a matrix- Nonautonomous linear system.

Unit-III (Chapters 7 and 8 of [1])

Nonlinear systems-Dynamical systems-The existence and uniqueness theorem-continuous dependence of solutions- The variational equation. Equilibiria in nonlinear systems- Nonlinear sinks and sources-saddles and stability-bifurcations.

Unit-IV (Chapters 9 and 10 of [1])

Global nonlinear Techniques- Nullclines -Stability of equilibria – Gradient systems- Hamiltonian systems, closed orbits and limit sets-Local sections and flow boxes- The Poincare Map-Monotone sequences in planar Dynamical systems- The Poincare_ Bendixson theorem-Applications.

Unit-V (Chapter 15 of [1])

Discrete dynamical systems-Bifurcations-The discrete logistic model- Chaos- Symbolic dynamics-The shift map –The Cantor middle_third set.

Text Book:

1. Morris W.Hirsch, Stephen Smale, Robert L.Devaney, Differential Equations and Dynamical systems and An Introduction to Chaos, Second edition, Academic Press(Elsevier) 2004.

Reference Books:

1. Robert L.Devaney, A First Course in Chaotic Dynamical Systems, Addison-Wesley Publishing Company, Inc. 1992.
2. Lawrence Perko, Differential equations and Dynamical Systems, (3^{rd} Edition), Springer 2001.

M.Sc MATHEMATICS

SOFT CORE : MATH: 566 - ADVANCED TOPOLOGY (4 Credits)

Objectives:

To study the basics of Connected components, Topological groups, Compactification, Dimension theory and Homotopy of paths.

Unit-I (Sections- 25, 29 and 34 of [1])

Connected components- Local connectedness - Locally path connected spaces- Local compactness, One point Compactification, Uryshon Metrization Theorem.

Unit-II (Chapter-10 of [2] and Sections- 22 and 36 of [1])

Nets and Filters- Quotient topology- Introduction to topological groups- Existence of partition of unity- Imbedding theorem for compact m- manifolds.

Unit-III (Sections-38,39,40,41 and 42 of [1])

The Stone -Cech Compactification- Locally finite spaces- Nagata- Smirnov Metrization theorem- Para compactness- Smirnov Metrization theorem.

Unit-IV (Sections-44 and 50 of [1])

The Peano space-filling curve- Introduction to dimension theory- Imbedding theorem for compact Metrizable spaces.

Unit-V (Sections- 51, 52, 53 and 54 of [1])

Homotopy of paths- The fundamental group- Covering spaces- The fundamental group of the circle.

Text Books:

1. James R. Munkres, Topology, Second edition, Pearson Education Inc.,(2002).
2. K. D. Joshi, Introduction to General Topology, First edition (revised), New Age International Publishers, 2004.

Reference Books:

1. Stephen Willard, General Topology, Dover, 2004.

M. Sc. MATHEMATICS

SOFT CORE: MATH: 567-SPECIAL FUNCTIONS IN NUMBER THEORY

(4 Credits)

Objectives:

To study the basics of Hyper Geometric series, Jacobi's triple product identity and its applications, q- series and theta functions and Modular relation related to hypergeometric series.

Unit I

Introduction to Basic hyper Geometric series- Binomial theorem- q- binomial theorem Heine's Transformation formula- Jackson transformation formula

Unit II

Jacobi's triple product identity and its applications and Quintuple product identity and new identity for $(q:q)_{\infty}^{10}$ with application to partition congruence modulo 11

Unit III

Bilateral Series- Ramanujan I Ψ 1summation and related identities- Ramanujan theta function identities involving Lambert series.

Unit IV

q- series and theta functions Entries 18 to 30 Chapter 16 of Ramanujan's notebook.

Unit V

Modular relation related to hypergeometric series and its applications.

Text Book

1. Gasper and Rahman, Basic hyper geometric series, Cambridge University press 1990.(Unit I-III)
2. BC Berndt Ramanujan's notebooks Part II Springer Verlag New York 1991.(Unit IV-V)

M.Sc. MATHEMATICS

SOFT CORE: MATH: 568 -THEORY OF PARTITIONS (4 Credits)

Objectives:

To study the basics of Hyper geometric series, Jacobi's triple product identity, Partition functions and Rank and crank of partitions.

Unit I:

Introduction to basic hyper geometric series, q- binomial theorem, Heine's transformation and Gaussian Polynomial.

Unit II:

Jacobi's triple product identity and its applications, bilateral series and its applications, theta functions.

Unit III:

Partition function and its generating function, Euler theorem for partition.

Unit IV:

Congruence properties of partition functions, Rogers Ramanujan Identities.

Unit V:

Rank and crank of partitions and restricted partitions.

Text Books

1. Bruce C. Berndt, Number Theory in the Spirit of Ramanujan, AMS (For unit I and II)
2. G. E. Andrews, The Theory of Partitions, Addison Wesley 1979.(For unit III, IV & V)

Reference Books:

1. Gasper and Rahman, Basic hypergeometric Series, Cambridge University Press 1990.
2. G.E Andrews, R. Askey and Ranjan Roy, Special functions, Cambridge University press 2000.
3. Bruce C. Berndt, Ramanujan's Notebooks Vol III, Springer, New York 1991.

M. Sc. MATHEMATICS

SOFT CORE: MATH-570: Introduction to Fuzzy Set (4 credits)

Objectives:

To study the basics of Fuzzy sets, Operations on Fuzzy sets, Functions on Fuzzy sets, Fuzzy controller and Fuzzy Data Analysis.

Unit 1: Basics on Fuzzy Set

Crispness-Vagueness-Fuzziness-Uncertainty-Fuzzy Set Theory- -Theoretic Operations for Fuzzy Set- Types of Fuzzy Sets- Operations on Fuzzy Set- Algebraic Operations- Set-Theoretic Operations.

Unit 2: Generalization of crisp mathematical concepts to fuzzy sets

Operations for Type2 Fuzzy Sets- Algebraic Operations with Fuzzy Numbers- Special Extended Operations- Extended Addition- Extended Product- Extended Subtraction- Extended Division- Extended Operations for LR-Representation of Fuzzy Sets.

Unit 3: Fuzzy Analysis

Fuzzy Functions on Fuzzy Sets-Integration of Fuzzy Functions-Integration of a Fuzzy Function over a Crisp Interval-Some Properties of Integrals of Fuzzy Functions-Integration of a (Crisp) Real-Valued Function over Fuzzy Interval-Fuzzy Differentiation.

Unit 4: Fuzzy Control

Origin and Objective-The Fuzzy Controller-Types of Fuzzy Controllers-The Mamdani Controller-Defuzzification-The Sugeno Controller- Design Parameters-Scaling Factors-Fuzzy Sets-Rules-Adaptive Fuzzy Control.

Unit 5: Fuzzy Data Analysis

Methods for Fuzzy Data Analysis-Algorithmic Approaches- Knowledge-Based Approaches-Dynamic Fuzzy Data Analysis- Similarity of Functions.

Text Book:

H.J. Zimmermann: Fuzzy set theory and its Applications, Springer Science + Business Media New York, 2001.

Reference Books:

George J. Klir and Bo Yuan: Fuzzy sets and Fuzzy Logic: Theory and Applications, Prentice – Hall of India Private Limited, New Delhi, 2000.

George Bojadziev and Maria Bojadziev, Fuzzy Sets, Fuzzy Logic, Applications, World Scientific Publishing Co.Pte.Ltd, Singapore, 1995.

M.Sc. MATHEMATICS

SOFT CORE: MATH-571 -CALCULUS OF VARIATIONS (4 Credits)

Objectives:

To study the basics of Functionals, Functionals depending on higher order derivatives, Variational problems, Noether's Theorem and Conservation laws.

Unit I: Functionals- some simple variational problems-The variation of a functional- A necessary condtion for an extremum- The simplest variational problem-Euler's equation-The case of several variables-A simple variable end point problem- The variational derivative-Invariance of Euler's equation. *[Chapter-1]*

Unit II: The fixed end point problem for n-unknown functions - Variational problem in parametric form- Functionals depending on higher order derivatives-Variational problems with subsidiary conditions. *[Chapter-2]*

Unit III: The general variational of a functional- derivation of the basic formula- End points lying on two given curves or surfaces- Broken extremals- The Weierstrass Erdmann conditions. *[Chapter-3]*

Unit IV: The canonical form of Euler equations- First integrals of the Euler equations- The Legendre transformation- Canonical transformations- Noether's Theorem- The principle of least action- Conservation laws- The Hamilton Jacobi equation- Jacobi theorem. *[Chapter-4]*

Unit V: The second variation of a functional- The formula for the second variation, Legendre conditions- Sufficient conditions for a weak extremum.. *[Chapter-5]*

Text Book:

I.M. Gelfand and S.V.Fomin, *Calculus of Variations*, Dover Publications, 2000.

Reference Books:

1. A.S. Gupta, *Calculus of Variations with Applications*, Prentice-Hall of India, 2008.
2. M.L. Krasnov, G.I. Makarenko and A.I. Kiselev, *Problems and Exercises in the Calculus of Variations*, Mir Publishers, Moscow 1975.

M. Sc. MATHEMATICS

SOFT CORE:- MATH-572: Probability and Statistics (4 Credits)

Objectives:

To study the basics of Probability density function, Special distributions, Distributions of functions of random variables, Sampling theory and Statistical inference.

Unit I: The probability set function – Random variables – Probability density function – Distribution function – Mathematical expectation – Special mathematical expectations – Chebyshev's Inequality – Conditional probability – Marginal and conditional distributions – Stochastic independence. *[Chapters 1 and 2 (except 1.1and 1.2) of the text book]*

Unit II: Some special distributions: The Binomial and related distributions – The Poisson distribution – The Gamma and Chi-Square Distributions – The Normal distribution- The Bivariate normal distribution. *[Chapter -3 of the text book]*

Unit III: Distributions of functions of random variables - Sampling theory – Transformations of variables of the discrete type – Transformations of variables of the continuous type – The b, t and *F* distributions- Distributions of order statistics- The moment generating function technique. *[Chapter 4 [sections 4.1 to 4.7] of the text book.]*

Unit IV: The distributions of $\bar{X}$ and nS^2/σ^2 - Expectations of functions of random variables – Limiting distributions: Limiting moment generating functions – The Central limit theorem. *[Chapter-4 [sections 4.8 and 4.9] and Chapter-5 of the text book.]*

Unit V: Introduction to statistical inference: Point Estimation – Confidence intervals for means – Confidence intervals for differences of means - Confidence intervals for variances. *[Chapter-6 of the text book]*

Text Book:

Robert V. Hogg and Allen T. Craig , *Introduction to Mathematical Statistics* (Fifth Edition) Pearson Education, 2005.

Reference Books:

1. Paul L.Meyar, *Introductory to Probability and Statistical Applications*, Oxford&IBH Publishers Co. Pvt .Ltd, 1969.
2. Arnold Naiman, Gene Zirkel and Robert Rosenfield, *Understanding Statistics*, McGraw-Hill, 1986.
3. William Feller, *An Introduction to Probability Theory and its Applications, Vol.I*, John Wiley, Third Edition, 2008.
4. A.Mood, F.Graybill, and D.Boes, *Introduction to the Theory of Statistics*, Tata McGraw Hill (Third Edition) 2008.

PONDICHERRY UNIVERSITY

DEPARTMENT OF STATISTICS

SYLLABUS FOR M.Sc. STATISTICS
(CBCS Pattern)
Effective from the Academic Year 2022-2023

PONDICHERRY UNIVERSITY
PUDUCHERRY 605 014

M.Sc. STATISTICS (CBCS - Semester Pattern)

REGULATIONS

Aim of the Course

The Degree of Master of Science in Statistics aims to train the students in the development and applications of Statistical techniques for analyzing data arising in the scientific investigation of problems in various disciplines. It is also proposed to provide first hand practical experience in handling modern statistical software in the analysis of such data.

Eligibility for admission

Candidates for admission to the first year of the M.Sc. (Statistics) degree programme shall be required to have passed the B.Sc. degree examination of any Indian University recognized by the University Grants Commission with Statistics as the main subject or Mathematics as the main subject with Mathematical Statistics as one of the minor subject and a minimum of 55% marks in the main and allied subjects.

Duration of the Course

The course shall be of two years duration spread over four semesters. The maximum duration to complete the course shall not be more than 8 semesters.

Eligibility for admission to Examination

A candidate shall be permitted to appear for the M.Sc. examination in a subject of study only if he/she secures not less than 70% attendance in the subject concerned.

Medium : The medium of instruction shall be English.

Passing Minimum and Weight age of marks

The weight age of marks for Continuous Internal Assessment (CIA) and end semester examinations shall be 40 and 60 respectively. As per the Choice Based Credit System regulations of the Pondicherry University, a student is declared as pass in a given subject he / she secures

(a) A minimum of 40% marks in end-semester exam and

(b) A minimum of 50% marks in aggregate when Internal assessment and End-Semester marks are added together

Supplementary Exam

(a) A failed student who meets the attendance requirement (70%) and has a minimum of 40% in the Internal Assessment marks may be permitted to register for the next End Semester examination in the following semester itself

(b) Students who have failed due to insufficient attendance and / or less than 40% in the Internal Assessment marks should repeat the course as and when it is offered.

Continuous Internal Assessment

The weightage of 40 marks for Continuous Internal Assessment component shall consist of the following:

a)	Internal Assessment Tests (two)	(2 x 15)	= 30 marks
b)	Seminars/Assignments/Presentations/Viva etc.	(1 x 10)	= 10 marks
	Internal Total		= 40 marks

Choice Based Credit System (CBCS)

The M.Sc. Statistics program is offered through a unique CBCS. The salient feature of the CBCS is that the program is offered through credit based courses. Subjects are divided into Hard Core and Soft Core. Hard Core subjects are compulsory. The students have the choice to select from among the list of soft core subjects. Soft core subjects are similar to elective subjects.

A student is expected to complete a minimum of 72 credits within four semesters. Students are assessed and awarded letter grades based on their performances in the respective courses.

M.Sc. (STATISTICS) – COURSE STRUCTURE
(With effect from 2022-23 onwards)

Objectives

The present course is intended to provide a platform for talented students to undergo higher studies in the subject as well as to train them to suit the needs of the society. Apart from teaching core Statistics subjects, the students are also trained to handle real life problems through practical classes. As part of the course, the students are taught some programming languages and also trained in various statistical softwares such as SPSS, R Programming, MINITAB.

Eligibility

B.Sc. degree in Statistics or Mathematics with Mathematical Statistics as a minor subject with a minimum 55% of marks.

Duration of the Course

The course shall be of two years duration spread over four semesters. The maximum duration to complete the course shall not be more than 8 semesters.

Medium

The medium of instruction shall be English.

Choice Based Credit System (CBCS)

The M.Sc. Statistics program is offered through a unique CBCS. The salient feature of the CBCS is that the program is offered through credit based courses. Subjects are divided into Hard Core and Soft Core. Hard Core subjects are compulsory. The students have the choice to select from among the list of soft core subjects. Soft core subjects are similar to elective subjects.

A student is expected to complete a minimum of 72 credits within four semesters. Students are assessed and awarded letter grades based on their performances in the respective courses.

PONDICHERRY UNIVERSITY
CHOICE BASED CREDIT SYSTEM
M.Sc. STATISTICS SYLLABUS
Effective from the Academic Year 2022 – 2023

Semester	Course Code	Title of the Course	Course Type	No. of Credits
First Semester				
I Semester	STAT-411	Linear Algebra & Matrix Theory	Hard Core	4
	STAT-412	Probability Theory	Hard Core	4
	STAT-413	Distribution Theory	Hard Core	4
	STAT-414	Programming in R (Lab Based)	Hard Core	4
	STAT-415 to STAT 417	Any One Soft Core Course among set of three are allowed	Soft Core	3
Second Semester				
II Semester	STAT-421	Theory of Estimation	Hard Core	4
	STAT-422	Sampling Theory	Hard Core	4
	STAT-423	Stochastic Processes	Hard Core	4
	STAT-424	Regression Analysis	Hard Core	4
	STAT-425	Statistical Laboratory - I Based on Stat-421, Stat-422 and Stat-424 (based on Calculator, Excel & R Programming as per suitability)	Hard Core	3
	STAT-426 to STAT 428	Any One Soft Core Course among set of three are allowed	Soft Core	3
Third Semester				
III Semester	STAT-531	Multivariate Statistical Analysis	Hard Core	4
	STAT-532	Testing of Statistical Hypotheses	Hard Core	4
	STAT-533	Linear Models and Design of Experiments	Hard Core	4
	STAT-534	Statistical Laboratory - II Based on Stat-531,Stat-532 and Stat-533 (based on Calculator, Excel & R Programming as per suitability)	Hard Core	3
	STAT-535 to STAT 538	Any Two Soft Core Courses among set of Four are allowed	Soft Core	3
			Soft Core	3
Fourth Semester				
IV Semester	STAT-541@	Project Work & Comprehensive Viva	Soft Core	12
	STAT-542 to STAT 546	Any FOUR relevant soft-core courses either within or outside the department	Soft Core	3
			Soft Core	3
			Soft Core	3
			Soft Core	3
Total Credits: 72-(Mandatory)				

@ Students can choose either STAT-541 or any FOUR courses from STAT-542 to STAT-546 as soft-core courses in the Final Semester

Soft Cores Courses in 1st Semester	Soft Cores Courses in 2nd Semester	Soft Core Courses in 3rd Semester	Soft Cores Courses in 4th Semester
STAT-415: Optimization Techniques	STAT-426: Survival Analysis	STAT-535: Reliability Theory	STAT-542: Actuarial Statistics
STAT-416: Statistical Quality Control	STAT-427: Decision Theory	STAT-536: Bayesian Inference	STAT-543: Data Analysis Using Statistical Packages
STAT-417: Econometrics	STAT-428: Biostatistics	STAT-537: Queuing & Inventory Theory	STAT-544: Demographic Techniques
		STAT-538: Statistical Data Mining Methods	STAT-545: Time Series Analysis
			STAT-546: Total Quality Management

STAT411 - LINEAR ALGEBRA AND MATRIX THEORY CREDITS: 4

Course Objectives: Understand vector spaces, subspaces and change of basis, Understand linear transformations. Need of Generalized inverse and Moore Penrose inverse of the matrix and to understand bilinear form and quadratic form

Course Outcomes: Compute the inverse of rectangular matrix, Find the matrix representation of linear transformations, Understand applications of vector spaces and subspaces

Unit I

Vector Spaces, Sub-spaces, Basis of a vector space – Vector spaces with inner products Gram-Schmidt orthogonalization.

Unit II

Linear transformation (LT) – Properties – Matrix of a linear transformation – Matrix of composite transformation – Matrix of an inverse transformation – Change of basis Orthogonal transformation - Dual space.

Unit III

Linear equations – Solution space and null space – Sylvester's law of nullity – Generalized inverse of a matrix – Moore – Penrose inverse

Unit IV

Eigen values and Eigen vectors of an LT – left Eigen vectors, right Eigen vectors, Diagonalizable LT – Lambda matrix, Composition of lambda matrices, Operator polynomial, Cayley-Hamilton theorem and minimal polynomial for an LT – Eigen values of matrix polynomials.

Unit V

Bilinear forms Canonical reduction – Sylvester's law of inertia-Definitions of quadratic form Lagrange's reduction – Kronecker's reduction Reduction involving the Eigen values of the matrix, Generalized Eigen value problem.

Books for Study

Biswas S. (2012), Text book of Matrix Algebra, Third Edition, PHI Learning Private Limited, New Delhi.

1. Bhattacharya P.B., Jain S.K., Nagpaul S.K. (2012), First Course in Linear Algebra, New Age International (P) Ltd, New Delhi.
2. Parashar B.P. (1989), Linear Algebra, CBS Publishers and Distributors, Delhi.
3. Rao C.R. (2009), Linear Statistical Inference and its Applications, Second Edition, John Wiley and Sons

Books for Reference

1. Friedberg S.H., Insel A.J. and Spence L.E. (2014), Linear Algebra, Pearson Education.
2. Gilbert J. and Gilbret L. (2005), Linear Algebra and Matrix Theory, Academic Press.
3. Lipschutz S. and Lipson M. (2009), Schaum's outlines, Linear Algebra, Fourth Edition, McGraw Hill Company.
4. Rao A.R. and Bhimasankaram P. (2000), Linear Algebra, Hindustan.
5. Searle S.R. and Khuri A.I. (2017), Matrix Algebra useful for Statistics, Second Edition, John Wiley and Sons, New Jersey.
6. Searle S.R. and Gruber MHI (2016), Linear Models, Second Edition, John Wiley and Sons, New Jersey.

STAT412 PROBABILITY THEORY **CREDITS: 4**

Course Objectives: The objective for this course is to learn the theory and methods of probability theory, and be able to apply and communicate them in practice.

Course Outcomes: A student will be able to: Recognize the role of probability theory in the sciences, communicate the ideas and results of probability; Graduate students will also be able to formulate and apply the definitions of convergence in distribution and in probability, formulate scientific problems involving randomness in mathematical terms, and use probability in their careers

Unit I

Algebra of sets - fields and sigma-fields, Inverse function – Measurable function – Probability measure on a sigma field – simple properties - Probability space - Random variables and Random vectors – Induced Probability space – Distribution functions – Decomposition of distribution functions.

Unit II

Expectation and moments – definitions and simple properties – Moment inequalities – Holder, Jenson, Chebyshev, Markov Inequalities– Characteristic function – definition and properties – Inversion formula.

Unit III

Convergence of a sequence of random variables - convergence in distribution, convergence in probability, almost sure convergence and convergence in quadratic mean - Weak convergence of distribution functions – Slustky theorem - Helly-Bray theorem.

Unit IV

Definition of product space – Fubini's theorem (statement only) - Independence of two events – Independence of classes – Independence of random variables – properties – Borel zero –one law.

Unit V

Law of large numbers - Khintchin's weak law of large numbers, Kolmogorov strong law of large numbers (statement only) – Central Limit Theorem – Lindeberg – Levy theorem, Linderberg – Feller theorem (statement only), Liapounov theorem – Relation between Liapounov and Linderberg – Feller forms – Radon Nikodym theorem and derivative (without proof) – Conditional expectation – definition and simple properties.

Books for Study

1. Bhat, B. R. (2007): Modern Probability Theory, 3rd edition, New Age International Pvt. Ltd.
2. Ash, R.B. (1972): Real Analysis and Probability, Academic Press.
3. Rohatgi, V.K. and Saleh (2002): An Introduction to Probability Theory and Mathematical Statistics, John Wiley

Books for Reference

1. Athreya K B and Lahiri S N (2005):Measure Theory, Hindustan Book Agency.
2. Tucker, H.G. (1967): A Graduate course in Probability, Academic Press.
3. Burill, C.W. (1972): Measure, Integration and Probability, McGraw Hill.
4. Chow, Y.S. and Teicher, H. (1979): Probability Theory, Springer.
5. Loeve, M. (1985). Probability Theory, 3rd edition, Springer..
6. Resnick S.I. (2001): A Probability Path, Birkauser.
7. Basu A K. and A Bandopadhyay (2012): Measure Theory and Probability, PHI Learning Pvt. Ltd.

STAT 413 – DISTRIBUTION THEORY **CREDITS: 4**

Course Objectives: This course is intended to train students in mathematical techniques of constructing various univariate, bivariate and multivariate distributions.

Course Outcomes: Students will learn about the characterizations of univariate, bivariate and multivariate distributions, its applications and theory of order statistics.

Unit I

Brief review of distribution theory, distribution of functions of random variables - Laplace, Cauchy, Inverse Gaussian, Lognormal, Logarithmic series and Power series distributions - Multinomial distribution

Unit II

Bivariate Binomial – Bivariate Poisson – Bivariate Normal- Bivariate Exponential of Marshall and Olkin - Compound, truncated and mixture of distributions, Concept of convolution

Unit III

Multivariate normal distribution (Definition and Concept only) - Sampling distributions: Non-central chi-square, t and F distributions and their properties - Distributions of quadratic forms under normality-independence of quadratic form and a linear form- Cochran's theorem

Unit IV

Order statistics, their distributions and properties- Joint and marginal distributions of order statistics - Distribution of range and mid range - Extreme values and their asymptotic distributions (concepts only)

Unit V

Empirical distribution function and its properties - Kolmogorov-Smirnov distributions -Life time distributions - Exponential and Weibull distributions - Mills ratio -Distributions classified by hazard rate.

Books for Study

1. Mood M., Graybill F.A. and Boes D.C.(2001) : Introduction to the Theory of Statistics, Tata McGraw-Hill, New Delhi.
2. Johnson, N.L,Kotz, S. and Balakrishnan, N. (1994): Continuous Univariate Distributions, Vol.1 &2, Wiley Series in Probabilty and Statistics.
3. Johnson, N.L , Kemp A.W. & Kotz, S. (1994): Univariate Discrete Distributions, Wiley Series in Probabilty and Statistics
4. David H. A. and Nagaraja H.N.(2003): Order Statistics, 3/e, John Wiley & Sons.

Books for Reference

1. Rao C. R.,(1973): Linear Statistical Inference and its Applications, Wiley Eastern Ltd, New Delhi.
2. Dudewicz, E.J and Mishra, S.N(1980): Mathematical Statistics, John Wiley, NY.
3. Kocherlakota S and Kocherlakota K(1992): Bivariate Discrete distributions, M. Dekker.
4. Balakrishnan N and Lai C.D.(2009): Continuous Bivariate Distributions, Springer.
5. Rohatgi, V.K. and Saleh (2002): An Introduction to Probability Theory and Mathematical Statistics, John Wiley.
6. Parimal Mukhopadhyay(2006):Mathematical Statistics, 3/e, Books and Allied (P) Ltd, Kolkata.

STAT 414–PROGRAMMING IN R (Lab. Based) CREDITS: 4

This course is partly theory and mostly lab oriented. There will be 2 hours of lectures per week and a minimum of 3 hours of lab. (One credit is equal to one hour of lecture or two hours of Lab.)

Course Objectives: This course is intended to train students to get knowledge in performing statistical data analysis using R language.

Course Outcomes: Students will be able to write program in R language for a various data analytic techniques which will help them in getting placed in analytic companies.

Unit I

R language Essentials: Expressions and objects, Assignments, creating vectors, vectorized arithmetic, creating matrices, operations on matrices, lists, data frames – creation, indexing, sorting and conditional selection ; examples.

Unit II

R Programming: conditional statements – if and if else; loops – for, while, do-while; functions – built-in and user defined; Data entry – reading from text file, data editor; examples.

Unit III

Descriptive Statistics and Graphics: Obtaining summary statistics; generating tables; Bar plots, Pie charts, Box plots, Histogram; exercises.

Unit IV

Probability and Distributions: Random sampling and combinatory; obtaining density, cumulative density and quantile values for discrete and continuous distributions; generating samples from discrete and continuous distributions; Plotting density and cumulative density curves; Q-Q plot.

Unit V

Correlation: Pearson, Spearman and Kendall's correlation; Regression – fitting, obtaining residuals and fitted values; one and two sample tests for mean and variance – one way and two way ANOVA.

Books for Study

1. Michael J.Crawley (2007), The R Book, John Wiley and Sons Ltd.
2. Peter Dalgaard (2008), Introductory Statistics with R, 2nd edition, Springer.

Lab Exercises:

1. Operations on vectors and matrices
2. Creating and manipulating data frames.
3. Writing user defined functions for finding arithmetic mean, median, factorial, matrix addition and multiplication.
4. Bar and Pie charts.
5. Box plots for single and multiple groups.
6. Density and cumulative density plots for Binomial, Poisson, Normal and exponential distributions.
7. Checking Normality using Histogram and Q-Q plot.
8. Correlation coefficient – Pearson's, Spearman and Kendall's Tau.
9. Fitting simple linear and multiple linear regressions.
10. One sample and two sample t test.
11. One way and two way ANOVA.

STAT 421 - THEORY OF ESTIMATION **CREDITS: 4**

Course objectives: The objective of the course is to learn the basic concepts in estimation theory like consistency, sufficiency, UMVUE and their applications. To study different methods of estimation and their properties.

Course outcomes: Students will gain knowledge about various statistical estimation methods and their applications.

Unit I

Parametric point estimation – properties of estimators – Consistency and its different forms Sufficient condition for consistency- Unbiasedness – sufficient statistics – Factorization theorem – Distributions admitting sufficient statistic – Exponential and Pitman families procedure for finding minimal sufficient statistic.

Unit II

The information measure – Cramer – Rao (CR) inequality – Chapman – Robbins (KCR) inequality (single parameter case only) – Bhattacharya inequality (single parameter case only) – minimum variance bound estimator- Invariant (equivariant) estimators (concepts only)

Unit III

Uniformly minimum variance unbiased estimators (UMVUE)- condition for the existence of UMVUE- Completeness and Bounded completeness- Relation between complete statistic and minimal sufficient statistic- Rao – Blackwell Theorem- Lehmann – Scheffe's theorem.

Unit IV

Methods of estimation – method of moments and its properties – method of maximum likelihood and its properties-Large sample properties of MLE - Method of minimum chi-square and its properties – Methods of least squares

Unit V

Interval estimation – Pivotal method of construction – shortest confidence intervals and their construction (minimum average width) – Construction of shortest confidence intervals in large samples. Decision Theory: Simple problems involving quadratic error loss function – Elementary notions of minimax estimation – Simple illustrations.

Books for Study

1. Rajagopalan M and Dhanavanthan P (2012): Statistical Inference, PHI Learning, New Delhi.
2. Casella, G. and Berger, R.L. (2002):Statistical Inference, Duxubury Process, Belmont, USA.
3. Rohatgi, V.K. (2003): Statistical Inference, Dover Publications, New York.

Books for Reference

1. Lehmann, E.L and Casella G(1998) :Theory of Point Estimation, 2/e, Wiley Eastern Ltd.
2. B.K.Kale and K.Muralidharan (2015), Parametric Inference – An Introduction, Narosa Publishing House
3. Kale, B.K. (1999): A First course on Parametric Inference , Narosa Publishing House.
4. Zacks,S. (1981): Parametric Statistical Inference, John Wiley, NY.
5. Srivastava, Khan and Srivastava (2014), Statistical Inference: Theory of Estimation, PHI, India

STAT 422 – SAMPLING THEORY CREDITS: 4

Course objectives: The objectives of this course are to teach basic ideas of sampling from an applied perspective and to provide uses in real life problems. To create the knowledge understanding census and sample survey sampling methods and applying them in practice.

Course Outcomes: Recognize the role of sampling theory in the sciences, it helps in learning various probability and non-probability sampling techniques and which experience how to draw a random sample and what amount of sample with respect to population to be drawn. which will be useful to the students and confidence building in taking decision of any object of the real life problems.

Unit I

Preliminaries – Sampling Designs – Simple random sampling– Stratified Random Sampling – Allocation problems – Systematic Sampling Schemes – Linear, Circular, Balanced and Modified systematic sampling methods

Unit II

Probability Proportional to size sampling- Inclusion Probabilities – Horvitz-Thompson estimator – Yates –Grundy Form –Midzuno Sampling design – PPSWOR- Des-Raj's Ordered estimator – Murty's unordered estimators

Unit III

Ratio estimators and their properties in Simple Random Sampling – Ratio estimators in Stratified Random sampling – Regression Estimators, Regression estimators in Stratified Random Sampling – Multivariate Ratio estimators and Multivariate Regression Estimators

Unit IV

Cluster Sampling: Equal cluster sampling – Estimators of mean and variance, optimum cluster size, Unequal cluster sampling – Estimators of mean and variance – Two stage sampling – variance of the estimated mean – Double Sampling for stratification and Ratio estimation

Unit V

Randomized response methods – Warner's, Simmon's and Two Stage response methods – Sources of errors in Surveys – Mathematical model for the effects of call-backs and the errors of measurement

Books for Study

1. Cochran, W.G. (1977): Sampling Techniques, 3/e, Wiley Eastern Ltd,.
2. Gupta, A. K. and Kabe D.G, (2011): Theory of Sample Surveys, World Scienific Publishing Co. Pte. Ltd., Singapore
3. Singh, D. and Choudhary, F.S (1986): Theory and Analysis of Sample Survey Designs, Wiley Eastern Ltd,.
4. Sukhatme PV. Etal. (1984): Sampling Theory of Surveys with Applications, Iowa State University Press and ISARI Publications, New Delhi

Books for Reference

1. Desraj and Chandhok P.(1998): Sampling Theory, Narosa Publications, New Delhi
2. Kish, L(1995) : Survey Sampling, John Wiley and Sons.
3. Murthy, M.N (1979): Sampling Theory and Methods, Statistical Publishing Society, Calcutta.

5. Sarjinder Singh (2004): Advanced Sampling – Theory with Applications, Kluwer Publications

STAT 423 – STOCHASTIC PROCESSES **CREDITS: 4**

Course Objectives: To understand various Processes of exploring the probability patterns, to understand Random Processes and finding Transition Probabilities, to formulate probability distributions with different types of stochastic processes and to get acquaintance with different applications of stochastic processes.

Course Outcomes: After completion of the course the student can learn about

1. Markov processes and development of transition probability matrices
2. Derivations of probability functions with the approaches of differential equations and Markov chains
3. The processes namely Birth, Death, Poisson, Weiner, Renewal, Branching and Time series Processes.
4. Deriving different statistical characteristics with above mentioned processes.

Unit I

Stochastic processes: Definition and classification – Markov chain– Examples (Random walk, Gambler's ruin problem)- Transition Probability Matrices - Higher Transition Probabilities - Bernoulli Trails - classification of states and chains - theorems and problems; Basic limit theorem of renewal theory.

Unit II

Poisson Process: Overview- postulates- probability mass function -Properties - inter related probability distributions- Generalization- Arrival process, Departure Process, Pure Birth(Yule-Furry) process, Birth and Death Processes, Birth-Death and Migrations processes- Chapman Kolmogorov Equations- Compound Poisson Process - Transition density matrix and Poisson Process.

Unit III

Weiner Process: Brownian Motion, Joint probabilities, Wiener process, Differential equations, Kolmogorov equations, First passage time distribution; Branching Process: properties of generating functions of branching processes, Probability of Ultimate extinction, Distribution of Total number of Progeny, Age dependent Branching process

Unit IV

Renewal processes: Definition, examples and relationships between terms – renewal interval, delayed recurrent event, Renewal Processes in continuous time, Renewal Function and renewal density, renewal equation, renewal theorems – Study of residual life time process

Unit V

Stationary processes and Time Series: Stationary Processes, second order, stationarity, Gaussian Processes, weakly and strongly stationary process; Time Series- White Noise process, first order Markov process, MA and AR processes, Autoregressive process of order two, ARMA process verification of stationarity.

Books for Study

1. Karlin, S and Taylor, H.M(1975): A First Course in Stochastic Processes, Academic Press, New York.
2. Medhi,J (2009): Stochastic Processes, 3/e, New age International.
3. Bhat B.R.(2004): Stochastic Models: Analysis and Applications, New Age Publications

Books for Reference

1. Bhattacharya and Waymire, E.C. (1992): Stochastic Process with Applications John Wiley and sons.
2. Jones,P.W and Smith,P(2001): Stochastic Processes: An Introduction, Arnold Press.
3. Cinlar, E(1975): Introduction to Stochastic Processes, Prentice-Hall Inc., New Jersey.
4. Cox, D.R and Miller, H.D(1983) : Theory of Stochastic Processes – Chapman and Hall, London,Third Edition
5. Ross S.M (1983): Stochastic Process, Wiley.
6. G. Grimmett and D. Stirzaker (2001): Probability and Random Processes, 3/e, OUP Oxford.

STAT 424 REGRESSION ANALYSIS CREDITS: 4

Course Objectives: This course is intended to train students to get knowledge in theoretical and practical applications of regression techniques.

Course Outcomes: Students will be able to perform predictive analytics for real life problems.

Unit I

Review of Linear Models Full rank linear model – least square estimators of the parameters and their properties – Gauss-Markov theorem – Model in centered form – Estimators under normality assumption and their properties – Coefficient of determination – Generalized least squares – misspecification of the error structure and the model.

Unit II

Test for overall regression and for a subset of the parameters – test in terms of R^2 – General Linear Hypothesis testing – special cases – confidence region for the parameters and the mean – prediction intervals – likelihood ratio tests for the parameters – study of the residual outliers and influential observations

Unit III

Selection of input variables and model selection – Methods of obtaining the best fit – Stepwise regression, Forward selection and backward elimination – Multicollinearity – Collinearity diagnostics – Causes, Consequences and Remedy –Departure from normality

Unit IV

Introduction to general non-linear regression – Least squares in non-linear case – Estimating the parameters of a non-linear system Non-linear growth models – Concept of non-parametric regression

Unit V

Robust regression – Linear absolute deviation regression – M estimators – least squares approach based on M-estimators – Re-sampling procedures for regression models – Bootstrap and Jacknife methods and its properties (without proof).

Books for Study

1. Alvin C. Rencher (2000): Linear Models in Statistics, John Wiley & Sons, New York (Chapters 7,8 & 9 for Unit I & II)
2. Draper, N and Smith, H (1998): Applied Regression Analysis, 3rd Edition, Wiley-Interscience.
3. Elizabeth C. Peck, Douglas C. Montgomery, G. Geoffry Vinning (2006): Introduction to Linear Regression Analysis, 3/e, John Wiley & Sons.

Books for Reference

1. Chaterjee, S, Ali S. Hadi (2013): Regression Analysis by Example, 5thedition, John Wiley.
2. Searle, S.R. (1997): Linear Models, John Wiley.
3. Thomas P.Ryan(2006): Modern Regression Methods, John Wiley and Sons,Inc.
4. Seber G.A.F and Wild C.J. (2003): Nonlinear Regression, John Wiley & Sons

STAT 425 - STATISTICAL LABORATORY – I **CREDITS: 3**

(Based on STAT 421, STAT 422 and STAT 424) (based on Calculator, Excel & R Programming as per suitability)

Course Objectives: This course is intended to train students to get knowledge in practical applications of Estimation Theory, Sampling Theory and Linear models

Course Outcomes: Students will be able to perform analysis of data sets using various statistical software.

I. Estimation (20 marks)

1. MLE and Standard error of ML estimators.
2. MLE through the method of successive approximation.
3. MLE for truncated distribution.
4. Method of Moments
5. Method of Minimum Chi-square
6. Method of Least square
7. Interval estimation: Confidence interval for mean,
8. Interval estimation - difference of means,
9. Interval estimation - variance and ratio of variances.

II. Sampling Theory (20 marks)

1. Simple random sampling methods of drawing sample – Estimation of the population total and variance estimation.
2. PPSWR – Hurwitz Thompson estimator - Des Raj ordered estimator – Murthy's unordered estimator – Midzuno scheme.
3. Linear and circular systematic sampling.
4. Stratified sampling – SRS, PPSWR, PPSWOR
5. Cluster sampling – of equal sizes.
6. Ratio, Regression and Difference estimation estimators.

III Linear Models and Regression Analysis (20 marks)

1. Fitting of Multiple linear regression model
2. Residual Analysis for model adequacy, detection of outliers and influential observations
3. Variable Selection procedures
4. Collinearity Diagnostics

STAT 531 – MULTIVARIATE STATISTICAL ANALYSIS CREDITS: 4

Course Objectives: To learn about multivariate normal distribution and its characterizations. To study the multivariate tests for mean vectors and covariance matrices. To know the theoretical concepts and applications of multivariate statistical methods like Discriminant Analysis, Principal Component Analysis, Canonical Correlation Analysis and Factor Analysis

Course Outcomes: Enable to understand the mathematical framework in multivariate statistical analysis and how to implement them in practical situations.

Unit I

Multivariate normal distribution– Marginal and conditional distributions – characteristic function. Maximum likelihood estimation of the parameters of Multivariate Normal and their sampling distributions – Inference concerning the mean vector when covariance matrix is known

Unit II

Total, Partial, Multiple correlation in the Multivariate setup – MLEs of Total, Partial and Multiple correlation coefficients. Sampling distributions of Total and Multiple Correlation in the null case. Hotelling T^2 statistic, derivation and its distribution –Uses of T^2 statistic - relation between T^2 and D^2– Mahalanobis D^2 statistic and its distribution

Unit III

Generalized variance – Wishart distribution (statement only) – Properties of Wishart distribution – Test for covariance matrix – Test for equality of covariance matrices

Unit IV

Classification problems – Classification into one of two populations (known and unknown dispersion matrix) – Classification in to one of several populations – Fisher's Linear discriminant function

Unit V

Principal components –properties, Extraction of Principal components and their variances Canonical correlation – Estimation of canonical correlation and variates. Factor analysis – Mathematical model- Estimation of Factor Loadings — Concept of factor rotation – Varimax criterion

Books for Study

1. Anderson, T.W. (2003) : An Introduction to Multivariate Statistical Analysis, Wiley Eastern Ltd.
2. Johnson, R. A and. Wichern D.W (2007): Applied Multivariate Statistical Analysis, 6 /e, Prentice-Hall of India Private Ltd., New Delhi.

   Giri, N.C(2003): Multivariate Statistical Inference, Academic Press, NY

Books for Reference

1. Morrison, F(1985): Multivariate Statistical Methods, Mc Graw Hill Book Company.
2. Rao, C.R(1998): Linear Statistical Inference and its Applications, Wiley Eastern Ltd,.
3. Alvin C. Rencher(2002): Methods of Multivariate Analysis, 2/e, Wiley Interscience
4. Srivastava M.S. and Khatri C.G.(1979):Introduction to Multivariate Analysis, Elsevier

STAT 532 – TESTING OF STATISTICAL HYPOTHESES CREDITS: 4

Course Objectives: To emphasize on the theoretical concepts of testing single and composite hypotheses under parametric and non-parametric set up.

Course Outcomes: Enable to understand the mathematical framework in testing problems and how to implement them in practical situations.

Unit I

Randomized and non-randomized tests, Neyman – Pearson fundamental lemma, Most powerful tests, Uniformly most powerful test, Uniformly most powerful test for distributions with monotone likelihood ratio, Generalization of fundamental lemma and its applications

Unit II

Unbiasedness for hypothesis testing, Uniformly most powerful unbiased tests, Unbiased tests for one parameter exponential family, Similar test and complete sufficient statistics, Similar tests with Neyman structure, Locally most powerful tests.

Unit III

Invariant tests, maximal invariants, Uniformly most powerful invariant tests, Consistent tests, Likelihood ratio test, its properties and its asymptotic distribution, Applications of the LR method.

Unit IV

Non-parametric tests: Goodness of fit test : Chi-square and Kolmogorov Smirnov test - Test for randomness, Wilcoxon Signed rank test – Two sample problem: Kolmogrov-Smirnov test, Wald-Wolfowitz run test, Mann-Whitney U test, Median test, Kruskal Wallis test and Friedman's test

Unit V

Sequential tests: Basic Structure of Sequential tests – Sequential Probability Ratio Test (SPRT) and its applications – Determination of the boundary constants – Operating Characteristic and expected sample size of SPRT – Optimum properties of SPRT.

Books for Study

1. Rajagopalan M and Dhanavanthan P (2012): Statistical Inference, PHI Learning, New Delhi.
2. Lehmann, E.L and Joseph P. Romano (2005): Testing Statistical Hypotheses, 3/e, Springer
3. Rohatgi, V.K.(2003): Statistical Inference, Dover Publications,.
4. Gibbons, J.D. (1985) : Non Parametric Statistical Inference , 2/e , Marckel Decker.

Books for Reference

1. Casella, G & Berger, R.L (1990):Statistical Inference , Duxubury Press, Belmont. USA
2. Ghosh,B.K(1970): Sequential Tests of Statistical Hypotheses, Addison Wesley.
3. Parimal Mukhopadhyay(2006):Mathematical Statistics, 3/e, Books and Allied (P) Ltd, Kolkata.
4. Manoj Kumar Srivastava and Namita Srivastava (2009): Statistical Inference – Testing of Hypotheses, Prentice Hall of India

STAT 533 – LINEAR MODELS & DESIGN OF EXPERIMENTS CREDITS: 4

Course Objectives: Understand the need of experimental design, understand the link between linear models and design of experiments, Understand the principles of Design of experiments, Understand different design of experiments.

Course Outcomes:

(1) Able to do understand the logic behind a particular design.
(2) Formulation of specific design in mathematical form.

Unit I

Full rank linear model – least square estimators of the parameters and their properties – Gauss-Markov theorem – Model in centered form – Estimators under normality assumption and their properties – Coefficient of determination – Generalized least squares – misspecification of the error structure and the model.

Unit II

Notion of design matrix- general analysis of design models (Inter and Intra Block analysis) – C Matrix and its properties – Expected Mean Squares (EMS) and its uses- Algorithm for calculating EMS – Two way elimination of heterogeneity – Orthogonality – Connectedness and resolvability

Unit III

Principles of scientific experimentation – Basic Designs: Overview of Completely Randomized Design (CRD), Randomized Block Design (RBD) and Latin Square Design (LSD) – Analysis of RBD (with one observation per cell, more than one but equal number of observations per cell) – Derivation of one and two missing values: Iterative and non-iterative methods – Loss of Efficiency due to missing values- Multiple comparison test: Least Significant Difference, Student Newman Kuel , Duncan's Multiple Range, Tukey tests.

Unit IV

Balanced Incomplete Block Design (BIBD)– Types of BIBD – Simple construction methods – Concept of connectedness and balancing – Intra Block analysis of BIBD – Recovery of Inter Block information – Partially Balanced Incomplete Block Design with two associate classes – intra block analysis only - Split plot and strip plot design and their analysis.

Unit V

Factorial experiments: 2^2, 2^3, 2^4 and 3^2, 3^3 experiments and their analysis – Complete and Partial Confounding - Fractional Replication in Factorial Experiments

Books for Study

1. Das, M.N. and Giri, N.C(1979): Design and Analysis of Experiments, Wiley Eastern Ltd,
2. Douglas C. Montgomery (2009) : Design and Analysis of Experiments, 7/e, John Wiley and Sons,
3. Graybill, F.A(1961) : An Introduction to Linear Statistical Models, Mc Graw Hilll Book Company

Books for Reference

1. John, P.W.M (1971): Statistical Design and Analysis of Experiments, Mc Graw Hill Book Company.
2. Kempthorne, O(1966): The Design and Analysis of Experiments, John Wiley and Sons.

3. Ragahavarao, D(1971): Constructions and Combinatorial Problems in Design of Experiments, John Wiley and Sons.
4. Searle, S.R(1987) : Linear Models, John Wiley and Sons.
5. Cochran .W.G. and Cox .G.M. (1995): Experimental designs, 4/e, Wiley.
6. Cobb G.W.(1998): Introduction to Design and Analysis of Experiments.
7. Parimal Mukhopadhyay(2005):Applied Statistics, 2/e, Books and Allied (P) Ltd, Kolkata.
8. R. Paneerselvam (2012), Design and Analysis Experiments, PHI Learning Pvt. Ltd
9. K.Krishnaiah and P. Shahabudeen (2013), Applied Design of Experiments and Taguchi Mehtods, PHI Learning Pvt. Ltd.

STAT 534 – STATISTICAL LABORATORY – II **CREDITS: 3**

(Based on STAT 531, STAT 532 and STAT 533)
(based on Calculator, Excel & R Programming as per suitability)

Course Objectives: This course is intended to train students to get knowledge in practical applications of Hypothesis testing, Multivariate analysis and Design of experiments.

Course Outcomes: Students will be able to perform analysis of data sets using various statistical software.

I Testing of Hypotheses (20 marks)

1. Construction of randomized and nonrandomized MP, UMP and UMPU tests of hypotheses and drawing the power curves.
2. Construction of SPRT and its OC and ASN curves.
3. Non parametric tests:
   Kolmogorov Smirnov test, Mann-Whitney U test, Median test for k-sample problem, Kruskal Wallis test and Friedman's test

II Multivariate Statistical Analysis

1. Test for equality of mean vectors when covariance matrix is unknown (Hotelling's T^2 test)
2. Test for Two Covariance matrices
3. Discriminant Analysis
4. Canonical correlation and canonical variables
5. One Way MANOVA with Post hoc tests (DMRT and Tukey's).
6. Principal Component Analysis
7. Factor Analysis

III Design of Experiments (20 marks)

1. Multiple Comparison tests (Least Significant Difference (LSD) test, Bonferonni's test)
2. Missing Data Analysis- one and two observations in RBD
3. Missing Data Analysis- one and two observations in LSD
4. 2^4 , 3^2 factorial experiments
5. Fractional factorial experiments
6. Complete confounding in 2^4, 3^2 factorial experiments
7. Partial confounding in 2^4, 3^2 factorial experiments
8. Split plot design
9. BIBD
10. Youden Square Design
11. Analysis of Covariance – CRD – One Concomitant Variable
12. Analysis of Covariance – RBD – One Concomitant Variable

SOFT CORE PAPERS

SEMESTER I

STAT 415 – OPTIMIZATION TECHNIQUES **CREDITS: 3**

Course Objectives:

1. To understand various issues of optimizations techniques linked with Mathematical Programming
2. To solve the Linear and Non linear programming formulae by using different methods
3. To learn about post optimality and sensitivity analysis with different optimization techniques
4. To pursue classical aspects with mathematical concepts and empirical procedures with numerical Illustrations

Course Outcomes:

After completion of the course the student can learn about

1. Formulation and solving procedures with graphical method, simplex method with and without artificial variables, duality of LPP, dual simplex method, revised simplex method.
2. Conducting Post optimality sensitivity analysis, solving Integer LPP with branch and bound, Montgomery Cut plane methods.
3. Solving procedures of Dynamic Programming techniques with Bellman's Principle, LPP, Manpower allocation, Travel salesman routing problem, Resources allocation etc.
4. Solving procedures for Network scheduling, Probability computations for PERT, cost Optimality analysis with CPM

Unit I

Mathematical Programming - Solving of LPP by graphical method - Linear Programming Problem (LPP)–Simplex, Big M and Two Phase methods – Revised simplex method – Solving LPP using Duality - Dual Simplex method

Unit-II

Post Optimality and Sensitivity Analysis–Variation in cost vector and requirement vector– Addition and deletion of single variable and single constraint - Integer Programming Problem (IPP) - Gomory's cutting plane algorithm– Mixed IPP – Branch and Bound technique

Unit III

Dynamic programming problem (DPP) - Bellman's principle of optimality - General formulation - computation methods and application of DPP - Solving LPP through DPP approach

Unit IV

Non Linear Programming: Constrained and Unconstrained Problems of Maxima and minima, Constraints in the form of equations (Lagrangian Method) and in equations (Kuhn-Tucker conditions), Quadratic programming: Beale's and wolf's methods simplex method for quadratic programming.

Unit- V

PERT - CPM: Applications, Basic Steps in PERT/CPM techniques; Time estimates and Critical Path in Network Analysis; Optimum and minimum duration cost, PERT, Resource Allocations.

Text Books

1. Hillier FS and LibermannGJ(2002):IntroductiontoOperationsResearch,7th Edition, McGraw Hill
2. KantiSwarup,P.K.GuptaandManMohan(2004):OperationsResearch,SultanChand and

Sons, New Delhi.
3. Gross D, Shortle J.F. , Thompson J.M. and Harris C.M. (2011): Fundamentals of Queuing Theory, John Wiley & Sons

Reference Books

1. Sinha SM(2006):Mathematical Programming: Theory and Methods, Elsevier Publications.
2. Devi Prasad (2015), Operations Research, Narosa Publishing House
3. Kapoor V.K.(2008):Operations Research, 8/e,SultanChand&Sons
4. Sharma .S.D(1999): Operation Research , Kedar Nath RamNath & Co., Meerut.
5. Hamdy A.Taha(1987):Operations Research – An Introduction, 4/e, Prentice Hall of India, PrivateLtd,NewDelhi.
6. Sujit K. Bose (2012), Operations Research Methods, 2/e, Narosa Publishing House
7. K. Chandrasekhara Rao and Shanti Lata Misra (2012), Operations Research, Narosa Publishing House

STAT 416 – STATISTICAL QUALITY CONTROL CREDITS: 3

Course Objectives: To give exposure on the practical implementation of the quality control techniques and acceptance sampling schemes.

Course Outcomes: Students will be able to cater the needs of the industry to resolve the quality issues.

Unit I

Modified control charts for mean – CUSUM chart – technique of V-mask – Weighted Moving average charts – multivariate control charts – Hotelling's T^2 control charts and Economic design of X-bar chart

Unit II

Process Capability analysis: Meaning, Estimation technique for capability of a process – Capability Indices: Process capability ratios C_p; C_{pk}, C_{pm}, C_{mk}, C_{pc} – Process capability analysis using a control chart – Process capability analysis using design of experiments

Unit III

Acceptance sampling – Terminologies – Attribute sampling plan by attributes – Single sampling plan and Double sampling plan – OC, ASN, AOQ, AOQL and ATI curves –MILSTD -105E Tables

Unit IV

Acceptance sampling variables for process parameter – Sequential plans for process parameter (σ known and unknown) – Sampling variables for proportion non-conforming - $\bar{X}$ method, K method –

Unit V

Double specification limits – M-method, Double sampling by variables - MILSTD -414 Tables – Continuous Sampling plan – CSP-1, CSP-2, CSP-3, Wald and Wolfowitz SP-A and SP- B

Text Books

1. Douglas C. Montgomery (2009): Introduction to Statistical Quality Control, 6/e, John Wiley and Sons, New York.
2. Edward G. Schilling, Dean V. Neubauer, (2009), Acceptance Sampling in Quality Control, Second Edition, Taylor & Francis
3. Oakland, J.S.(1989): "Total Quality Management", Butterworth–Hcinemann Ltd., Oxford

Reference Books

1. Mittage, H.J and Rinne, H(1993): Statistical Methods of Quality Assurance, Chapmann Hall, London, UK
2. Zeiri (1991): "Total Quality Management for Engineers", Wood Head Publishers.
3. Juran J.M and Frank M.Gryna Jr .(1982): "Quality Planning and Analysis", TMH, India.

STAT 417 – ECONOMETRICS **CREDITS: 3**

Course objectives: This course provides insight knowledge about Econometrics, Econometric modeling, its application with real time data and as an outcome it is used for researchers and in areas such as Statistics, Economics and Finance.

Course outcomes: Students will be able to apply various econometric models to address the issues concerning economic and longitudinal data.

Unit I

Nature and Scope of Econometrics - Review of General Linear Model (GLM), Ordinary Least Squares (OLS), Generalized Least Squares (GLS) and Multicollinearity – Sources, consequences and detection – Principal Component regression and Ridge Regression.

Unit II

Heteroscedasticity - consequences and detection: Graphical methods – Tests: Park test – Glejser's test – Spearman's rank Correlation test – Goldfeld-Quandt test – Breusch-Godfrey-Godfrey test and White's Geenral Heteroscedasticity test – remedial measures for Heteroscedasticity – Weighted Least Squares approach.

Unit III

Linear regression with stochastic regressors - Errors in variables - Instrumental variable estimation - Autocorrelation – consequences and tests: Run's test –Durbin-Watson test - Autoregressive linear regression

Unit IV

Distributed lag models – Finite and Infinite Distributed lag models – Koyck's approach, Almons' Model, Cagan's approach, Arithmetic Lag, Geometric Lag model, Inverted V Lag Model, Pascal's Lag Model, Nerlove's Lag Model, Instrumental Variable method.

Unit V

Simultaneous linear equations model - Identification problem - Restrictions on structural parameters - rank and order conditions - Restrictions on variances and covariances - Estimation in simultaneous equations model

Text Books:

1. Gujarati, D.N. (2003): Basic Econometrics, McGraw Hill.
2. Johnston, J. (1984): Econometric methods, Third edition, McGraw Hill.
3. Nachane. D.M. (2006): Econometrics: Theoretical Foundations and Empirical Perspective, Oxford University Press.

Reference Books:

1. Apte, P.G. (1990): Text book of Econometrics. Tata McGraw Hill.
2. Intrulligator, M.D. (1980): Econometric models - Techniques and Applications, Prentice Hall of India.
3. Kleiber, C. and Zeileis, A. (2008): Applied Econometrics with R, Springer, NY.

SEMESTER – II

STAT 426 - SURVIVAL ANALYSIS **CREDITS: 3**

Course Objectives: To aware about the dealing of life time data in engineering and medical sciences, to learn several methods in reliability theory as well as survival analysis, apply these techniques to prevent or to reduce the likelihood or frequency of failures.

Course Outcomes: To predict the life time of subject and to know the pattern of rate of failure and compare the treatments in medical sciences.

Unit I

Concepts of time, Order and random Censoring, likelihood in these cases. Life distributions- Exponential, Gamma, Weibull , Lognormal , Pareto , Linear Failure rate. Parametric inference (Point estimation, scores, MLE)

Unit II

Life tables, failure rate, mean residual life and their elementary properties. Concept of Ageing, Types of Ageing classes and their properties and relationship between them , Bathtub Failure rate, Concept of Inverse Hazard rate.

Unit III

Estimation of survival function Actuarial Estimator, Kaplan- Meier Estimator, Estimation under the assumption of IFR / DFR . Tests of exponentiality against non- parametric classes- Total time on test, Despande test.

Unit IV

Two sample problem- Gehan test, Log rank test. Mantel Haenszel test, Tarone Ware tests. Introduction to Semi- parametric regression for failure rate, Cox's proportional hazards(PH) model with one and several covariates and estimation problems in Cox's PH Model. Rank test for the regression coefficients.

Unit V

Introduction to Competing risks analysis and estimation problems in competing risk model for parametric and non- parametric semi parametric set up. Ideas of Multiple decrement life table and its applications.

Books for Study:

1. Miller, R.G. (1981) : Survival analysis (John Wiley).
2. Cox, D.R. and Oakes, D. (1984) : Analysis of Survival Data, Chapman and Hall, NewYork.
3. Elisha T Lee, John Wenyu Wang and Timothy Wenyu Patt(2003): Statistical Methods for Survival data Analysis, 3/e, Wiley Inter Science.

Books for Reference:

1. Gross, A.J. and Clark, V.A. (1975) : Survival distribution : Reliability applications in the Biomedical Sciences, John Wiley and Sons.
2. Elandt Johnson, R.E. Johnson N.L.: Survival Models and Data Analysis, John Wiley and sons.
3. Kalbfleisch J.D. and Prentice R.L.(1980), The Statistical Analysis of Failure Time Data, JohnWiley.
4. Klelin P. John and Moeschberger(2003): Survival Analysis: Techniques for Censored andTruncated Data, 2/e, Springer.
5. Lawless J.F. (1982) Statistical Models and Methods of Life Time Data; John Wiley & Sons.

STAT 427–DECISION THEORY **CREDITS: 3**

Unit I

Basic elements of a decision problem - Randomized and non-randomized decision rules - Estimation and testing of hypothesis as decision problems - Baye's approach to inference and decision -

Unit II

Loss functions - Prior and Posterior distributions and its analysis for Bernoulli, Poisson, and normal processes - Decision principles and Baye's risk–

Unit III

Utility theory - axioms, construction of utility functions, sufficiency, equivalence of classical and Bayesian sufficiency, complete and essentially complete classes of decision rules

Unit IV

Minimax analysis - Basic elements of game theory - General techniques of solving games - Finite games - Supporting and separating hyper plane theorems - Minimax theorem - Minimax estimation for normal and Poisson means

UNIT V

Admissibility of Baye's and minimax rules, General theorems on admissibility, Robustness of Baye's rules, Invariant decision rules, Location parameter problems, Confidence and credible sets.

Text Books:

1. James O. Berger (1980): Statistical Decision Theory and Bayesian Analysis, Springer Verlag
2. M.H. DeGroot (1970): Optimal Statistical Decisions, John Wiley
3. H. Raiffa and R. Schlaifer (2000): Applied Statistical Decision Theory, Wiley

Reference Books:

1. Zellener (1971): An Introduction to Bayesian Inference in Econometrics, Willey
2. Hayes J. G and Winkler R I (1976): Probability, Statistics and Decision, Dower
3. Anthony O' Hangan (1994): Kendall's Advanced theory of Statistics Vol. 2B, Bayesian Inference, John Wiley

STAT 428 - BIOSTATISTICS **CREDITS: 3**

Course Objectives: Enable the students to understand the basic preliminaries and advanced modeling techniques applied in biological and medical sciences.

Course Outcomes: This course will enhance the capability in handling practical situations that arise in pharmaceutical and health care industries.

Unit I

Statistical Methods in Clinical Trials: Introduction to clinical trial and it's phases I, II, III and IV, statistical designs-fixed sample trials: simple randomized design, stratified randomized crossover design; Sequential design - open and close sequential design. Randomization-Dynamic randomization, Permuted block randomization; Blinding-Single, double and triple.

Unit II

Biological Assays: Introduction, parallel-line assay, slope- ratio assays and quantile- response assay, Feller's theorem. Dose-response relationships-qualitative and quantitative response, dose response relation- estimation of median effective dose – PK-PD Analysis.

Unit III

Categorical Data Analysis: Categorical response data, logistic regression-odds ratio, Wald's statistic, logistic regression and its diagnostics, - Poison regression – Estimation of relative risk and its applications.

Unit IV

ROC Curve analysis - Estimation of Binomial Model and the Area under the Curve, its applications – Properties of ROC curve - Kullback –Leibler Divergence (KLD)– definition – functional relationship between Kullback –Leibler Divergence and the slope of the ROC curve – derivations of KLD expressions for Bi-normal ROC model

Unit V

Repeated Measures ANOVA – One Way and Two Classified Data –Measures of disease frequency – incidence – prevalence – relative risk – Epidemiological study designs – Cohort study design and its analysis – Case control study design and its analysis – concept of bias – information bias and selection bias

Text Books

1. Elisa T.Lee & John Wenyu Wang (2003): Statistical methods for Survival Data analysis, 3rd Edition, John Wiley
2. Jerrold H. Zar (1999): Biostatistical Analysis, 4th edition, Pearson
3. Armitage, P, Berry G and Mathews J.N.S (2002): Statistical Methods in Medical Research, 4/e, Blackwell Scientific Publications
4. Krzanowski, W and Hand, D.J.(2009): ROC Curves for Continuous Data, Chapman and Hall

Reference Books

1. Hosmer and Lemeshow (2000): "Applied Logistic Regression", 2/e, Wiley Series
2. Alan Agresti (2002): Categorical Data analysis, 2/e, John Wiley
3. Sylvia Wasserthial and Smoller, (2004): Biostatistics and Epidemiology – A Primer for Health and Biomedical professionals, 3rd Edition, Springer
4. Rastogi, V.B. (2006): Fundamentals of Biostatistics, ANE Books, India

SEMESTER III

STAT 535 – RELIABILITY THEORY **CREDITS: 3**

Course Objectives: To aware about the dealing of life time data in engineering and medical sciences, to learn several methods in reliability theory as well as survival analysis, apply these techniques to prevent or to reduce the likelihood or frequency of failures.

Course Outcomes: To predict the life time of subject and to know the pattern of rate of failure and compare the treatments in medical sciences.

Unit I

Introduction to Reliability and its needs; Structural properties of coherent system: components and systems, coherent structures, representation of coherent systems in terms of paths and cuts, relevant & irrelevant structure; Modules of coherent systems; Reliability of a coherent systems; Reliability importance of components; Bounds on System Reliability.

Unit II

Life Distributions: Concept of distribution function, hazard function, Reliability function, MTTF, Bathtub failure rate; loss of memory property of Exponential distribution - parametric families of some common life distributions – Exponential, Weibull and Gamma and its characterization - Reliability estimation of parameters in these models.

Unit III

Notions of Ageing; Classes of life distributions and their duals - preservation of life distribution classes for reliability operation - Formation of coherent systems, convolutions and mixtures.

Unit IV

Univariate stock models and life distributions arising out of them: cumulative damage model, shock models leading to univariate IFR, Successive shock model; bivariate shock models; common bivariate exponential distributions due to shock and their properties.
Maintenance and replacement policies; availability of reparable systems; modeling of a repairable system by a non-homogeneous Poisson process.

Unit V

Stress-Strength reliability - Concepts and its estimation for exponential, Weibull and gamma distributions; Reliability growth models; probability plotting techniques; Hollander –Proschan and Despande tests for exponentiality – Basic ideas of accelerated life testing.

Text Books:

1. Barlow, R.E. and Proschan F. (1985) Statistical Theory of Reliability and Life Testing; Rinehart and Winston.
2. Lawless, J.F. (2003): Statistical Models and Methods of Life Time Data; John Wiley.

Reference Books:

1. Bain L.J. and Max Engelhardt (1991): Statistical Analysis of Reliability and Life Testing Models; Marcel Dekker.
2. Nelson, W (1982): Applied Life Data Analysis; John Wiley.
3. Zacks, S(1992): Introdcution to Reliability Analysis, Springer Verlag.
4. Marshall, A.W. and Olkin I(2007): Life Distributions, Springer

STAT 536 -BAYESIAN INFERENCE **CREDITS: 3**

Course Objectives: To learn advance method of estimation. The objectives of the Bayesian inference is that to incorporate the past information with observed data in order to predict the future inferences.

Course Outcomes: The students would able to calculate relative frequencies to estimate probabilities. Calculate conditional probabilities using Bayes's rule. It also helps to incorporate the various types of priors for drawing inference from Posterior distribution

Unit I

Introduction about Thomas Baye's-Motivations and Contributions - Evaluation of Subjective probability of an event using a subjectively unbiased coin - Subjective prior distribution of a parameter – Baye's theorem and computation of the posterior distribution.

Unit II

Introduction of Prior Distributions, Types of Prior Distributions, Proper Prior-Enlarging the natural conjugate family by enlarging hyper parameter space - mixtures from conjugate family - choosing an appropriate member of conjugate prior family - Non informative, improper and invariant priors - Jeffrey's invariant prior

Unit III

Bayesian point estimation: Prediction problem from posterior distribution - Baye's estimators for absolute error loss, squared error loss, linear loss function, Jeffrey's and 0 -1 loss - Generalization to convex loss functions - Evaluation of the estimate in terms of the posterior risk

Unit IV

Bayesian interval estimation : Credible intervals - Highest posterior density regions - Interpretation of the confidence coefficient of an interval.

Unit V

Bayesian Testing of Hypothesis: Prior and Posterior odds - Baye's factor for various types of testing hypothesis problems -Monte-Carlo Integration and Basic Concepts on Markov chain Monte Carlo techniques (MCMC)(without proof).

Text Books

1. Bansal A.K.(2007): Bayesian Parametric Inference, Narosa Publications
2. Sinha S K (1998): Bayesian Estimation, New Age International(P) Ltd, New Delhi

Reference Books

1. Berger, J.O.(1985): Statistical Decision Theory and Bayesian Analysis, 2/e, Springer Verlag.
2. Robert C.P. and Casella, G.(2004): Monte Carlo Statistical Methods, 2/e,Springer Verlag.
3. DeGroot, M.H.(2004): Optimal Statistical Decisions, Wiley-InterScience.
4. Gamerman, D. and Lobes H.F. (2000): Stochastic Simulation for Bayesian Inference, Taylor and Francis.
5. Box, G.P. and Tiao, G.C.(1973): Bayesian Inference in Statistical Analysis, Addison – Wesley.

STAT 537 – QUEUEING AND INVENTORY THEORY CREDITS: 3

Course Objectives:

1. To Know about various descriptions, characteristics, related random processes and background themes of P*oisson Queuing Models with single server*, and *multiple server*. To study the assumptions and derivations of different mathematical relations like steady state equations, Queue characteristics of Non Poison (Erlangian) Queuing Models.
2. To Study the fundamental notions, applications and scope of Probabilistic and Deterministic Inventory Models. To describe and derive different mathematical relations of different Inventory models along with price break inventory policies.

Course Outcomes:

1. Derivation of and problem solving characteristics on (M/M/1): (∞/FIFO) and (M/M/1): (N/FIFO) Models, simple numerical problems. Derivations and problem solving of steady state equations for different processes such as birth, death, migrations and Poisson, M/M/1 and M/M/C models.
2. Derivation and problem solving of different properties of Earlangian Queuing Models $M/E_k/1$, $E_l/M/1$ and $E_l/E_k/1$ models. Derivations and problem solving of EOQ, Optimal Total Cost, Optimal number of runs and optimal ordering times in deterministic inventory models with and without shortages. Understanding the notion of Inventory with Price breaks and optimal total cost and optimal order quantity with multiple price breaks.

Unit I

Poisson Queuing Models with single server: Descriptions of queuing models, Generalized Birth and Death Processes, steady state Birth and death processes- Assumptions, Probability distributions for number of Units (steady state), waiting time distribution, Derivation of characteristics on (M/M/1): (∞/FIFO) and (M/M/1): (N/FIFO) Models, simple numerical problems

Unit II

Poisson Queuing Models with multiple server: Descriptions of the model, Assumptions, Probability distributions for number of Units (steady state), waiting time distribution, Derivation of characteristics on (M/M/C): (∞/FIFO), (M/M/C): (N/FIFO) and (M/M/C): (C/FIFO) Models, simple numerical problems

Unit III

Non Poison Queuing Models (Erlangian): Descriptions of the model, Assumptions, Probability distributions for number of Units (steady state), waiting time distribution, Derivation of characteristics on (M/Ek/1), (Ek/M/1), simple numerical problems

UNIT – IV

Scope and notion of Inventory, Terminology, overview on probabilistic& Deterministic Models, optimality issues with Inventory; Deterministic Inventory models with shortages and without shortage. Finding EOQ and other characteristics, Simple Problem

UNIT – V

Deterministic Inventory models with simultaneous replenishment and stock clearance, with shortages and without shortages, finding EOQ and other parameters, Simple Numerical Problems; Deterministic Inventory models with Single and multiple price Breaks and numerical examples.

Books for Study:

1. KantiSwarup et al.:Operations Research, Sultan Chand and Sons,New Delhi
2. S.D Sharma: Operations Research
3. Donald Gross & Carl M Harris (1998): Fundamentals of Queuing theory, John Wiley & Sons, Inc.

4. Hamdy A.Taha(2006): Operations Research – An Introduction, 8/e , Prentice Hall of India Private Ltd., New Delhi

Books for Reference:

1. Hiller F S and Libermann G J (1995):Introduction to operations Researsch, 6th Edition, McGraw Hill
2. Prabhu N.U. (1965) Applied Stochastic Processes, Mc.Millan
3. J.Medhi (2009), Stochastic Processes, 3/e, New Age International
4. Bhat. B.R. (2002), Stochastic Processes, 2/e, New Age International

STAT 538 - STATISTICAL DATA MINING METHODS CREDITS: 3

Course Objectives: This course is intended to equip students to get knowledge in clustering and classification techniques.

Course Outcomes: Students will gain knowledge on the working principle of algorithms related to clustering and classification techniques and its application to real life problems.

Unit I

Introduction to data mining – data types – Measures of similarity and dissimilarity – Data mining tools – supervised and unsupervised learning – Introduction to Cluster Analysis – Types of clustering – Agglomerative Hierarchical clustering algorithm – Issues – strength and weaknesses.

Unit II

Basic k-means algorithm – Issues – fuzzy clustering – fuzzy c means algorithm - cluster evaluation – unsupervised and supervised measures - Introduction to classification – Decision Trees – Building a decision tree – Tree induction algorithm – model over fitting – Evaluating the performance of a classifier

Unit III

Nearest Neighbor classifiers – kNN algorithm – Naïve Bayesian classifier – Binary logistic regression – odds ratio – Interpreting logistic regression coefficients – Multiple logistic regression

Unit IV

Association rules mining – Basics – Apriori algorithm – Pruning and candidate generation – Rule mining.

Unit V

Case studies based on k means clustering - fuzzy c means clustering - kNN classification - Binary logistic regression using R programming language.

Text Books

1. Tan, T., Steinbach, M. and Kumar, V. (2006): Introduction to Data Mining, Pearson Education. (relevant portions of Chapters 1, 2, 4, 5 and 8).
2. Gupta, G.K. (2008): Introduction to Data Mining with case studies, Prentice – Hall of India Pvt. Ltd. (relevant portions of Chapter 2)
3. Daniel T. Larose (2006): Data Mining: Methods and Models, John Wiley and sons. (relevant portions of Chapter 4).

Reference Books

1. Han, J. and Kamber, M. (2006): Data Mining: Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publishers.
2. Paolo Gludici (2003): Applied Data Mining: Statistical Methods for Business and Industry, John Wiley and sons.
3. Rajan Chattamvelli (2009): Data Mining Methods, Narosa Publishing House, New Delhi.

SEMESTER IV

STAT 541 - PROJECT WORK & COMPREHENSIVE VIVA CREDITS: 12

Course Objectives: This course is intended to expose students to apply the methodologies that were covered in the curriculum.

Course Outcomes: Students will gain knowledge on the working principle of advanced multivariate tools and techniques and their application to real life problems.

1. It is an individual project work offered in IV semester with 12 credits.
2. The Project work shall be guided and supervised by a faculty member assigned in the beginning of the semester.
3. The project work should be undertaken in a reputed and relevant organization and topics are to be selected in such a way that there is enough scope to apply and demonstrate the statistical techniques learnt in the course.
4. At the end of the semester, before the last working day, project report should be submitted (two copies) with a certificate from industrial guide.
5. The project report shall contain the statement of problem, Methodology adopted, statistical tools used for analysis, findings, conclusions, suggestions and references.
6. The project work will be assessed for 12 credits. Students have to give a seminar of their project report at the end of the semester and which will be evaluated internally.
7. There will be viva-voce examination by an internal and an external examiner during end semester examination in 4th semester.
8. Report shall have the following format: Chapter I for Introduction for providing conceptual clarity, Chapter II for Review of Literature, Chapter III for Methodology, Chapter IV, V & VI for analysis and interpretations of each objectives (Number of chapter can be reduced or increased depending upon the number of objectives), chapter VII for findings and suggestions.

STAT 542 - ACTUARIAL STATISTICS **CREDITS: 3**

Unit I

Basic deterministic model: Cash flows, discount function, interest and discount rates, balances and reserves, internal rate of return, The life table: Basic definitions, probabilities, construction of life tables, life expectancy, Life annuities: Introduction, calculating annuity premium, interest and survivorship discount function, guaranteed payments, deferred annuities.

Unit II

Life insurance: Introduction, calculation of life insurance premiums, types of life insurance, combined benefits, insurances viewed as annuities, Insurance and annuity reserves: The general pattern reserves, recursion, detailed analysis of an insurance, bases for reserves, non forfeiture values, policies involving a return of the reserve, premium difference and paid-up formula.

Unit III

Fractional durations: Life annuities paid monthly, immediate annuities, fractional period premium and reserves, reserves at fractional durations, Continuous payments: Continuous annuities, force of discount, force of mortality, Insurance payable at the moment of death, premiums and reserves. The general insurance – annuity identity, Select morality: Select an ultimate tables, Changed in formulas.

Unit IV

Multiple life contracts: Joint life status, joint annuities and insurances, last survivor annuities and insurances, moment of death insurances. The general two life annuity and insurance contracts, contingent insurances

Unit V

Multiple decrement theory: Basic model, insurances, Determination of the models from the forces of decrement. Stochastic approach to insurance and annuities; Stochastic approach to insurance and annuity benefits, deferred contracts, Stochastic approach to reserves and premiums, variance formula.

Text Books

1. Promislow, S.D(2006): Fundamentals of Actuarial Mathematics, John Willey, Chapters 2- 11 &14.
2. Newton L. Bowers, Jr, Hans U. Gerber, James C. Hickmann, Donald A. Jones and Cecil J. Nesbitt (1997): Actuarial Mathematics, The Society of Actuaries.

Reference Books

1. Neill, A. (1977): Life contingencies, Heinemann, London.
2. King, G. Institute of Actuaries Text Book. Part 11, Second edition, Charles and Edwin Layton, London.
3. Donald D.W.A. (1970): Compound Interest and Annuities, Heinemann, London.
4. Jordan, C.W. Jr. (1967): Life Contingencies, Second edition, Chicago Society of Actuaries.
5. Hooker, P.F. and Longley Cook, L.W. (1953): Life and other Contingencies, Volume I and Volume II (1957) Cambridge University Press.
6. Spurgeon, E.T. (1972): Life Contingencies, Third edition, Cambridge University Press.

STAT 543 DATA ANALYSIS USING STATISTICAL PACKAGES CREDITS:3

Unit – I

Basic of SPSS – Importing and Exporting of files – Recoding and Computing new variables – Visual Binning – Selection of cases – splitting and merging of files – multiple responses – Graphical plots: Box Plot, Scatter plot, Histogram, Bar and Pie charts.

Unit – II

Fitting of Curves: Parabola, cubic and exponential – correlation and regression: simple, multiple – Rank correlation – Variable Selection in Multiple Regression - Residual Analysis: model adequacy, detection of outliers and influence observations.

Unit – III

Testing of Hypotheses – two sample and paired samples t – test; F-test for two sample variances; Chi-square test for independence of attributes – One way and Two Way Analysis of Variance – Multiple Comparison tests : Tukey's test, Duncan's Multiple range test and Dunnett's test.

Unit – IV

Non-Parametric tests: One sample and Two sample Kolmogorov – Smirnov test, Kruskal – Wallis test, Friedman test, Median Test – One Way MANOVA – Hotelling's T^2 two sample test – Test for two Covariance matrices – One way Repeated Measures ANOVA.

Unit - V

Factor Analysis : Identification of Principle Component, Varimax rotation – Discriminant Analysis – Enter and Stepwise procedures, discriminant scores – Logistic regression – variable selection procedures (Backward and Forward with conditional and wald methods), Odds ratio, Classification matrix – 2^2, 2^3, 3^2 and 3^3 factorial designs – Split Plot designs.

Books for Study

1. Ajai S. Gaur and Sanjaya S Gaur (2009), Statistical Methods for Practice and Research - A Guide to Data Analysis Using SPSS, Second Edition, SAGE Publications Pvt. Ltd
2. William E Wagner, III (2010), Using IBM® SPSS® Statistics for Social Statistics and Research Methods, Third Edition, PINE FORGE PRESS, An Imprint of SAGE
3. Robert Ho (2006), Handbook of Univariate and Multivariate Data Analysis and Interpretation with SPSS, Chapman and Hall, CRC Press

Books for Reference

1. Sarma KVS (2010), Statistics Made Simple – Do It Yourself on PC, Second Edition, PHI Learning.
2. Sabina Landau and Brian S. Everitt (2004), A Handbook of Statistical Analysis using SPSS, Chapman and Hall, CRC Press
3. Andy Field (2009), Discovering Statistics Using SPSS (Introducing Statistical Methods Series), Third Edition, SAGE Publications Ltd.

STAT 544 - DEMOGRAPHIC TECHNIQUES **CREDITS: 3**

Course Objectives: This course is intended to provide basics of demography and official statistics

Course Outcomes: Students will gain knowledge about constructions of life tables and measures of population dynamics.

Unit I

Sources of demographic Statistics, Basic demographic measures: Ratios, Proportions and percentages, Population Pyramids, Sex ratio Crude rates, Labour force participation rates, Density of population, Probability of dying.

Unit II

Life tables: Construction of a life table, Graphs of l_x, q_x, d_x, Functions L_x, T_x, and E_x. Abridged life tables Mortality: Rates and Ratios, Infant mortality, Maternal mortality, Expected number of deaths, Direct and Indirect Standardization, Compound analysis, Morbidity.

Unit III

Fertility: Measures of Fertility, Reproductively formulae, Rates of natural increase, Fertility Schedules, Differential fertility, Stable Populations, Calculation of the age distribution of a stable population, Model Stable Populations.

Unit IV

Population estimates, Population Projections: Component method, Mortality basis for projections, Fertility basis for projections, Migration basis for projections.

Unit V

Ageing of the population, Estimation of demographic measures from incomplete data.

Text Books:

1. Pollard, A. H. Yusuf, F. and Pollard, G.N. (1990). Demographic Techniques, Pergamon Press, Chapters 1-8, 12.

Reference Books:

1. Keyfitz, N. (1977) Applied Mathematical Demography A Willey-Interscience Publication.
2. Keyfilz, N. (1968) Introduction to the Mathematic of Population Ready, Mass: Addition-Wesley.
3. Keyfilz, N. and Caswell, H. (2005) Applied Mathematical Demography, Third edition, Springer.

STAT 545 - TIME SERIES ANALYSIS **CREDITS: 3**

Course Objectives:
Providing a clear explanation of the fundamental theory of time series analysis and forecasting with regression and autoregression combination models. Modeling and forecast evaluation, along with a sample size analysis for common time series models to attain adequate statistical power.

Course outcomes :
The students who have studies this course are able to read and retrieve the real time data and work with it efficiently and effectively with the help of packages like R and Python , students are trained in identifying the data and models which will suit the data.

Unit I
Exploratory Time Series Analysis: Forecasting trend and seasonality based on smoothing. Methods of Exponential and moving average smoothing; Types and implications of interventions; Outliers, additive and innovational outliers, procedure for detecting outliers

Unit II
Stationary Stochastic models: weak and strong stationarity, Deseasonalising and detrending an observed time series, Auto-covariance, autocorrelation function (ACF), partial autocorrelation function (PACF) and their properties, Conditions for stationarity and invertibility,

Unit III
Models for Time Series: Time series data, Trend, seasonality, cycles and residuals, Stationary, White noise processes, Autoregressive (AR), Moving Average (MA), Autoregressive and Moving Average (ARMA) and Autoregressive Integrated Moving Average (ARIMA) processes, Choice of AR and MA periods

Unit IV
Spectral analysis and decomposition: Spectral analysis of weakly stationary process, Periodogram and Correlogram analysis, Spectral decomposition of weakly AR process and representation as a one-sided MA process – necessary and sufficient conditions, implication in prediction problems.

Unit V
Modeling Seasonal Time Series: seasonal ARIMA models, estimation and forecasting, Fitting ARIMA models with Box-Jenkins procedure, Identification, Estimation, Verification, Test for white noise, Forecasting with ARMA models.

Text Books:

1. Nicholas T. Thomopoulos, 1980, Applied Forecasting Methods, Prentice Hall
2. BoxGEP,JenkinsGMandReinselGC(2004):TimeSeriesAnalysis–Forecasting and Control, Pearson Education.
3. BrockwellPJandDavisRA(2002):IntroductiontoTimeSeriesandForecasting, Springer.
4. Montgomery D C and Johnson L A (1977): Forecasting and Time Series analysis, McGraw Hill.

Reference Books:

1. ChatfieldC(1996):TheAnalysisofTimeSeries:TheoryandPractice,fifthedition, Chapman and Hall.
2. NachaneD.M.(2006):Econometrics:TheoreticalFoundationsandEmpiricalPerspective, Oxford University Press
3. Diggle, P.J Time Series: A Bio-statistical Introduction, Oxford University Press

(1990).
4. Hamilton, J., 1994, Times Series Analysis, Princeton University Press.
5. Harvey, A.C., 1993, Time Series Models, MIT Press.
6. Kendall, Sir Maurice and Ord J K (1990): Time Series, Edward Arnold.
7. Tsay, R., 2002, Analysis of Financial Time Series, Wiley Series

STAT 546-TOTAL QUALITY MANAGEMENT CREDITS: 3

Course Objectives: To give exposure on the practical implementation of the quality control techniques and acceptance sampling schemes.

Course Outcomes: Students will be able to cater the needs of the industry to resolve the quality issues.

Unit I

Need for TQM, evolution of quality, Definition of quality, TQM philosophy – Contributions of Deming, Juran, Crosby,Taguchi and Ishikawa.

Unit II

Vision, Mission, Quality policy and objective, Planning and Organization for quality, Quality policy Deployment, Quality function deployment, Analysis of Quality Costs.

Unit III

Customer focus, Leadership and Top management commitment, Employee involvement – Empowerment and Team work, Supplier Quality Management, Continuous process improvement, Training, performance Measurement and customer satisfaction.

Unit IV

PDSA, The Seven QC Tools of Quality, New Seven management tools, Concept of six sigma, FMEA, Bench Marking, JIT, POKA YOKE, 5S, KAIZEN, Quality circles.

Unit V

Need for ISO 9000 Systems, clauses, Documentation, Implementation, Introduction to QS 9000, Implementation of QMS, Case Studies.

Text Books

1. Dale H.Besterfiled(2002): "Total Quality Management", Pearson Education Asia
2. Oakland.J.S(1989): "Total Quality Management", Butterworth–Hcinemann Ltd., Oxford

Reference Books

1. Narayana V. and Sreenivasan, N.S.(1996): "Quality Management – Concepts and Tasks", New Age International.
2. Zeiri(1991): "Total Quality Management for Engineers", Wood Head Publishers.
3. Juran J.M and Frank M.Gryna Jr.(1982): "Quality Planning and Analysis", TMH, India.
4. Brain Rethery(1993): ISO 9000, Productivity and Quality Publishing Pvt.Ltd.
5. D.Mills(1993): Quality Auditing, Chapman and Hall.

SOFT CORE COURSE FOR OTHER DEPARTMENTS

STAT 418 STATISTICAL METHODS **Credits: 3**

Course Objectives: To focus attention on various statistical methods and to apply them for basic data analysis.

Course Outcome: Students will be able to present the data in terms of graphs, summary statistics and comparative analysis.

Unit I

Definition of statistics – Scope and limitations of statistics – Primary and Secondary data and its sources - Simple Random, Stratified and Systematic sampling techniques - preparation of a questionnaire -Collection and classification of data – Frequency tables – Diagrammatic and Graphical representation of data

Unit II

Measures of central tendency – Mean, Median and Mode – Measures of dispersion – Range, Quartile deviation and Standard deviation – Coefficient of variation and skewness

Unit III

Study of relationship between variables: Quantitative: Correlation and Regression – Partial and Multiple correlation (three variables only) – Qualitative: Contingency tables – Measures of Association.

Unit IV

Elementary Probability theory: Addition theorem – Conditional probability and Multiplication theorem - Baye's Theorem – Random variables and probability distributions – Binomial, Poisson , Normal (simple applications of the distribution) – Sampling distributions: t, F and chi-square (definition only)

Unit V

Hypothesis testing: Basic concepts in Hypothesis Testing – Types of error – Tests for Mean and Proportion based on Normal and Student t-distribution - Chi-square test for independence of attributes – One-way and two-way Analysis of Variance

Text Books

1. Hooda.R.P.(2003) : Statistics for Business and Economics , 3/e, Mac Millan .
2. Medhi.J. (1992) : Statistical Methods an Introductory Text , Wiley Eastern Ltd.,.
3. Kapoor.V.K. and Gupta.S. (1978): Fundamentals of Applied Statistics,Sultan Chand and Sons.
4. Sharma J.K.(2004): Business Statistics, Pearson Education

Reference Books

1. Agarwal.B.L(1996): Basic statistics, 3/e, New Age International (P) Ltd.,.
2. Anderson.R, Sweeney.J and Williams.A (2002): Statistics for Business and Economics, 8/e, Thomson.
3. Sheldon M.Ross (2006): Introductory Statistics, 2/e, Elsevier Publications.
4. Murray R. Spiegel and Larry J. Stephens (2005): Schaum's Outline of Theory and Problems of Statistics, 3/e, Tata Mc Graw Hill Publishing Company Ltd, New Delhi.

DEPARTMENT
OF
APPLIED PSYCHOLOGY

Guidelines and Syllabus for M.Sc in Applied Psychology and PhD Programme
Approved in the Board of Studies held on 09-05-2019

SCHOOL OF PHYSICAL, CHEMICAL & APPLIED SCIENCES
PONDICHERRY UNIVERSITY
Puducherry – 605 014

THE UNIVERSITY

Pondicherry University, a Central University established in 1985 by an Act of Parliament with the objective to disseminate and advance knowledge by providing instructional and research facilities in such branches of study as it may deem fit and more specifically, to make special provisions for studies in French and for integrated courses in Science and Humanities and to promote inter-disciplinary studies and research in the University. The university has secured 48th place under the university category and 72nd place under overall category in National Institutional Ranking Framework for the year 2019. The University has 15 Schools, 39 Departments, 11 Centres and One Chair offering over 141 PG, P.G. Diploma/ Certificate & Research programmes. Students are selected through an All-India Common Entrance Examination. The University has been constantly receiving more than 35,000 applications for its various programmes year after year. The University has more than 6400 students (40% of the students are female students) including foreign students on its rolls.

The University has over 357 faculty and more than 6400 students on its rolls from across the country. There are over 49,000 students in its 95 affiliated colleges. 14 Departments of the University has already been covered under Special Assistance Programme (SAP Departments) of UGC, three DSTFIST Programme, one DBT-BINC scheme and DST-PURSE II, a 2nd phase of the PURSE grant scheme awarded with Rs.8.45 Crores. The campus is vibrant with a series of conferences, seminars, symposia, cultural programmes, festivals etc., The University has 48 MoUs (25 international and 23 national) with Foreign Universities / Institutions and Indian Institutions. The University Library has a good collection of 4,67,143 books and 37,587 Nos. of Journals (Print: 13,352 & Electronic 24,235) and over 2,49,676 e-resources comprising 1,59,894 e-books, 24,235 e-journals, 46 e-databases and 896 e-theses.

The University, though located in deep south, is popularly known throughout the length and breadth of the country for its quality education and academic excellence all through the days of its existence from 16th October 1985, thereby retaining its continuous glory, to attain the pinnacle of its success in academic circles.

DEPARTMENT OF APPLIED PSYCHOLOGY

To meet the contemporary needs of the society the department was established in October 2007 with a view to offer two year Post Graduate course in Applied Psychology. The department started functioning with 20 students during the academic session 2007-08. The course aims at preparing students with both theoretical and practical knowledge so that in turn they can render professional services to the society through different organizations. Currently there are three specializations in Applied Psychology viz., Clinical Psychology, Industrial/Organizational Psychology and Counseling Psychology. The department started running one year P.G. Diploma Course in Industrial Psychology from 2009 and PhD programme from 2010. The mission of the department is to empower students with psychological knowledge, skills and evidence to make them confident mental health professional for serving the society. And the vision of the department is to develop as a globally recognized destination for teaching and researching in the context of indigenous cultural and value system resulting in the further strengthening of Psychology as an academic discipline to serve all the stake holders.

The department has three classrooms with in-built ICT arrangements and one seminar room in addition to two well equipped labs with psychological test and experiments. Apart from test materials, clinical equipments such as Multi Behavior Therapy, EEG Alpha Bio Feedback, and Respiration Bio- Feedback are also used for research purpose. During the short span of 11 years the department has organized three national and three international conferences. The faculty members have completed eight national and international research projects. The alumni of this department have been appointed in various reputed organizations like, DIPR, Central Universities and State Universities, professional institutes spread across India and abroad.

PROGRAMMES OFFERED IN THE DEPARTMENT

- M.Sc in Applied Psychology
- PhD in Applied Psychology

VISION

A systematic study on the scientific nature, day to day application and problem solving nature of Psychology keeping the Indian context in view and serve the people in need proactively and thus serve the society and nation.

MISSION

To develop as a globally recognized destination for teaching and researching in the context of indigenous cultural and value system resulting in the further strengthening of Psychology as an academic discipline to serve all the stake holders.

AIMS & OBJECTIVES

The department was started with the aim to train students to make psychology more practically oriented and to apply the principles of psychology to cater to the needs of the society. Hence, on successful completion of the course, the students of department of applied psychology will be able to,

- Develop indigenous psychological principles keeping the cultural and value system in the Indian context for the benefit of Indian society.
- Use the psychological testing tools to assess the personality, intelligence and other psychological characteristics.
- Apply the psychological principles in the field of organizational, clinical and counselling settings.
- Understand and cater to the needs of psychologically normal and abnormal individuals by using the diagnostic principles and tools of psychology.
- Apply the knowledge of psychology in their day to day interaction with the society and serve those who seek help in psychological aspects.

- Understand the cognition, social backgrounds, basic theories and systems of psychology, the secrets of researching to equip the students for basic understanding that help in application of psychological theories to the society.

- Equip the students in many areas of psychology namely, rehabilitation, developmental, and counselling areas in addition to the training of psychological statistics that helps in simplifying and understanding of the abundant data on the human nature.

- Help students to get better clarity on their own strengths and weaknesses to select the best fit field of their choice in psychology so as to continue to facilitate research or practice of their choice in future endeavor in their psychology profession.

- Serve to the psychological needy of the university students and staff as well as to the people of adopted village.

- Organize seminars, conferences, workshops and other academic activities to update the knowledge base of the faculty and teachers.

COURSE DESCRIPTION

The M.Sc. Applied psychology aims to train the students with theoretical knowledge and practical skills of psychology. Each year of the course has two semesters numbered in succession from one to four. The first two semesters offers common papers to all the students enrolled from MSc applied psychology that aims to equip students for the theoretical and practical aspects of general understanding of psychology in its totality.

During third and fourth semesters the students are opted to choose one of the three specializations namely clinical, industrial, and counselling psychology. The specialization courses intend to train students in the different areas from both theoretical and practical application to the respective fields. Therefore, the specializations have internship as well as dissertations that equip both practice of the specialized field as well as researching in the area of specialization.

The course is designed in such way that students are trained in the overall spectrum of specialization along with the background preparation. The focus is given to the cultural context and value system of Indian subcontinent.

In view of the advancements of the field of study, the course has been designed strive to prepare competencies in theoretical and practical aspects of psychology to use the knowledge to apply it in the highest standards of morals and ethics.

- Core papers in the first two semesters comprising of papers, which can be considered to be fundamental in imparting a larger perspective of Psychology for its theoretical and practical foundation. At the end of the first year students are allowed to take an internship in their interested field to facilitate them to choose their specializations.
- The third and fourth semester aims at training students in the chosen specialisation papers namely, clinical, organizational/industrial and counselling psychology with the on field exposure through an internship. The specialization is prepared in such a manner that students can relish the knowledge of both practice and research by way of internship and dissertation work after the completion of MSc.

PROGRAMME OUTCOME (M.Sc. Applied psychology)

The M.Sc. Applied psychology programme is developed as a rigorous two-year programme with extensive theoretical knowledge and widespread practical experience to acquire the necessary skills in the area of Applied Psychology. On completion of the course, the student is expected to perform the following functions:

- Understand the human behaviour in cultural and intercultural context.
- Able to apply psychological tools to assess the psychological profile of individuals.
- Apply psychological techniques to help individuals in need be it in normal behaviours as well as abnormal behaviours.
- Able to apply psychological tools to diagnose the psychological issues in clinical, counselling and organizational fields.

- Facilitate students for future training into techniques of diagnostics, therapy, research, and practice in their respective field of specialization.
- Conceptualize specific adult and child mental health problems within a psychological framework, giving due consideration to psychosocial/ contextual factors, and carryout relevant treatment/management.
- Apply psychological principles and techniques in persons with mental health problems and disabilities.
- Work with the psychosocial dimensions of physical diseases, formulate and undertake focused/targeted psychosocial interventions.
- Able to work with community to promote health, quality-of-life and psychological well-being.
- To develop research acumen and thereby contribute to knowledge in professional areas.
- To develop self-reflective skills.

COURSE REGULATIONS (2019-20)

The MSc in Applied Psychology offered by Department of Applied Psychology, Pondicherry University is a full-time programme of two-year duration, which consists of four semesters.

Academic year of the Course Implementation: 2019-20

Eligibility: B.A./ B.Sc. three years course in Psychology with at least 55% marks or Bachelor's degree with at least 55% marks in aggregate in any discipline with Psychology as one of the subjects for all three years.

Course structure

The course structure of the M.Sc Applied Psychology Programme is given below:

M.Sc (Applied Psychology)

Course Structure
(Hard Core Courses offered)

(Regulations 2019-20)

FIRST SEMESTER			
Code	**Title**	**Credits**	**Marks**
APSY 411	Cognitive Psychology	3	100
APSY 412	Advanced Social Psychology	3	100
APSY 413	Theories of Personality	3	100
APSY 414	Research Methodology	3	100
APSY 415	Practicum - Experimental Psychology	3	100
	Total Credits/Marks	15	500
SECOND SEMESTER			
Code	**Title**	**Credits**	**Marks**
APSY 421	Biological Psychology	3	100
APSY 422	Positive Psychology	3	100
APSY 423	Health Psychology	3	100
APSY 424	Statistics in Psychology	3	100
APSY 425	Practicum - Psychological Testing	3	100
	Total Credits/Marks	15	500
THIRD SEMESTER			
Code	**Title**	**Credits**	**Marks**
APSY 510	**Summer Internship 1 – General**	3	100
	A. Clinical Psychology Specialisation		
APSY 511	Psychopathology	3	100
APSY 512	Psychological Therapies	3	100
APSY 513	Community Psychology	3	100
APSY 514	Neuropsychology	3	100
APSY 515	Practicum – Clinical Psychology	3	100
	Total Credits/Marks	18	600

THIRD SEMESTER			
Code	**Title**	**Credits**	**Marks**
APSY 510	**Summer Internship 1 – General**	3	100
B. Human Resource Development Psychology Specialisation			
APSY 511	Psychopathology	3	100
APSY 521	Organisational Behaviour	3	100
APSY 522	Human Resource Management	3	100
APSY 523	Training and Development in Organisations	3	100
APSY 524	Practicum - HRD Psychology	3	100
	Total Credits/Marks	18	600

THIRD SEMESTER			
Code	**Title**	**Credits**	**Marks**
APSY 510	**Summer Internship 1 – General**	3	100
C. Counselling Psychology Specialisation			
APSY 511	Psychopathology	3	100
APSY 531	Theories and Approaches to Counselling	3	100
APSY 532	Counselling Skills	3	100
APSY 533	Career Guidance and Counselling	3	100
APSY 534	Practicum – Counselling Psychology	3	100
	Total Credits/Marks	18	600

FOURTH SEMESTER			
Code	**Title**	**Credits**	**Marks**
APSY 541	Internship	4	100
APSY 542	Dissertation and Viva-Voce	8	100
	Total Credits/Marks	12	200

Total Credits **60 (Hard Core Courses)**

The student needs a total of 72 credits. The department offers 60 credits from the hard core courses. However, according to CBCS regulations, the students are required to earn a minimum of 72 credits for the successful completion of M. Sc. Degree in Applied Psychology. Hence, the remaining 12 credits have to be acquired from soft core courses either from the department or from outside the department.

Soft Core Courses offered

(Regulations 2019-20)

Code	Title	Credits	Marks
APSY 551	Environmental Psychology	3	100
APSY 552	Psychology of Interpersonal Relationship	3	100
APSY 553	Psychology for Effective Living	3	100
APSY 554	Para Psychology	3	100
APSY 555	School Psychology in Indian Context	3	100
APSY 556	Psychology for Social Problems	3	100
APSY 557	Industrial Relations and Labour Welfare	3	100

Semester	Total number of papers	Total Credits	Total Marks
	HARD CORE PAPERS (3 credits and 100 marks)		
First Semester	5	15	500
Second Semester	5	15	500
Third Semester			
Summer Internship I		3	100
Third Semester	5	15	500
Fourth Semester	Internship II	4	100
	Dissertation and Viva-Voce	8	100
Total		**60**	**1800**

Examinations

Choice Based Credit System (CBCS) is followed in the department. Grading is used for performance evaluation. Grades are awarded in the final assessment taking into consideration cumulative grade point averages. Evaluation of students is done two ways:

1. **Internal assessment**: Internal assessment is continuous and is awarded out of 40 marks in each paper by the teacher concerned. The assessment is based on tests, and other participatory pedagogy (case analysis, field based projects, term papers, case discussions, class room participation, web assignments, brain storming, simulation, role plays, mini projects, industrial visit reports, quizzes etc.).

   Each teacher shall organize a continuous assessment of each of the courses assigned to him/her. The internal assessment marks shall be given as per the following breakup:

   Internal Assessment Tests / Term Papers / Quizzes (two) 2 x 15 = 30

   Assignments/ Presentations/ Write ups/ Viva, etc. = 10

   Internal Total **40**

2. **End semester examination**: The end semester examination for 60 Marks will be conducted as per CBCS regulation with time to time modification by university administration.
3. Proportion of marks between internal and external evaluation for all subjects: 40:60
4. Question paper pattern for end semester examination is shown in the following exhibit.

M.Sc (Applied Psychology)
MODEL QUESTION PAPER – Theory

Time: 3 Hours **Max. Marks: 60**

Section	**Pattern**	Remarks
SECTION A	Answer ALL questions from the following (10 X 2 = 20 Marks) (Maximum 50 words)	Two questions from each unit
SECTION – B	Answer ALL questions from the following (5 X 4 = 20 Marks) (Maximum 200 words)	One question from each unit
SECTION – C	Answer Any TWO questions from the following (2 X 10 = 20 Marks) (Maximum 800 words)	Five questions to be given drawing one question from each unit
Question paper - Practical		
SECTION A	writing plan and procedure for any one of the experiment – 10 marks	Dictation of one experiment by the examiner
SECTION B	(i)Conduction of an experiment - 10 marks and (ii)writing the result – 10 marks	Lottery System is used to select any one of the experiment
SECTION C	Viva Voce – 20 Marks	
SECTION D	Record Book Evaluation -10 marks	

5. Marks for Internships/Dissertation

(a) Project/Dissertation

The project work or the dissertation that the students carry out is assessed based on the quality of research they have undertaken. Students are assessed by both internal examiner as well as external examiner by way of viva-voce in front of an examination committee comprised of Head of the Department, external examiner and an internal examiner.

Awarding Marks for Dissertation

Marks are awarded based on the internal and external evaluation. Internal Evaluation carries 40 marks and External carries 60 marks. The 60 marks are awarded based on the following criteria for the Viva Voce:

i.	Organisation and structure of report	20
ii.	Presentation	20
iii.	Novelty and utility	10
iv.	Interaction	10

b) Internship

There are two internships that students have to undergo. The first internship is called as Internship – General, and the second internship as Internship – Specialization.

Internship I – General

The first internship will be immediately after the first year during the summer vacations. The place of internship could be selected by the students themselves. The duration of the internship is one month, which could be divided into two halves, if student wished. There will be a presentation of the internship on reopening of the classes.

Report and evaluation

After completion of one month internship in an organisation/institution, students will submit a report of work done during internship period to the department along with a certificate of attendance from the organisation/Institution. Each student would be allotted a supervisor/guide for internship who will be the internal examiner for evaluation of both the internships. Mode of evaluation of the internships would be as under

Total Marks for internship	**100 marks**
Report component (To be awarded by the guide allotted)	**40 marks (40%)**

Internship II - Specialization

The second internship will be carried out in the beginning of the fourth semester. The duration of the internship is one month without any break. The place of internship could be selected by the students themselves. In both the internships it is important that students keep their faculty guides informed regarding the place of internship, contact details of the personnel at the place of internship, and maintain daily activity diary for the internship. The faculty guide will consider these and other related aspects while assigning internal marks. The daily activity diary should also be submitted to the department at the time of presentation of internship.

Report and evaluation

After completion of one month internship in an organisation/institution, students will submit a report of work done during internship period to the department along with a certificate of attendance from the organisation/Institution. Each student would be allotted a supervisor/guide for internship who will be the internal examiner for evaluation of both the internships. Mode of evaluation of the internship would be as under

Total Marks for internship	**100 marks**
Report component (To be awarded by the guide allotted)	**40 marks (40%)**
Viva-voce component (To be awarded by the guide and external examiner)	**60 marks (60%)**

Suggested Format for Writing Internship Report (Maximum 10 pages)

- Brief outline of objectives, structure and activities of the organisation
- Elaboration of learning experience as an intern
- Major skills learned during internship
- Problems experienced, if any,
- Suggestions and recommendations for future interns

6. Passing Condition

In order to declare a student pass the end semester exams, a minimum of 40% marks in end semester exams and a minimum of 50% in aggregate when internal assessment and end semester examination marks are added.

Supplementary Examinations

a. A failed student who meets the attendance requirement and has a minimum of 40% in internal assessment marks may be permitted to register for the next end semester examination in the following semester itself.
b. A student who has failed due to insufficient attendance and/or less than 40% internal assessment marks should repeat the course as and when offered.

7. Maximum number of years permitted after completion of Semester IV and to write arrear subjects: Two years under the new regulation.

8. Attendance

The mandatory minimum attendance requirement is 70% in each semester to recommend the student for writing the end semester examinations.

FIRST SEMESTER

Course Code	Credits
APSY 411 : Cognitive Psychology	--- 3
APSY 412 : Advanced Social Psychology	--- 3
APSY 413 : Theories of Personality	--- 3
APSY 414 : Research Methodology	--- 3
APSY 415 : Practicum – Experimental Psychology	--- 3

APSY 411: COGNITIVE PSYCHOLOGY

Learning Outcomes

To enable the students to understand

- The fundamental questions and findings of cognitive psychology.
- Explore the ways in which psychologists go about studying these questions.
- Explore the relationship between theories of cognition and empirical research.

UNIT-I: The Foundations of Cognitive Psychology: The Science of the Mind - scope of cognitive psychology, A Brief History, the emergence of modern cognitive psychology. Research in cognitive psychology. The neural basis of cognition -the Principal Structures of the Brain – neurons, communication of neurons, structure of functions of brain.

UNIT-II: Attention and Perception: Selective attention, divided attention, models of attention – filter model and attenuation model. Bottom up and top down processing in perception, Object Recognition – template matching, interactive activation model, feature integration theory, recognition by components theory. Gestalt laws of perceptual organization. Face perception, Speech perception.

UNIT-III: Human Memory Systems: meaning, types of memory, working memory, long term memory. Memory Acquisition; Retrieval; Encoding Specificity; Implicit Memory; Theoretical Treatments of Implicit Memory; Amnesia; Memory Errors and Memory Gaps; Autobiographical Memory. Mnemonic systems.

UNIT-IV: Language and Thinking: Concepts: Definitions and Prototypes; Organization of Language, Phonology, Words, Syntax, Sentence Parsing, Language and Thought, Judgment Heuristics, Anchoring; Reasoning: Confirmation and Disconfirmation, Logic, Decision-Making; Problem Solving: General Problem-Solving Methods, Relying on Past Knowledge. Defining the Problem.

UNIT- V: Consciousness: Meaning, history. Consciousness and cognitive psychology. Modern theories of consciousness – DICE, Global Worksplace. The functions of Consciousness – cognitive neuroscience of consciousness, the function of neuronal workspace, consciousness as justification for action. Indian thoughts on consciousness – Vedic model -the five levels; Buddhist model.

Text Books

Reisberg, Daniel (2018). Cognition: Exploring the science of the mind. (7thEdition). New York: Norton.

Goldstein, E. Bruce (2018). Cognitive Psychology: connecting mind, research and everyday experience (5th Ediction). Wadsworth.

Farmer T A, Matlin, M W (2019). Cognition (10th Edition), Wiley.

Suggested Reference

Dehaene, S et al. (2006). Core knowledge of geometry in an Amazonianindigene group. *Science, 311,* 381-384.

Green CS, Bavelier D (2003). Action video game modifies visual attention. *Nature, 423,* 534-537.

Lehman, D., Lempert, R., &Nisbett, R. (June 1988), The effects of graduate training on reasoning:Formal discipline and thinking about every-day events, *American Psychologist,* 431-442.

Loftus, E. (2003). Make-believe memories. *American Psychologist, Nov 2003.*

McNally, R. J. (2003). Recovering memories of trauma: A view from the laboratory. *Current Directions in Psychological Science*, 12, 32-35

Strayer, D. L., & Johnston, W. A. (2001). Driven to distraction: Dual-task studies ofsimulated driving and conversing on a cellular telephone. *Psychological Science, 12,* 462-466

Wolfe, JM et al. (2005). Rare items often missed in visual searches. *Nature, 435,I 439-440.*

Subhash C. Kak (1997). On the Science of Consciousness in AncientIndia.*Indian Journal of History of Science,* vol. 32, 105-120.

Pier Luigi Luisi (2008). The Two Pillars of Buddhism— Consciousness and Ethics. *Journal of Consciousness Studies*,15, No. 1,84–107.

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APSY 412: Advanced Social Psychology

Learning Outcomes:

To students will be able to understand

- ❖ The meaning and importance of social psychology in the present context.
- ❖ The preconceived notion about various social and health issues and its impact.
- ❖ The causes and consequences of contemporary social problems and their evidence-based remedial measures

Unit I: Definition of social psychology; current trends; methods of social psychology; importance of social psychology in today's context. Group Processes: Group Formation, Group dynamics, group cohesiveness and group influence.

Unit II: Social perception and cognition: Impression management, Attribution, biasness in social perception, Meaning, formation and changes of attitudes, influence of attitude on behavior. Barriers in changing attitudes. Prejudice; stereotype, myths, misconception and discrimination and their effects. Measures for prevention of prejudice, stereotype, myths, misconception and discrimination.

Unit III: Prosocial Behavior: Motives for Prosocial behavior; Responding to an emergency: Bystanders interventions; External and internal influences of Prosocial acts; Long term commitment to Prosocial acts.

Unit IV: Aggression & Violence: In search of the roots of violence; Causes and consequences of human aggression; Violence and types of violence. Violence against women & children, Bullying at work, Mob lynching; Prevention and control measures.

Unit V: Application of social psychology in different fields: Social Psychology and legal system; Social Psychology and Health; Social Psychology and World of Work; Gender Psychology, Implications of population explosion on quality of life and society

Text Books

Baron,R.A.,Branscombe.N.R, Byrne.D. and Kapur, P. (2017). *Social Psychology* (14th Edition). Pearson Publications.

Deb, S. (2016). Child Safety, Welfare and Well-being: Issues and Challenges, New Delhi, Springer.

Deb, S.; Gireesan, A. & Prabhavalkar, P. (2019). Social Psychology in Everyday Life. New Delhi: Sage

Myers, D.G. (2010). Social Psychology. New Delhi: Tata McGraw Hill.

Worcel, S., Cooper, J., Goethals, G.R. & Olson, J.M. (2000). Social Psychology. CA Wadsworth.

Suggested Reference Materials

Deb, S., & Modak, S. (2010). Prevalence of Violence against Children in Families in Tripura and Its Relationship with Socio-Economic Factors. *Journal of Injury and Violence Research*, *2*(1), 5.

Tripathi, R. C. (2019). Unity of the Individual and the Collective. In Girishwar Misra (Ed.), ICSSR Research Surveys and Explorations Psychology Volume 1 - 5 (Vol. 1). London: Oxford University Press.

Jewkes, R. (2002). Intimate partner violence: causes and prevention. *The Lancet*, *359*(9315), 1423-1429.

Kapadia, S. (2019). Socialization and Parenting: Mapping the Indian Landscape. In Girishwar Misra (Ed.), ICSSR Research Surveys and Explorations Psychology Volume 1 - 5 (Vol. 3). London: Oxford University Press.

Singh, P., & Siddiqui, R. N. (2019). Identity Discourse: From Negotiations to Harmony in Plural Societies. Mapping the Indian Landscape. In Girishwar Misra (Ed.), ICSSR Research Surveys and Explorations Psychology Volume 1 - 5 (Vol. 3). London: Oxford University Press.

World Health Organization. (2002). *WHO multi-country study on women's health and domestic violence against women* (No. WHO/FCH/GWH/02.2). Geneva: World Health Organization

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APSY 413 Theories of Personality

Learning Out come

- The students will be able to understand the nature of historical development of contemporary psychological theories on personality
- The students will be trained in such a way to learn the concepts of psychological foundations with suitable examples and application to the personality theories.
- The students will be able to know the Indian context of self and personality development.

Unit I: Introduction to Personality theories, major theoretical perspectives of cognitive; behavioural; psychoanalytic; humanistic, and biological theories

Unit II: Freud's Psychoanalytic theory, Jung Analytical, Adler's Individual theory, Horney's social and cultural theory, Allport theory of personality

Unit III: Humanistic Perspectives: Maslow's self-actualization theory, Carl Roger's person centred theory

Unit IV: Eysenck's biological theory, Kelly's personal construct theory, Bandura's social cognitive theory, Integration of personality theories

Unit V: Personality from Indian perspectives: Integral Psychology, Self and Yoga, Buddhist approaches

Text Books

Schultz.,P and Schults.,E.S (2015). Theories of Personality. 11th ed. Cengage. Boston.

Crowne, D. P. (2009). Personality theory . 2nd ed . Oxford University Press.

Baron (2005). Psychology: An Introduction, 5th ed. Prentice Hall of India, Pearson Education, New Delhi.

Burger, J.M. (2011) Personality. 8th Ed. Wadsworth.

Morgan, King and Robinson (2015). Introduction to Psychology, 7th edn, Tata McGraw Hill, Delhi

Suggested Reference Materials

Feist, J., & Feist, G. J. (2006). Theories of personality (6th ed.). New York: McGraw-Hill. [Chapter 16 “Bandura: Social Cognitive Theory”, pp. 467- 498.]

Olson, M., & Hergenhahn, B. R. (2012). A n introduction to theories of personality (8th ed.). New York: Pearson. [Chapter 15 “Abraham Maslow”, pp. 466 - 499.].

Singh, J. K., & Tung, N. S. (2019). Personality Studies in India. In Girishwar Misra (Ed.), ICSSR Research Surveys and Explorations Psychology Volume 1 - 5 (Vol. 3). London: Oxford University Press.

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APSY 414 Research Methodology

Learning Outcomes:

The students will be able to understand

- The need and purpose of research, various types of research and its importance in overall social development.
- The ethical issues involved in research and importance of ethical issues in research.
- How to conceptualize a research problem; write objective and hypothesis along with design of the study?
- The various data collection techniques, both qualitative and quantitative.
- Writing a good research proposal and report as well as article for the journals.

Unit I: Purpose and types of research: Basic research; applied research; action research; Quantitative and qualitative research; difference between qualitative and quantitative research and their strengths and weaknesses.

Unit II: Problems, hypotheses constructs, variables and definitions: Definition of problems and hypotheses; The importance and criteria of good research problems and hypotheses; definition and types of variables; constitutive and operational definitions of variables.

Unit III: (a) Sampling: Definition; sample size and representativeness; kinds of sampling- probability and non- probability.

(b) Research Designs**:** Meaning, purpose and principles; Experimental design, non-experimental design, ex-post-fact design; other specialised designs like pre-post-test design, the cross-sectional design, single subject study design, the longitudinal study design, survey research, correlational design, observational design and ethnography design.

Unit IV: (a) Process of Data Collection: (i) Quantitative (structured questionnaire, semi-structured questionnaire and standardized test) and (ii) qualitative (informal interview, case study, in-depth interview, focus group discussion, observation, participatory rural appraisal, projective tests); (b) Development and standardization of tool.

Unit V: (a) Ethics in research and its importance especially need for informed consent, confidentiality of information, compensation and deciding date and time for data collection as per convenience of the study subjects and giving feedback about the findings. Reference writing styles; (b) Monitoring and evaluation: Utility of monitoring and evaluation of programs; preparing a research proposal and writing research report and article; plagiarism.

Text Books

Best, J.W. and Kahn, J.V. (2014). Research in education (10th Edition) New Delhi: Pearson Education.

Kerlinger, F.N. (2017). Foundations of Behavioural Research. Delhi: Surjeet Publications.

Kothari, C.R. & Gaurav C. (2019). Research Methodology.(4th Edition) New Age International

Singh, A.K. (2017). Tests, Measurements and research Methods in Behavioural Sciences. Patna: Bharati Bhaban Publishers.

Reference Materials

Kenneth, B.S.& Bruce, A.B. (2013). Research Design and Methods. (9th Edition) New Delhi: Tata McGraw Hill Publishing Company Ltd.

Russell, B.H. (1988). Research Methods in Cultural Anthropology. New Delhi: Sage Publications

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APSY 415: Practicum: Experimental Psychology

(Any Eight Experiment to be conducted)

Measurement / Assessment of

1. Subliminal Perception
2. Suggestibility
3. Effect of knowledge of results
4. Types of learning (Whole Vs part, Massed Vs spaced, Meaningful Vs rote)
5. Styles of learning and Thinking (SOLAT)
6. Memory
7. Imagery
8. Free association (Chain method or Word association method)
9. Concept formation
10. Social facilitation (Vowel cancellation test)
11. Motives
12. Judging Emotions
13. Intelligence
14. Problem Solving
15. Stroop effect.

SECOND SEMESTER

APSY 421 : Biological Psychology	---	3
APSY 422 : Positive Psychology	---	3
APSY 423 : Health Psychology	---	3
APSY 424 : Statistics in Psychology	---	3
APSY 425 : Practicum – Psychological Testing	---	3

APSY 421: Biological Psychology

Learning Outcomes:

The students will be able to understand

- ❖ Biological Bases of Behaviour
- ❖ Importance of physiological system in behaviour

Unit I: Biological Basis of Psychology; Body-Mind Relationship in relation to wellness & illness; Research in Biological Psychology Ethical Issues related to Biological Psychology

Unit II: Biological Systems: Structure and Functions of Nervous System; Endocrinal System

Unit III: Respiratory System; Cardiovascular System;

Unit IV: Gastrointestinal System; Renal System; Reproductive System; Immune System

Unit V: Sleep; Biopsychology of sleep, Sleep Hygiene & its significance; Sleep Disorders; Interventions for healthy sleep

Text Books

Kalat, J.A. (2014). Biological Psychology (11th Edition). Nelson Education.

Pinel, J.P.J. (2016). Introduction to Biological Psychology (9th Edition). New Delhi: Pearson

Wickens, A. (2009).Introduction to Biopsychology: Pearson Education Limited

Carlson, N.R.(2017). Physiology of Behaviour (12th Edition).

Reference Materials

Rosenzweig, M. R., Breedlove, S. M., & Leiman, A. L. (2002). *Biological psychology: An introduction to behavioral, cognitive, and clinical neuroscience*. Sinauer Associates.

Breedlove, S. M., Watson, N. V., & Rosenzweig, M. R. (2007). *Biological psychology: An introduction to behavioral and cognitive neuroscience*. Sinauer.

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APSY 422: Positive Psychology

Learning Outcomes:

The students will be able to

- Understand the aims and scope of positive Psychology
- Apply the basic concepts from the course to an analysis of their own lives and personal strength

Unit–I: Introduction to Positive Psychology, Assumption and Goals of Positive Psychology; Genesis of Positive Psychology as a separate Branch; Eastern and Western Perspectives of Positive Psychology

Unit – II: Happiness: Meaning and Measure; Hedonic and Eudaemonic Approach to Happiness; Determinants of happiness; Happiness and Well-being, Positive Emotion: Defining Emotional Terms; Distinguishing the Positive and the negative affect; Broaden-and-Built Theory; Cultivating Positive Emotion

Unit – III: Positive Cognitive States: Optimism; Mindfulness; Flow; Courage. Self – regulation and self –control: The value of self-control; Personal goals and self - regulation; goals that create self – regulation problems; everyday explanations for self–control failure; goal disengagement.

Unit – IV: Prosocial Behaviour: Altruism; Gratitude; Forgiveness; Positive Relationship, Successful Aging: Physical and Mental Health; Social Interaction and Support; Cognitive reserve

Unit – V: Positive Schooling: Care; Trust; Respect for Diversity; Goals; Plans; Motivation, Positive Behaviour at Workplace: Positive Organisational Behaviour; Positive Organisational Scholarship; Psychological Capital; Thriving; Flow at Work; Employee Engagement;

Text Books

Baumgardner, S. R., & Crothers, M. K. (2009). *Positive psychology*. Prentice Hall/Pearson Education.

Carr, A. (2011). *Positive psychology: The science of happiness and human strengths*. Routledge.

Snyder. C.R, Lopez, S.J. & Jenifer T. Pedrotti (2010). Positive *Psychology: The Scientific & Practical exploration of human strengths*. New Delhi: Sage Publications

Suggested Reference Materials

Baltes, P. B., & Smith, J. (2003). New frontiers in the future of aging: From successful aging of the young old to the dilemmas of the fourth age. *Gerontology*, *49*(2), 123-135.

Kumar, U , Archana & Prakash, V. (2015) Positive Psychology: Applications in Work, Health and Well-being. New Delhi: Pearson

Bierhoff, H. W. (2002). *Prosocial behaviour*. Psychology Press.

Goldstein, T., Russell, V., & Daley, A. (2007). Safe, positive and queering moments in teaching education and schooling: A conceptual framework. *Teaching Education*, *18*(3), 183-199.

Mehrotra, S., & Tripathi, R. (2019). Positive Psychology: Fuzzy Boundaries, Growing Pains, and Emergine Challenges. In Girishwar Misra (Ed.), ICSSR Research Surveys and Explorations Psychology Volume 1 - 5 (Vol. 2). London: Oxford University Press.

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APSY 423: Health Psychology

Learning Outcomes:

The studenst will be able to understand

- The theoretical concept of health psychology and various psycho-social models of health.
- The causes, consequences and the psycho-social impact of chronic illnesses

Unit I: Introduction to health psychology: Concept of Health, Definition of health psychology, Health Behavior, Health Promotion, factors predicting health behavior.

Unit II: Models of health- biomedical, biopsychosocial, health belief and social cognitive models.

Unit III: Chronic illness: Adjusting to a chronic illness; causes, effects, medical regimen and psychosocial factors in asthma, epilepsy, nervous system injuries, Diabetes, arthritis, hypertension and Alzheimer's disease; Coping with and adapting to high mortality illness- Heart disease, Stroke, cancer; psychosocial interventions for people with chronic conditions.

Unit IV: Pain: Types of pain, Specific chronic pain conditions, Models of pain- The Gate Control Theory, Biopsychosocial Model, Cognitive-Behavioral Fear-Avoidance Model; Psychosocial factors and pain, Assessment of pain, Management of pain.

Unit V: Health communication: Perceiving and interpreting symptoms, Using and misusing health services, patient- practitioner relationship, Patient-practitioner interaction, Adhering to medical advice, Assessment of Health.

Text Books

Edward P Sarafino, Timothy W Smith (2012). Health Psychology 7th edition, Wiley India.

Shelley Taylor (2014). Health Psychology. 9th edition Mc Graw- Hill publication.

Suggested Reference Materials

Bret A. Boyer and M. Indira Paharia (2008). Comprehensive Handbook of Clinical Health Psychology, John Wiley & Sons, Inc.

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APSY 424: Statistics in Psychology

Learning Outcomes

After completing the course students will be able to

- Understand the meaning of statistics along with different types of statistical analyses.
- Understand difference between various types of statistics and their place of application.
- Understand the concept of normal distribution and its importance in the statistical inferences.

Unit I Introduction: Meaning of statistics, Classification of statistics – descriptive vs inferential, parametric vs non-parametric. Levels of Measurement. Measures of central tendency – Mean, median, Mode. Measures of variability – range, average deviation, quartile deviation, standard deviation.

Unit II Correlation – Meaning, product moment correlation, partial correlation, multiple correlation. Regression – linear, multiple. Brief introduction to factor analysis (without statistical problems).

Unit III Normal Distribution – Meaning, importance, properties. Hypothesis testing – types of hypothesis testing, type I error, type II error, one tailed and two tailed tests. Mean difference – t test, z test.

Unit IV ANOVA – One way and two way, ANCOVA, Post hoc comparison – Duncan's multiple range test, Tukey tests, Scheffe test, Dunnett's tests.

Unit V Non parametric tests – chi-square, Mann Whitney U-test, Kruskal Wallis, Rank order (Spearman, Kendell Tau), Biserial, Point Biserial, Tetra choric, Phi Coefficients.

Text Books

Garrett, H.E. (2005). Statistics in psychology and Education. Paragon Internatinal

Guilford J.P & Fruchter.B. (1978).Fundamental Statistics in Psychology and Education. New York, McGraw Hill.

Howell, D.C. (2012). Statistical methods for Psychology. USA: Wadsworth

Suggested Reference Materials

Jeremy Miles & Philip Banyard (2007). Understanding and Using Statistics in Psychology: A Practical Introduction. Sage Publications

Siegal, S. (2002). Non –parametric Statistics for the Behavioural Sciences. New Delhi: Tata McGraw Hill.

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APSY 425: Practicum: Psychological testing

(Any eight Practical to be conducted)

Measurement / Assessment

1.16 P.F

2. MMPI

3. NEO-5

4. Sentence completion test

5. Draw –a-person test

6. Bell's adjustment inventory

7. Transactional styles

8. Locus of control

9. Interpersonal sensitivity

10. State and Trait Anxiety

11. Emotional Intelligence

12. Personal Effectiveness

13. Creativity

14. Psychological mindedness

15. Self-Efficacy

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APSY 510: SUMMER INTERNSHIP – 1: GENERAL

After second semester during summer vacation students will undergo an internship called as Internship 1 – General with 3 credits, which will help them to opt their specialisation in third semester. Therefore, this internship is part of third semester.

Internship I – General

The first internship will be immediately after the first year during the summer vacations. The place of internship could be selected by the students themselves. The duration of the internship is one month, which could be divided into two halves, if student wished. There will be a presentation of the internship on reopening of the classes.

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THIRD SEMESTER

APSY 510: Summer Internship – General --- 3

A. Clinical Psychology Specialization

APSY 511 :	Psychopathology	---	3
APSY 512 :	Psychological Therapies	---	3
APSY 513 :	Community Psychology	---	3
APSY 514 :	Neuropsychology	---	3
APSY 515 :	Practicum – Clinical Psychology	----	3

B. Human Resource Development Psychology Specialization

APSY 511 :	Psychopathology	---	3
APSY 521 :	Organisational Behaviour	---	3
APSY 522 :	Human Resource Management	---	3
APSY 523 :	Training & Development in Organisations	---	3
APSY 524 :	Practicum: HRD Psychology	----	3

C. Counselling Psychology Specialization

APSY 511 :	Psychopathology	---	3
APSY 531 :	Theories and Approaches to Counselling	---	3
APSY 532 :	Counselling Skills	---	3
APSY 533 :	Career Guidance and Counselling	---	3
APSY 534 :	Practicum: Counselling Psychology	----	3

A. Clinical Psychology Specialisation

APSY 511: PSYCHOPATHOLOGY (Common to Clinical Psychology and HRD Psychology Specialisation)

Learning Outcomes :

The students will be able to know:

- Various paradigms of Psychopathology
- Latest DSM-5 and ICD -11classification system of Mental Disorders
- The symptoms, etiology and prognosis of different Mental Disorders

UNIT – I Ancient and modern conceptions of mental abnormality, Classification and assessment of mental abnormality - DSM -V and ICD -11, Methods of clinical assessment – interviews, case studies, psychological tests and behavioral observation, Case history and Mental Status Examination

UNIT – II Schizophrenia Spectrum and Other Psychotic Disorders, Bipolar and Related Disorders, Depressive Disorders

UNIT – III Anxiety Disorders, Obsessive-Compulsive and Related Disorders, Trauma and Stressor –Related Disorder

UNIT – IV Dissociative Disorders, Somatic Symptom and Related Disorders, Sexual Dysfunctions, Paraphilic Disorders

UNIT – V Disruptive, Impulse - Control and Conduct Disorders, Substance-Related and Addictive Disorders, Personality Disorders. Childhood Disorders: Learning Disability; ADHD

Text Books

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

Butcher J.N; Mineka Susan; and Hooley Jill M. (2018). *Abnormal Psychology* (17th Ed.) Dorling Kindersley(India) Pvt.Ltd. of Pearson Education

Comer, R.J., & Comer, J. S. (2017). *Abnormal Psychology*. (8th Edition) New York: Worth.

Suggested Reference Materials

Puri, B.K., Laking, P.J. & Treasaden, I.H. (2002). *Textbook of psychiatry.* New York: Churchill Livingstone.

Sue, D., Sue D. W., Sue, S. & Sue, D.M., (2015) *"Abnormal Behavior" (11*th Edi), Wadsworth.

World Health Organization (1992). *The ICD-10 Classification of mental and behavioural disorders: Clinical description and diagnostic guidelines:* Delhi: Oxford University Press.

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APSY 512: Psychological Therapies

Learning Outcomes:

The students will be able to know:

- The nature, goals and prerequisites of psychopathology
- Different schools and techniques in psychotherapy.

Unit I: Introduction: Interventions; definitions of psychotherapy; goals of psychotherapy; professional issues, training; ethical issues; personal characteristics of therapists; common and unique features of psychotherapies.

Unit II: Psychodynamic Therapy; Humanistic Therapy (Client Centered Therapy); Gestalt Therapy.

Unit III: Cognitive Behaviour Therapy; Albert Ellis Therapy; Aaron Beck's Cognitive Therapy. Third Wave Therapies; DBT; MBTSR.

Unit IV: Behaviour Therapies: Therapeutic techniques based on classical, operant and modeling theories, Modeling – live modeling; Participant modeling (behaviour rehearsal) symbolic modeling and covert modelling, Relaxation training; muscular relaxation; Meditation; Flooding; Systematic Desensitization; Paradoxical Intention;; Assertive training.

Unit V: Group Therapy (in brief); Family/Marital Therapy; Transactional Analysis.

Text Books

Bellack, A.S., Herson, M & Kazdin, A.E. (2012).International Handbook of Behaviour Modification And Therapy; Springer.

Bergin, A.E. & Garfield, S.L. (1994). Handbook of Psychotherapy and Behavioural Change. 4th ed. N.Y. Wiley.

Colemom J.C. Butcher J.N. and Carson B.C. (1984) Abnormal Psychology and Modern Life, 7th edition. Scot, Foresman and Company.

Gabbarel, G.O., Beck, J.S., & Holmes, J. (2007). Oxford Text Book of Psychotherapy. New York: Oxford University Press.

Norcros, J. C., & GoldFried, M. R., (2005). Handbook of Psychotherapy Integration New York: Oxford Press.

Suggested Reference Materials

Jones, C.C. (1993) Family Systems Therapy, Wiley Norcross

Lane D. & Miller. A. (1992). Child and Adolescent Therapy. A Handbook Milton Keynes open Univ. Press.

Sarason I.G. & Sarason B.R. (2017). Abnormal Psychology. Prentice Hall of India Pvt. Ltd. New Delhi.

Spiegler. M.D., & Guevremont (2014). Contemporary Behaviour Therapy. (6th Edition) New Delhi. Cengage Learning Publishing.

Stein, S.M. Hough, R. & Stein, J. (1999). Essentials of Psychotherapy. UK: Hodder Arnold Publishers.

Steven J.L. & John. P.G. (1985). Contemporary Psychotherapeutic Models and Methods. Ohil, Charles E. Merrit.

Wolberg. L.R. (1995). The Technique of Psychotherapy. Vol. I & II London, Jason Aronson Inc.

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APSY 513: Community Psychology

Learning Outcomes:

The students will be able to know:

- The theoretical concepts of community psychology and importance of the subject in the present context, parameters for measuring quality of life and strength of empowerment.
- The role of community psychologist at the grass-root level in addressing issues of students, disadvantaged children, and aged people.
- The community perception about mental health and issues and challenges faced by people with HIV/AIDS.

Unit I: Definition and perspectives of community psychology with reference to mental health, organizational health and social action; individual wellness, quality of life and parameters to measure quality of life, sense of community, psychological sense of community, social justice, participatory approach, empowerment, citizen participation, collaborative community strength, human diversity and empirical grounding; primary, secondary and tertiary prevention.

Unit II: Introduction on school interventions- scope and need; Challenges faced by the students like academic stress, anxiety related to examination, depression, adjustment of the students, dependence of students on substance; institutional disciplinary measures and its impact; safety measures in the schools; motivating students; life skill education for students; parents and community involvement in school development and functioning; intervention program for parents and teachers for creating student friendly environment; government response for prevention of corporal punishment; National Education Policy; Integrated school-based intervention program for addressing students' mental health.

Unit III: Definition and background of vulnerable children; their prevalence; living condition of street/orphan children, slum children, children in conflict with law and children of commercial sex workers; child abuse, trafficking and prostitution; problems encountered by the vulnerable children; child rights; prevention, role of psychologists and social workers and other professionals in intervention and rehabilitation of vulnerable children; steps for effective implementation of intervention program; social defense measures; government policies for vulnerable children.

Unit V: Role of aged in the family; problems faced by the elderly people in the family; domestic violence, causes and consequences amongst elderly; illness and palliative care; family-based intervention programs; social support, maladjustment and role conflict; support services for the family and elderly people; perception about support services; positive aging; institutional, community and palliative care. National Policy for Protection of Rights of Aged People.

Community Psychology in the service of HIV/AIDS Affected: Definition of HIV/AIDS, and basic information; need and importance of HIV/AIDS counseling, qualities of a counselor, micro-skills in counseling, objectives of pre and post-test counseling; psycho-social impact of the disease; stigma attached with the disease; prevention, intervention and rehabilitation; skill development training; National AIDS Control

Program with special reference to care and support services for the people living with HIV/AIDS.

Text Books

Barrera, M. (2000). Social Support Research in Community Psychology. In *Handbook of Community Psychology* (pp. 215-245). Springer, Boston, MA.

Deb, Sibnath et al. (2019). Childhood to Adolescence: Issues and Concerns, New Delhi, PEARSON.

Deb, Sibnath (2018). Positive Schooling and Child Development: International Perspectives. Singapore, Springer Nature.

Deb, Sibnath (2017). An Empirical Investigation into Child Abuse and Neglect in India: Burden, Impact and Protective Measures, New Delhi, Springer.

Deb, Sibnath (2016). Child Safety, Welfare and Well-being: Issues and Challenges, New Delhi, Springer.

Orford, J. (2008). *Community Psychology: Challenges, Controversies and Emerging Consensus*. John Wiley & Sons.

Reich, S., Riemer, M., Prilleltensky, I., & Montero, M. (2007). *International community Psychology*. New York: Springer Science+ Business Media, LLC.

Seidman, E., & Rappaport, J. (2000). Handbook of Community Psychology.

Suggested Reading Materials

Browne, A., & Finkelhor, D. (1986). Impact of Child Sexual Abuse: A Review of The Research. *Psychological Bulletin*, *99*(1), 66.

Finkelhor, D. (1994). The International Epidemiology of Child Sexual Abuse. *Child Abuse & Neglect*, *18*(5), 409-417.

Dorji, N., Dunne, M. P., Seib, C., & Deb, Sibnath (2017). Quality of Life among Senior Citizens in Bhutan: Associations with Adverse Life Experiences, Chronic Diseases, Spirituality, and Social Connectedness. *Asia Pacific Journal of Public Health*, *29*(1), 35-46.

Deb, Sibnath & Ray, Mrinal Kanti (2016). Child Abuse and Neglect in India: Risk Factors and Protective Measures. In Deb, S. (Ed.) '*Child Safety, Welfare and Well-being'* (2016), New Delhi, Springer.

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APSY 514: NEUROPSYCHOLOGY

Learning Outcomes

The students will be able to:

- Understand the fundamentals of neuropsychology;
- Understand the symptoms, functions and disorders of the lobes;

Unit I: Introduction: The Brain Versus Heart, Aristotle, Descartes, Darwin and Materialism; Experimental Approaches To Brain Function- Localization of Function, Localization and Lateralization of Language, Sequential Programming and Disconnection, Loss And Recovery Of Function, Hierarchical Organization And Distributed Systems In The Brain; Contributions to Neuropsychology From Allied Fields- Neurosurgery, Psychometrics and Statistical Evaluation, Brain Imaging.

Unit II : The organization of the nervous system: Neuroanatomy, Nervous System, The Spinal Cord- structure and functions, Central Nervous System, Peripheral Nervous System, The Brainstem- Hindbrain, Midbrain, Diencephalon, Forebrain, Basal Ganglia, Limbic System, Neocortex, Fissures, Sulci, and Gyri.

Unit III: Organization of the Sensory Systems- General Principles of Sensory-System Function, Vision, Hearing, Body Senses, Taste and Smell, Cerebral Asymmetry.

Unit IV: Cortical functions: Occipital Lobes- Anatomy, Disorders of Cortical Function, Visual Agnosia; Parietal Lobes- Anatomy, Somatosensory Symptoms of Parietal Lobe Lesions, Symptoms of Posterior Parietal Damage, Apraxia; Temporal Lobes- Anatomy, Symptoms of Temporal Lobe Lesions, Disorders of Music and Visual Perception; Frontal Lobes- Anatomy, Symptoms of Frontal Lobe Lesions

Unit V: Neuropsychological testing: Neuropsychological Tests for parietal, frontal, temporal and occipital lobe damage, brain plasticity, neuropsychological retraining.

Text Book

Bryan, Kolb & Ian Q. Whishaw. (2015). Fundamentals of Human Neuropsychology. (7th Edition). Worth Publishers.

Pinel,J.P.J. (2016). Biopsychology, 9th edn. New Delhi, Pearson

Harry A. Whitaker. (1988). Neuropsychological Studies of Nonfocal Brain Damage. New York: Springer-Verlag.

Ottoson, D. (1987). Duality and Unity of the Brain. London: MacMillan.

Suggested Reference Materials

Harry A. Whitaker. (2011). Neuropsychological Studies of Nonfocal Brian Damage. New York: Springer-Verlag.

Ottoson, D. (2012). Duality and Unity of the Brain. Springer .

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APSY 515: Practicum – Clinical Psychology

Learning Outcomes

- Administration, Scoring & Interpretation of various clinical tests

Any Eight practicals to be conducted

Neuropsychological Assessment
NIMHANS Neuropsychological Battery,
Finger Tapping Test, Tactile Perception Test (using Seguin Form Board).
Psychological Assessment of Children
CBCL
Raven's Colored Progressive Matrices
WISC
Tests of Cognitive Functions
WAIS
Bender Gestalt Test
Wechsler Memory Scale
Wisconsin Card Sorting Test
Dyslexia Adult Screening Test
Knox- Cube Test
Seguin Form Board
Benton Visual Retention Test
Projective Tests (any one)
Sentence Completion Test
Children Apperception Test
Rorschach Inkblot Test
Somatic Inkblot Test
Draw-a-person test
House-tree-person test
TAT
Personality (any one)
MMPI
16 PF
NEO – 5 Personality Inventory
Vineland Social Maturity Scale
Multidimensional Assessment of Personality (Manju Agarwal, 1988)
Mental Disposition
Beck Anxiety Scale
Beck Depression Scale or Centre for Epidemiologic Studies Depression Scale (CES-D)

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B. Human Resource Development Psychology Specialisation

APSY 511: PSYCHOPATHOLOGY (Same as Clinical Psychology and Counselling Psychology Specialisation)

APSY 521: Organisational Behaviour

Learning Outcomes: The students will be able to:

- Understand the aims and scope of Psychology in Organisational Context
- Develop an idea about the individual grounding in organization
- Comprehend the various Group related aspects in organization
- Understand the contextual impact of organization on the individual member
- Apply the basic concepts from the course to various types of organisations in field.

Unit – I Introduction to Organisational Behaviour: Defining organization; Analysing behavior in Organisation at different levels; Historical foundation of modern organizational behaviour; Theoretical frame works – cognitive frame work, behaviouristic frame work and social learning framework; Challenges and opportunities before Organisational behaviour. **Personality & Ability:** Definition and meaning; Determinants- heredity, environment; Five-factor personality model; Organisational uses. **Ability:** The Intellectual Abilities, Physical Abilities; The Ability-Job fit

Unit – II Work Attitudes: Components and functions of attitude; Job satisfaction – factors, outcomes; Organisational commitment- types, consequences. **Work Motivation:** Meaning – primary, secondary and general motives; Content theories of work motivation- Maslow's need hierarchy, Herzberg's two factor theory, Alderfer's ERG model; Process theories of work motivation – Vroom's expectancy theory; Job design and motivation.

Unit – III Communication: Historical back ground- Fayol's contribution, Bernard's contribution; Communication process; Non-verbal communication; Communication networks; Barriers to effective communication. **Decision Making:** Individual and group decision making; Models of managerial decision making – Rational model, Bounded rational model, Social model; Group decision making – Interacting group method, Delphi technique, Nominal group method.

Unit – IV Group Dynamics: Fundamentals of group; Dynamics of group formation; Classification of groups; Group vs Team; Types of teams; Characteristics of effective teams; Factors influencing team effectiveness. **Leadership**: Leadership vs management; Established approaches to leadership- Trait model, Behavioural model, Contingency approach; Contemporary approaches to leadership – Transformational Leadership approach, Servant leadership

Unit – V Organisational Change: Forces of Change; Planned Change; Resistance to Change; Approaches to manage Organisational Change. **Occupational Stress:** Meaning; Causes-Individual and Organisational Stressors; Effects –Physical; Psychological and Behavioural; Coping Strategies-Individual and Organisational

Text Books

Luthans, F., Luthans B.C, & Luthans K.W. (2015). *Organizational Behavior*. (13th Edition) Information Age Publishing

Pareek, U. (2008). *Understanding organizational behaviour*. Oxford university press.

Robbins, S. P. & Judge, T.A. & Vohra, N. (2018). *Organizational Behavior*. Pearson Education

Suggested Reference Materials

Greenberg, J., & Baron, R. A. (2011). Behavior in organizations. Texas: Prentice Hall

Gregory Stone, A., Russell, R. F., & Patterson, K. (2004). Transformational versus servant leadership: A difference in leader focus. *Leadership & Organization Development Journal*, *25*(4), 349-361.

Hellriegel, D. & Slocum, J. W. (2011). *Organizational behavior*. Singapore: Thomson Asia Pvt Ltd. 13th Edition

Sinha, J. B. (2009). *The cultural context of leadership and power*. SAGE Publications Pvt. Limited.

Singh, S., & Gupta, V. (2019). Organizational Performance Research in India: A Review and Future Research Agenda. In Girishwar Misra (Ed.), ICSSR Research Surveys and Explorations Psychology Volume 1 - 5 (Vol. 4). London: Oxford University Press.

Vohra, N., Nair, N., & Sheel, R. (2019). Burnout, Organisational Cynicism, Alienation: Review of Negative Workplace Attitudes, Behaviours, and Cognitions. In Girishwar Misra (Ed.), ICSSR Research Surveys and Explorations Psychology Volume 1 - 5 (Vol. 4). London: Oxford University Press.

Bhal, K. T. (2019). Ethical Leadership in India: A Review of Theory and Research. In Girishwar Misra (Ed.), ICSSR Research Surveys and Explorations Psychology Volume 1 - 5 (Vol. 4). London: Oxford University Press.

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APSY 522: Human Resource Management

Learning Outcomes: The students will understand:

- The importance of human being (Employee) as an asset
- The importance of human resource in any organization
- The operative functions dealt by Human Resource Managers
- Psychological aspects involved in various HR functions.

Unit I: Human resource management: Nature, Function, Personnel Management vs. HRM, HRD vs. HRM, Strategic Role, International human resource management.

Unit II: Human Resource Planning: Importance, process, Forecasting Demand, Estimating Supply, Effective HRP, Human resource accounting. Job Analysis**:** Uses, Process, Methods, job description & job specifications.

Unit III: Recruitment: Objectives & Constraints, Sources, Methods, Selection: Process, Tests for Selection (Cognitive Ability, Motor & Physical Ability, Personality, Achievement), Interview as selection Device.

Unit IV: Job Evaluation: Uses, Methods, job evaluation and Establishing pay structure. Performance Appraisal: Comparing with Performance Management, Methods, Challenges, Legal implications

Unit V: (i) Employee compensation: Incentive Plans: Individual Employee, Team/Group, organisation-wide. Employee Benefits: Pay for time not worked, Insurance benefits, Retirement benefit, Personal & Family friendly benefits.

(ii) Health & Safety: Legal Provisions, Measures, Accidents, Safety Management. Grievance & Discipline: Features & Forms, Model Grievance Procedure, Approaches to Discipline, Disciplinary Action, Essentials for a Good Disciplinary System.

Text Books

Bermardin, H.J. (2007). Human resource management. New Delhi: Tata McGraw Hill.

Decenzo, D.A. & Robbins, S.P., & Verhulst, S.L. (2015). Personnel and human resource management. Wiley India (11th Edition) New Delhi

Rao V.S.P. (2010). Human resources management: Text and cases. New Delhi: Excel Books .

Suggested Reference Materials

Dessler, G., Varrkey, B. (2017). Human resource management. New Delhi: Pearson Prentice Hall.

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APSY 523: Training and Development in Organisations

Learning Outcomes:

The students will be able to:

- understand various concepts in Training and Development.
- Gain an in-depth understanding of various Training Methods
- Understand the principles of Organization Development and its Techniques

UNIT I Training and Assessment of Needs: Definition -Importance of training in organizations, Training as a profession, skills for trainers, Training Needs Analysis, Training design

UNIT II Training Methods: Non-experiential Training Techniques: Lecture method, Audio Visual assisted method, Programmed Instruction and Computer Assisted Instruction method: Suitability, advantages and limitations.
Experiential Training Techniques: Experiential Learning approaches; Simulation, In-basket Technique, Case- study, Role- Playing, T- Groups, group Discussion, business games-suitability, advantages and limitations.

UNIT III Technical Training Systems: On- the- job and off- the- job technical training-Training approaches to improve productivity and quality: TQM and TPM, 5-s concept, six sigma, Quality circles and KAIZEN.

UNIT IV Training and Developing Managers: Management Development: The nature of the Managerial job- Knowledge and Skills requirements of managers-Management Development Programs and Techniques-Career Planning and Development - Assessment centres

Unit V Organizational Development: Definition, nature and objectives - Phases of an OD Programme-OD Interventions-Limitations

Text Books

Aswathappa (2013). Organizational Behavior. Text, cases, games. (11th Edition) Mumbai. Himalaya Publishing House.

Camp, Blanchard & Huszczo (1986). Toward a more Organizationally Effective Training Strategy & Practice. New Jersey. Prentice Hall.

French & Bell (1998). Organization Development. Behavioral Science Interventions for Organization Improvement (6th edition). Prentice Hall.

Goldstein (2002). Training in Organizations. 4th edition. Thomson & Wadsworth.

Suggested Reference Materials

Goetsch, D. L., & Davis, S. B. (2014). *Quality management for organizational excellence*. Pearson

Landale (2006). Advanced Techniques for Training and Development. Infinity Books.

Muchinsky (2006). Psychology Applied to Work. 8th edition. Thomson Wadsworth.

Tripathi (2010). Organizational Development & Human Resource Development. New Delhi. Sultan Chand & Sons.

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APSY 524: Practicum - HRD Psychology

(Any Eight practical to be conducted)

Learning Outcomes

The students will be able to undertake:

- ❖ Administration, Scoring & Interpretation of various test results
- ❖ Developing modules for various training/OD activities

1. Fundamental interpersonal relations orientation (FIRO-B)
2. MBTI
3. Developing Job Evaluation Profile (Point Ranking/Factor Comparison)
4. Group Decision Making (Nominal Group/Delphi)
5. Organisational Climate
6. Dexterity Test (Minnesota Manipulation/ O'Conner's/Stromberg/Purdue)
7. Adult Intelligence (WAIS/Kaufmann/Slosson)
8. Emotional Intelligence

Compulsory (Any Two out of the following) practicals

9. Developing a management game (Leadership/Motivation/Interpersonal Relationship)
10. Designing any OD intervention
11. Preparing a training module for a given case situation.
12. Developing soft skill based training module for school/colleges students

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C. Counselling Psychology Specialisation

APSY 511: PSYCHOPATHOLOGY (Same as Clinical Psychology and HRD Psychology Specialisation)

APSY 531: Theories and Approaches to Counselling

Learning Outcome

By the end of these units, students will be able to:

- Describe the historical development, philosophical influences and theoretical bases of major psychotherapeutic schools;
- Understand and apply important skills and processes from a range of counselling approaches;
- Critically evaluate the strengths, limitations and evidentiary base of major schools of counselling;
- Evaluate the potential application of a variety of counselling frameworks with diverse groups of clients;
- Critically reflect on the potential relevance of counselling schools studied in the unit for their own developing approach to practice.

Course Structure

Unit I: Meaning, purpose and goals of counselling, Distinction between psychotherapy and Counselling: Arts and Science perspective, Process of counselling, Characteristics of Counsellors.

Unit II: Introduction - Psychodynamic school- Classical psychoanalysis by Sigmund Freud; Analytical therapy by Carl Jung; Historical development and theoretical perspectives, Processes and skills. Humanistic-existential school – Person centred therapy by Carl Rogers, Gestalt therapy by Fritz Perls, Transactional analysis by Eric Berne, Reality therapy by William Glasser, Existential therapy by Irvin Yalom, Logotherapy by Viktor Frankl.

Unit III: Cognitive-behavioural school – Behaviour therapy by Ivan Pavlov, Rational emotive behaviour therapy by Albert Ellis, Cognitive therapy by Aaron Beck, Multimodel therapy by Arnold Lazarus.

Unit IV: Postmodern school – Solution-focused therapy by Steve de Shazer, Narrative therapy by Michael White.

Unit V: Integration of diverse approaches, contemporary trends and controversies, crisis intervention.

Text Books

Corey, G. (2016). Theory and Practice of Counseling and Psychotherapy (10th Ed). Belmont, CA, Thomson Learning (Brooks/Cole).

Corsini, R.J. & Wedding, D. (2010). *Current Psychotherapies.*(9th Ed). Belmont, CA, Thomson Learning (Brooks/Cole).

Richard Nelson – Jones (2014). *Theory and Pracitice of Counselling and Therapy*, 6thedn. London: Sage Publications.

Suggested Reference Materials

Mearn, D , Thorne, B., & McLeod, J. (2013). Person-Centred Counselling in Action, (4th Edition). London: Sage Publications.

Sanders, P. (2011). *First Steps in Counselling: A Studnets's Companian for Basic Introductory Courses*, (4th Edition). Ross-on-Wye: PCCS Books

Sanders, D. & Wills, F. (2005). Cognitive Therapy: An Introduction, 2ndedn. London: Sage Publications.

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APSY 532: Counselling Skills

Learning outcomes

The students will be able to understand:

- ❖ Micro skills in counselling
- ❖ Understanding skills required at various stages of counselling
- ❖ Professional and Ethical issues in counselling

UNIT I Skills in Counselling: Counsellors as helpers, communication skills in counselling, counselling and helping process, micro skills in counselling

UNIT II Skills in Relating Stage: Understanding internal frame of reference, showing attention and interest, reflecting feelings, managing resistance

UNIT III Skills in understanding stage: Assessing feelings, thinking and physical reactions, Assessing communication, challenges feedback and self-disclosure, monitoring, summarising and identifying.

UNIT IV Skills in changing stage: Coaching skills; speaking, demonstration and rehearsing, improving communication, thinking and actions, negotiation homework, terminating counselling

UNIT V Professional and ethical issues in counselling: Professional code of ethics in counselling, client diversity issues in counselling, distance counselling mediated by technology and social media.

Text Books

Corey, G. (2015). *Theory and practice of counseling and psychotherapy*. Nelson Education.

Nelson-Jones, R. (2012). *Introduction to counselling skills: Text and activities*. (4th Edition) Sage.

Nelson-Jones, R. (2015). *The theory and practice of counselling psychology(Sixth Edition).SAGE Publications*.

Nystul, M. S. (2015). *Introduction to counseling: An art and science perspective*. SAGE Publications.

Suggested Reference Materials

American Counselling Association (2014).Code of Ethics.Alexandria.

Woolfe, R., Strawbridge, S., Douglas, B and Kasket, E. & Galbraith, V. (2016). Handbook of Counselling Psychology, 4th Edn. London: Sage Publication

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APSY 533: Career Guidance and Counselling

Learning Outcomes

The students will be able to:

- Understand the basic principles of Career Guidance and Counselling
- Develop insight into different models in Career Counselling

Unit– I: Counselling as a helping profession; the Professional Counsellor; counselling as a discipline; Traditional activities; Basic principles for schools and community agencies; Future Directions for the profession.

Unit – II: Counselling and misconceptions, Skills necessary to be an effective career counsellor, Principles and stages in career counselling, Goals of Counselling; The Counselling Process; Relationship establishment; Problem Identification and exploration.

Unit – III: Student Counselling in educational institutions, Types of students, bullying, Special counselling situations – drug abuse, tobacco use, alcohol abuse, Victims of abuse, students with disabilities, students with poverty, HIV AIDS. Role and function of counsellor as career guidance and counsellor; training programmes for counsellor and relationships with other helping professions; patterns of Counselling Programmme Organization in educational settings; future directions for programmes of Counselling; Guidance – personal, academic and vocational.

Unit – IV: Theories of Career Development and Decision Making; Overview of Career Development Models: Donald's Super, Bandura's Social Cognitive Theory, Nancy Schlosberg Career Shift Theory, Holland's Self Directed Search, Career Counselling and the Development of Human Potential; Career Planning and decision making in schools; Career Counselling in non-school settings; Computerized Career Assistance Systems.

Unit – V: (i) Assessment in Career Counselling: Guiding the students to prepare for career entry by designing good bio-data/resume, facing interviews and group discussion and excelling in the career path. (ii) Types of standardized tests: Intelligence testing, Aptitude tests, Special aptitude tests, Vocation; Aptitude

batteries, Scholastic Aptitude Tests, Academic Achievement tests, Interest inventories, Observation instruments; self-reporting; group assessment techniques, Personality and understanding personality tests. (iii) Ethical issues; The Counsellor and the Law; Legal concerns of Counsellors

Text Books

Gibson R. & Mitchell H.M.(2015) Introduction to Counselling and Guidance. 7th edition. Delhi: Pearson Education.

Narayana Rao (2003) Counseling and guidance. 2nd edition. New Delhi. Tata Mc Graw Hill.

Nystul, M (2018). Introduction to Counseling. As art and science perspective.(6th Edition) Cognella Inc

Richard Nelson – Jones (2012). Basic Counselling Skills. 3rd Edn. New Delhi: Sage Publication

Suggested Reference Materials

Bond, T. (2015). Standards and Ethics for Counselling in Action, 4th Edn. London: Sage Publication

Griffiths, & Weatherilt, T. (2001). Safe School, Friendly School: A Framework for Developing a Safe and Friendly School. Swan Education District, Perth, WA: Department of Education.

Woolfe, R., Strawbridge, S., Douglas, B and Kasket, E. & Galbraith, V. (2016). Handbook of Counselling Psychology, 4th Edn. London: Sage Publication

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APSY 534: Practicum - Counselling Psychology

Learning Outcomes

The students will be able to undertake:

Administration, Scoring & Interpretation of various test results

Any Eight practical to be conducted

1. Case History Taking
2. Clinical Interview
3. WISC
4. Wechsler Adult Intelligence Scale (Indian Adaptation)
5. Culture Fair Intelligence Scale for Children (Indian Adaptation)
6. Dyslexia Adult Screening Test (DAST)
7. Davis Battery of Differential Abilities (Indian Adaptation)
8. Super Career Maturity Inventory
9. Entrepreneurial Talent Measure
10. Differential Abilities
11. Interest Measurement
12. Anxiety
13. Depression
14. Multidimensional Assessment of Personality
15. Learning Disability

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FOURTH SEMESTER

APSY 541: Internship 2 – Specialization	---- 4 credits
APSY 542: Dissertation and Viva-Voce	--- 8 credits

APSY 541: Internship II – Specialization

The second internship will be carried out in the beginning of the fourth semester. The duration of the internship is one month without any break. The place of internship could be selected by the students themselves. In both the internships it is important that students keep their faculty guides informed regarding the place of internship, contact details of the personnel at the place of internship, and maintain daily activity diary for the internship. The faculty guide will consider these and other related aspects while assigning internal marks. The daily activity diary should also be submitted to the department at the time of presentation of internship.

APSY 542: Dissertation and Viva-Voce

Dissertation

The project work or the dissertation that the students carry out is assessed based on the quality of research they have undertaken. Students are assessed by both internal examiner as well as external examiner by way of viva-voce in front of an examination committee comprised of Head of the Department, external examiner and an internal examiner.

Awarding Marks for Dissertation and Viva- Voce

Marks are awarded based on the internal and external evaluation. Internal Evaluation carries 40 marks and External carries 60 marks. The 60 marks are awarded based on the following criteria for the Viva Voce:

i.	Organisation and structure of report	20
ii.	Presentation	20
iii.	Novelty and utility	10
iv.	Interaction	10

SOFT CORE COURSES

APSY 551: Environmental Psychology

Learning Outcomes:

The students will be able to:

- ❖ Understand the relationship between environment and behavior
- ❖ Analyze person-environment processes
- ❖ Understand the psychological aspects behind societal issues of environment

Unit I: Nature and scope of Environmental Psychology, Environmental Perception, Spatial Cognition.

Unit II: Personal Space: Measurement, Influences, Theories; Territoriality: Factors, theories, and Measurement.

Unit III: Crowding: Factors, Theories, Crowding & Environmental Design, Environmental Psychology in Residence and Community.

Unit IV: Psychology in Relation to Physical Environment: Noise, Climate, Light and Colour, Environmental Psychology & Social Dilemmas: Pollution, Energy-Conservation, Recycling.

Unit V: Psychology and Work Environment; Emerging issues: Place Attachment, Pro-Environmental Behaviour, Ecological Consumerism.

Text Books

Dolnicar, S. & Grun, B. (2009). Environmetally friendly behavior. *Environment & Behaviour*, 41(5), 693-714.

Easton, J., Ljungberg, M. K, & Cheng, J.C.H. (2009). Discourses on pro-environmental behaviour. *Applied Environmental Education and Education, 8,* 126-134.

Gifford, R. (2007). Environmental Psychology: principles and practice. Massachusetts: Allyn and Bacon, Inc.

Suggested Reference Materials

Knussen, C. & Yule, F (2008). I am not in the habit of recycling. *Environment and Behaviour,40 (5),* 683-702.

Tanner, C., Kaiser, F. G., & Kast, S. W. (2004). Contextual Consideration of ecological consumerism. *Environment & Behaviour. 36 (1),* 94-111.

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APSY 552: Psychology of Interpersonal Relationship

Learning Outcomes

The students will be able to:

- Understand the various kinds of Interpersonal Relationships and related theories
- Understand about interpersonal relationships in various social settings
- Understand about the various interpersonal communication styles and techniques to improve relationship

Unit I: Concept and Types of Interpersonal Relationship: Interaction: the essence of a relationship –Theories of Social Interaction, Interpersonal Attraction, Transactional Analysis- types of relationship.

Unit II: Romantic and Marital Relationship: Taxonomies of love- Psychometric approaches to love- theories of Love- passionate and companionate Love- theoretical approaches to mating relationships- Mate preferences, relational sex- sexual attitudes – sexuality in established relationship. Nature of marital relationships- distinction from romantic relationships- factors associated with satisfaction- happy and unhappy marriages- distress in marital relationships, therapeutic interventions for distressed paths to divorce and separation- bereavement.

Unit III: Relationship at Work: Nature, purpose and importance of human relations at work-forces influencing behavior at work- development of human relations movement- team work and team building- social loafing- leader-follower, formal and informal relationship at work.

Unit IV: Interpersonal Communication: Basic nature and forms of communication- verbal and nonverbal communication- communication channels, process and barriers- communication through body language- improving personal communication.

Unit V: Conflicts in Relationship and Strategies for Improving Human Relationship: Self disclosure: JOHARI window- SWOT Analysis- barriers to self disclosure- improving self perception- positive strokes and relationship building. Prosocial behavior- factors involved in co- operation- selfishness and altruism- Conflict: nature and major causes of conflict in relationships- individual level conflict- group conflict- conflict management techniques.

Text Books

Berscheid, E., & Regan (2005). The Psychology of Interpersonal Relationships. Englewood Cliffs, NJ: Prentice Hall.

Duck (2007). Human Relationships. 4th Edition. Thousand Oaks, CA: Sage Publications.

Greenberg & Baron (2008). Behavior in organizations. 9th edition. NJ. Prentice Hall.

Suggested Reference Materials

Hendrick & Hendrick (Eds) (2000). Close Relationships: A Sourcebook 2nd ed. London: Sage Publications.

Reece & Brandt (2008). Effective Human Relations. Personal and Organizational Applications. 10th Edition. New York. Houghton Mifflin Company.

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APSY 553: PSYCHOLOGY FOR EFFECTIVE LIVING

Learning Outcomes

The students will be able to:

- Know and explain self
- Identify the ways to have control
- Understand motive and emotion
- Know how to become stress free and maintain friendship

UNIT –I: **Seeking Selfhood**- Self-Concept, Self-Image, Ideal Self, Multiple Selves; Core Characteristics of Self-Concept: Self-Consistency, Self-Esteem, Self-Enhancement and Self Verification; The Self-Concept and Personal Growth: The Self You'd Like to Be, Our Social Selves, Learning from Criticism, Greater Self-Direction.

UNIT-II: **Taking Charge**- Mastery and Personal Control: Perceived Control, Consequences of Perceived Control, Misperception and Maladjustment, Learned Optimism; Personal Resolve and Decision Making: The Process of Decision Making, Making Better Decisions; Decisions and Personal Growth: Identifying the Basic Decisions in Your Life, Making New Decisions, Some Practical Applications.

UNIT-III: **Managing Motives And Emotions**- Understanding Motivation: Understanding Your Needs, Differences Between You and Others, Everyone's Basic Needs, Psychosocial Motives, Personal Motivation; Understanding Emotions: What are Emotions, Experiencing Emotions, Expressing Emotions, Managing Emotions, Special Emotions.

UNIT-IV: **Making and Keeping Friends**- Meeting People: Are First Impressions Most Important? Mistaken Impressions, Shyness; Keeping Friends: Friendships are Precious, When Friends Get Together, Self-Disclosure-Those Little Secretes, Same-Sex and Opposite-Sex Friends, Staying Friends, Loneliness.

UNIT-V: **Stress**- Oh No! - Understanding Stress: Conceptualizing Stress, Stress and You; Yikes! – Reactions to Stress: Physiological Stress Reactions, Psychological Stress Reactions, How Do You React to Stress? Phew! – Managing Stress: Modifying Your Environment, Altering Your Life Style; Using Stress for Personal Growth.

Text Books:

Kirsh, S. J., Duffy, K. G., & Atwater, E. (2014). *Psychology for Living: Adjustment, Growth, and Behavior Today*. Pearson.

Suggested Reference Materials

Guy, J. D. (2000). Self-care corner: Holding the holding environment together: Self-psychology and psychotherapist care. *Professional Psychology: Research and Practice*, *31*(3), 351.

Mouly, G. J. (1968). *Psychology for effective teaching*. Holt, Rinehart and Winston.

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APSY 554: Para Psychology

Unit I: INTRODUCTION: Definition of Terms, Scope of the phenomena, Science vs. the Supernatural: What makes psi research a science? The Scientific Method, Popular Misconceptions and their origins: Parapsychology, the Occult & the New Age, The Interdisciplinary Nature of Parapsychology; where it overlaps with other fields of science.

Unit II: HISTORY: The Roots of Psychical Research, Spiritualism, Empirical Science and the Serious Investigation/Research of Psychic Experience, The Rise of Parapsychology and Controlled Laboratory Research, Yoga, meditation and Siddhis, Psi Research in the 20th Century.

Unit III: EXTRASENSORY PERCEPTION: Phenomenology of ESP: Spontaneous ESP Experiences, Conceptual Issues, Experimental Research: Methodologies and Findings, Theoretical Considerations.

Unit IV: PSYCHOKINESIS: Phenomenology of PK: Spontaneous PK Experiences, Conceptual Issues, Experimental Research: Methodologies and Findings, Theoretical Considerations. Psychic Fraud: In the "Wild": Psychics, Mediums, Magicians, and Mentalists. In the Laboratory: Controlling for Potential Fraud

Unit V: SURVIVAL OF BODILY DEATH: Consciousness. What Might Survive? What is the Evidence for Survival? Out of Body Experiences, Near Death Experiences, Apparitional Experiences, the Super-Psi Hypothesis vs. the Survival Hypothesis. Key Correlates to ESP and PK: Personality, Belief, Environmental, etc. Criticisms of Parapsychology.

Text Book

Harvey J. Irwin & Caroline A. Watt. (2007). Introduction to Parapsychology, 5th ed. by McFarland & Company: 2007.

Flexner, W. (2007). Introduction to Parapsychology. Sarup & Sons.

Suggested Reference Materials

B. Greyson / Incidence and correlates of near-death experiences in a cardiac care Unit. *General Hospital Psychiatry* 25 (2003) 269–276.

Pasricha S, (1993). A Systematic Survey of Near-Death Experiences in South India. Journal of Scientific Exploration, Vol. 7, No. 2, pp. 161-171, 1993

Braud, W. G. (2008). Patanjali yoga and siddhis: Their relevance to parapsychological theory and research. *Handbook of Indian psychology*, 217-243.

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APSY 555: School Psychology in Indian Context

Learning Outcomes

By the end of these units, students will be able to:

- Describe the concept of school psychology, historical development, and clinical and educational psychology
- Understand the need of School Psychology services, Role of School Psychologists, Counselling, Consultation, Intervention, Testing and Assessment, Academic Factors, Mental Health Factors, Health and Prevention factors, and Environmental Factors

Course Structure

Unit I: Introduction to school Psychology, Concept of school psychology, Historical foundations of school psychology, Clinical and educational psychology

Unit II: School psychology services: Need of School Psychology services, Role of School Psychologists, Counselling, Consultation, Intervention, Testing and Assessment, Academic Factors, Mental Health Factors, Health and Prevention factors, Environmental Factors

Unit III: Competencies in school psychology: School Psychologists are integral part of school system, Fidelity and responsible care, Professional learning and application to practice, Professional attributes, collaboration, commitment, communication, Ethical behaviour, inclusive practice, Dimensions of school psychologist's work

Unit IV: Indian context of school psychology: School system in India, Right to education, Role of Government in promotion of school education, Essential School Psychology Services in Schools, Inclusive education, Role of School Psychologists in special schools,

Unit V: Futuristic aspects of school psychology in India: Promotion of school psychology in India, role of professional association in promoting school psychology in India.

Text Books:

Ramalingam, Panch. (2016). *School Psychology in Indian Context*, Delhi: Sage Publications

Department of Education, Western Australia (2015). Competency Framework for School Psychologists

Suggested Reference Materials

Peter Farrell (2010). International School Psychology

Ramalingam, Panch. (2017). *Educational Psychology*, New Delhi: McGraw Hill Publishers

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APSY 556: Psychology of Social Problems

Learning Outcomes:

By the end of the course the students will:

- ❖ Have a clear idea about nature and application of Applied Psychology
- ❖ Understand the psychological processes mediating various Social Problems

Unit I: Media Influences on Social Behaviour: Depiction of violence and aggression; nudity and pornography; surrogate advertisements; pro-social behaviour – role of persuasion and cognitive dissonance.

Unit II: Gender and Sexuality: Theories of gender identity development; cultural construction of feminine and masculine identity in India; gender differences and discrimination; socio-legal issues of transgender and homosexuals.

Unit III: Group Conflicts: Psychological underpinnings - stereotypes, prejudices and discrimination; racism, communalism and terrorism; socio – economic and personality dynamics; primary and secondary victims.

Unit IV: Suicides: Psychological perspectives on suicidal behaviour; neurobiological basis of suicidal ideation; risk factor assessment and prediction; suicide in India; suicide in Pondicherry – A case study.

Unit V: Psychology and Sustainable Future: Earth's carrying capacity and sustainable lifestyle; materialism and consumerism; post-materialist attitudes and behaviour; globalisation and its impact on human behaviour.

Text Books

Alexander. R. (2010). *Human Behaviour in the Social Environment: A macro, National and International Perspective,* Sage Publications

Anthony Gale and Antony J. Chapman (1987). *Psychology and Social Problems : An Introduction to Applied Psychology*, John Wiley and Sons

Baron,R.A.,Branscombe.N.R, Byrne.D. and Bhardwaj.G. (2010). *Social Psychology* (12th Edition). Pearson Publications.

David G. Myers (2010). *Social Psychology* (10th edition). New Delhi: Tata-McGraw Hill

John W. Berry., Mishra R.C. and Tripathi,. R.C. (2003). *Psychology in Human and Social development*, Sage Publications

Mayer.P., Bradley.C.,Steen.D.,Ziaian.T.(2011). *Suicide and Society in India*, Routledge/ASAA South Asian Publications Series

Suggested Reference Materials

Kumar.U and Mandal.M.K. (2010). *Suicidal Behaviour: Assessment of people at Risk,* Sage Publications India Pvt. Ltd.

Saundra K. Ciccarelli and Glen E. Meyer. (2008). *Psychology,* Sage Publications

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APSY 557: Industrial Relations and Labour Welfare

Learning Outcomes

The students will be able to:

- Understand the importance of Industrial relation and ways of promoting sound industrial relations in an organization.
- Have an insight into the various kinds of statutory and non statutory welfare measures for employees in different organizational set up
- Understand about the emerging issues in Industrial relations and Global HR practices.

UNIT I Industrial Relations and Industrial Disputes: Definition and Evolution of Industrial Relations-Need for sound Industrial Relations-Tripartite System; Role of ILO, Central and State Governments-Salient features of Industrial Disputes Act, 1947, nature and causes methods and machinery for settlement of disputes

UNIT II Labour- management co-operation: Meaning and Goals- different degrees and forms of Co-operation- workers participation in management- Trade Union Movement, Types, structure and functioning of trade unions-registration and recognition of trade unions-collective bargaining: importance, factors involved and methods.

UNIT III Social Security and Welfare: meaning of social security-major social security provisions: Employees Provident Fund, Employees state insurance, Payment of Bonus, Gratuity. Welfare provisions under Factories Act and Maternity Benefits.

UNIT IV Emerging Issues in Industrial Relations: Issues relating diverse and cross cultural workforce-New categories of Labour; Knowledge workers, workers in service sectors- Global HR Practices: Personnel Practices and Industrial Relations in multinational companies- Effect of globalization on working class: need for a new outlook on industrial relations, labour welfare and legislations

UNIT V Corporate Social Responsibilities- Quality of work life and work life balance. Sexual harassment at workplace: prevention and legislation

Text Books

Cascio(2015). Managing Human Resources. Productivity, Quality of Worklife, Profits. (10th Edition) Singapore. McGraw Hill.

Mamoria C.B., & Gankar S.V. (2011). Personnel Management. New Delhi. Himalayan Publishing House.

Srivastava (2012). Industrial Relations and Labour Laws. (6th Edition) New Delhi. Vikas Publishing House

Suggested Reference Materials

Rao, Subba (2011). Essentials of HRM and Industrial Relations. New Delhi. Himalayan Publishing House.

Sinha & Sinha, Shekar (2012). Industrial Relations, Trade Unions and Labour Legislations. 2nd Edition. New Delhi. Pearson Publishers.

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Pondicherry University

SCHOOL OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

Curriculum and Syllabus

BACHELOR OF TECHNOLOGY

B.Tech.

Computer Science and Engineering

2024-25

CSBS101 MATHEMATICS - I

L	T	P	C
3	1	0	4

Course Objective:

- To comprehend the mathematical concepts of matrices, ordinary differential equations, multivariable calculus and problem-solving.

Course Outcomes:

- To solve practical problems using Matrix algebra.
- To solve various types of ordinary differential equations, including higher-order linear equation.
- To compute partial derivatives, determine total derivatives, Jacobians, employ Taylor series, and find extremes of functions of two variables.
- To demonstrate proficiency in evaluating double integration and triple integration and using them to compute area and volume.
- To apply Green's theorem, Stoke's theorem and Gauss divergence theorem.

UNIT I (12 Hrs)

LINEAR ALGEBRA(MATRICES): Rank of a matrix - Consistency of a system of linear equations - Characteristic equation of a matrix - Eigen values and Eigen vectors - Properties of Eigen values and Eigen vectors - Cayley-Hamilton theorem (excluding proof)- Verification- Application (Finding Inverse and Power of a matrix)- Diagonalization of a matrix by orthogonal and similarity transformation- Quadratic form – Nature of Quadratic Form- Orthogonal reduction of quadratic form to canonical form.

UNIT II (12 Hrs)

ORDINARY DIFFERENTIAL EQUATIONS: Differential Equations of First Order- Exact equations- Leibnitz's linear equations- Bernoulli's equation- Equations solvable for p- Clairaut's equation- Differential equations of Higher order- Linear differential equations of higher order with constant coefficients- Euler's linear equation of higher order with variable coefficients- Method of variation of parameters.

UNIT III (12 Hrs)

MULTIVARIABLE CALCULUS (DIFFERENTIATION): Partial differentiation- Partial derivatives of first order and higher order- Partial differentiation of implicit functions- Euler's theorem on homogeneous functions - Total derivative - Jacobian Properties - Taylor's series for functions of two variables- Maxima and minima of functions of two variables.

UNIT IV (12 Hrs)

MULTIVARIABLE CALCULUS (MULTIPLE INTEGRALS): Double integration (Cartesian form and Polar form)- constant limits- variable limits- over the region R- Change of variables in double integrals (Cartesian to polar)- Application of double integral- Area by double integration- Change of Order of Integration- Triple Integration (Cartesian- Spherical and Cylindrical)- constant limits- variable limits- over the region R- Application of triple integral- Volume by triple integration.

UNIT V (12 Hrs)

MULTIVARIABLE CALCULUS (VECTOR CALCULUS): Vector Differential Operator- Gradient - Properties - Directional derivative - Divergence and Curl Properties and relations- Solenoidal and Irrotational vector fields - Line integral and Surface integrals - Integral Theorems (excluding Proof) - Green's theorem - Stoke's theorem - Gauss divergence theorem.

Text Books:

1. Veerarajan T., "Engineering Mathematics - I & II ", Tata McGraw-Hill, New Delhi, 2014 & 2015.
2. Dr. M.K. Venkataraman, "Engineering Mathematics – Volume I and Volume II", The National Publishing Company, Chennai 2008.

References:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd, 2011.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 9th Edition, 2011.
4. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.

ONLINE / NPTEL Courses:

1. Differential equations for engineers: https://nptel.ac.in/courses/111106100
2. Calculus of Several Real Variables: https://nptel.ac.in/courses/111104125
3. Engineering Mathematics - I: https://nptel.ac.in/courses/111105121
4. Matrix Analysis with Applications: https://nptel.ac.in/courses/111107112

CSBS102 PHYSICS

L	T	P	C
3	0	0	3

Course Objective:

- To learn the fundamental concepts of oscillations, waves, optics, applications of real life optical systems, communication and other applications.

Course Outcomes:

- To understand physical characteristics of SHM and obtaining solution of the oscillator using differential equations.
- To gain knowledge on transverse and longitudinal waves in one dimension.
- To acquire skills to identify and apply formulas of optics and wave physics.
- To apply principles of interference, diffraction and polarization gain knowledge on interferometers.
- To gain knowledge on lasers to engineering situations.

UNIT I (9 Hrs)

SIMPLE HARMONIC MOTION - DAMPED AND FORCED SIMPLE HARMONIC OSCILLATOR: Mechanical and electrical simple harmonic oscillators - complex number notation and phasor representation of simple harmonic motion - damped harmonic oscillator – heavy - critical and light damping - energy decay in a damped harmonic oscillator - quality factor - forced mechanical and electrical oscillators - electrical and mechanical impedance - steady state motion of forced damped harmonic oscillator - power absorbed by oscillator.

UNIT II (9 Hrs)

NON-DISPERSIVE TRANSVERSE AND LONGITUDINAL WAVES IN ONE DIMENSION AND INTRODUCTION TO DISPERSION: Transverse wave on a string - the wave equation on a string - Harmonic waves - reflection and transmission of waves at a boundary - impedance matching - standing waves and their Eigen frequencies - longitudinal waves and the wave equation for them - acoustics waves and speed of sound - standing sound waves. Waves with dispersion - water waves - superposition of waves and Fourier method - wave groups and group velocity.

UNIT III (9 Hrs)

THE PROPAGATION OF LIGHT AND GEOMETRIC OPTICS: Fermat's principle of stationary time and its applications e.g. in explaining mirage effect -laws of reflection and refraction - Light as an electromagnetic wave and Fresnel equations - reflectance and transmittance - Brewster's angle - total internal reflection - evanescent wave. Mirrors and lenses and optical instruments based on them - transfer formula and the matrix method.

UNIT IV (9 Hrs)

WAVE OPTICS: Huygens' principle - superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment - Newton's rings - Michelson interferometer - Mach- Zehnder interferometer, Farunhofer diffraction from a single slit and a circular aperture - the Rayleigh criterion for limit of resolution and its application to vision, Diffraction gratings and their resolving power.

UNIT V (9 Hrs)

LASERS: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion - different types of lasers, gas lasers (He-Ne - CO_2) - solid-state lasers (ruby - Neodymium) - dye lasers,Properties of laser beams, mono-chromaticity - coherence - directionality and brightness - laser speckles - applications of lasers in science - engineering and medicine.

Text Books:

1. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", John Wiley & Sons Inc.USA 11th Edition, 2018.
2. Arthur Beiser, "Concepts of Modern Physics", Mc-Graw Hill Publications Private Limited, 7th Edition, 2017.
3. N.Subramanyam, "Waves and oscillations", Vikas Publishing house,2nd Edition, 2009.

References:

1. Renk, Karl.F, "Basics of laser physics", Springer international publishing, 2nd Edition, 2017.
2. H. J. Pain, Patricia Rankin, "Introduction to vibration and waves", Wiley, 1st Edition, 2015.
3. David Halliday, Robert Resnick and Jearl Walker, "Fundamentals of Physics", Wiley publications, 2013.

ONLINE/NPTEL Courses:

1. Engineering Physics I (Theory): https://nptel.ac.in/courses/122103011
2. Waves and Oscillations: https://nptel.ac.in/courses/115106119
3. Modern Optics: https://nptel.ac.in/courses/115105104

CSES103 BASIC ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

Course Objective:

- To learn the fundamental skills in construction of electronics circuit design and develop various electronic systems.

Course Outcomes:

- To understand the semiconductor physics of the intrinsic, p and n materials.
- To understand the function and operation of diodes, transistors and amplifiers.
- To analyze the performances of BJT & FETs and its uses in amplifiers and oscillators.
- To analyze and design the operational amplifiers circuits.
- To understand the architecture, functions & their applications of IC 741 OP-Amp.

UNIT I (9 Hrs)

SEMI CONDUCTORS AND DIODES: Conductors - Semiconductors - Intrinsic Semiconductors - Extrinsic Semi Conductors. Diode Theory, Basic Ideas - ideal Diode - Forward and Reverse Bias - Diode Equation - Volt-Ampere Characteristic- Special diodes, symbol of zener diode - operation - V-I characteristics - symbol of photo diode - working principle - LED symbol and principle.

UNIT II (9 Hrs)

RECTIFIERS: Half-wave Rectifier - Full-wave and Bridge Rectifier - derivation of Ripple factor - efficiency of Half-wave -Full-wave and Bridge rectifiers, Merits and demerits of Half-wave - Full-wave and Bridge rectifiers - Comparisons of rectifiers.

UNIT III (9 Hrs)

BIPOLAR JUNCTION &, FIELD-EFFECT TRANSISTORS: Symbols of PNP and NPN transistors and their working principles -Transistor - Construction & working - Input and output characteristics of CB and CE configuration - Transistor as an Amplifier -Principle and working of Hartley oscillator and RC phase shift oscillator - Construction and working of JFET & MOSFET.

UNIT IV (9 Hrs)

DIGITAL CIRCUITS: Boolean algebra – Reduction of Boolean expressions - De-Morgan's theorem – Logic gates -Implementation of Boolean expressions - Flip flops - RS - JK - T and D Combinational logic - Half adder - Full adder and Subtractors, Sequential logic - Ripple counters and shift registers.

UNIT V (9 Hrs)

OPERATIONAL AMPLIFIERS: Characteristics of Op-Amps, Introduction to Op-amp - Op-amp Block Diagram - ideal and practical Op-Amps specifications - 741 Op-Amps & its features - Op-amp parameters & Measurement - Applications of Op-Amps: Inverting and Non-inverting amplifier - Integrator and differentiator - Comparators.

Text Books:

1. Albert Malvino and David J Bates, "Electronic Principles", Tata McGraw–Hill, 9th Edition, 2021. (Unit 1 & 2)
2. Boyelstad, "Electronic Devices and Circuits Theory", Pearson Education, 11th Edition, 2013.(Unit 1, 2 & 3)
3. Morris Mano, "Digital design", PHI Learning, 4thEdition, 2016. (Unit 4)
4. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits", PHI, 4th Edition, 2015. (Unit 5)
5. D. Roy Chowdhury, "Linear Integrated Circuits", New Age International Pvt.Ltd., 5th Edition, 2018.(Unit 5)

References:

1. Robert L.Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson/PHI, 10th Edition, 2010.
2. David A.Bell, "Electronic Devices and Circuits", Oxford, 5th Edition, 2009.
3. S.Salivahanan, Kumar, Vallavaraj, "Electronic Devices and Circuits", TATA McGraw Hill, 2nd Edition, 2003.
4. David A, "Operational Amplifiers & Linear ICs", Oxford Uni. Press, 3rd Edition, 2005. (Unit 5)

ONLINE / NPTEL Courses:

1. Introduction to Basic Electronics: https://archive.nptel.ac.in/courses/122/106/122106025/
2. Basic Electronics: https://archive.nptel.ac.in/courses/108/101/108101091/

CSBL101 PHYSICS LAB

L	T	P	C
0	0	4	2

Course Objective:

- To understand the working principles of spectrometer, polarimeter, curvature of lens and determination of optical absorption.

Course Outcomes:

- To understand and experiment Newtons rings.
- To understand the principles, concepts abd comparison of results with theoretical calculations.
- To understand measurement technology, usage of new instruments and real time applications in engineering studies.
- To state various laws which they have studied through experiments.
- To describe principles of optical fibre communication.

LIST OF EXPERIMENTS

1. Radius of curvature of a Lens - Newton's rings.
2. Thickness of a thin object by air – wedge.
3. Spectrometer – resolving power of a prism.
4. Spectrometer - determination of wavelength using grating.
5. Spectrometer - ordinary and extraordinary rays by calcite prism.
6. Laurant's Half shade polarimeter – determination of specific rotatory power.
7. Determination of wavelength of a laser source using transmission grating, reflection grating vernier calipers and particle size determination.
8. Determination of numerical aperture and acceptance angle of an optical fiber.
9. Determination of optical absorption coefficient of materials using laser.
10. Compact disc - determination of width of the groove using laser.

(Total Periods:45)

CSEL102 BASIC ELECTRONICS LAB

L	T	P	C
0	0	4	2

Course Objective:

- To design and analyze electronic circuits such as diodes, rectifiers, Zener diode, BJT, FET. To verify the basic logic operations and simple arithmetic circuits using logic gates.

Course Outcomes:

- To understand the characteristics of basic electronic devices.
- To apply problem-solving skills, recognize and utilize the characteristics of diodes, rectifiers & transistors.
- To construct the adder, subtractor, multiplier circuits to verify their functionalities.
- To interpret the Op-Amp based inverting and non-inverting amplifier circuit.
- To integrate diverse applications of Op-Amp in differentiator, integrator, adder & subtractor circuits.

LIST OF EXPERIMENTS

1. Measurement of different signal parameters using oscilloscope.
2. V-I characteristics of ordinary p-n junction diode.
3. Full wave rectifier, with and without filter.
4. Zener diode as a voltage regulator.
5. Input and output characteristics of BJT.
6. Input and output characteristics of FET.
7. Realization of basic gates using Universal logic gates.
8. Construction of simple Decoder & Multiplexer circuits using logic gates.
9. Construction of simple arithmetic circuits-Adder, Subtractor.
10. Op-Amp based inverting and non-inverting amplifier.
11. Op-Amp based differentiator and integrator.
12. Op-Amp based adder and subtractor.

(Total Periods:45)

CSEL103 ENGINEERING GRAPHICS AND DESIGN LAB

L	T	P	C
1	0	4	3

Course Objective:

- To provide the basic knowledge about Engineering Drawing and learn the concepts of projections, technical drawing, dimensioning and specifications.

Course Outcomes:

- To understand the visual aspects of Engineering Design.
- To understand Engineering Graphics Standards.
- To illustrate Solid Modelling.
- To understand Computer-Aided geometric design
- To understand creation of design working drawings.
- To understand Engineering Communication inspect.

UNIT I

INTRODUCTION: Introduction, Conics and Special Curves.

UNIT II

PROJECTIONS: Projection of points, lines and planes.

UNIT III

SOLIDS: Projection of solids, section of solids, surface development in Engineering Design and Graphics Lab.

UNIT IV

ISOMETRIC: Isometric and Orthographic projections.

UNIT V

AUTOCAD: Introduction to computer aided drafting, hardware, overview of application software – 2D drafting commands (Auto CAD) for simple shapes – Dimensioning.

Text Books:

1. Bhatt N.D., Panchal V.M. and Ingle P.R., "Engineering Drawing", Charotar Publishing House, 2014.
2. Lakhwinder Pal Singh and Harwinder Singh, "Engineering Drawing Principles and Applications", Cambridge University Press Education, 2021.
3. Agrawal B. and Agrawal C. M., "Engineering Graphics", TMH Publication, 2012.
4. K. Venugopal, "Engineering Drawing and Graphics + Auto CAD", New Age International Publication Ltd., 4th Edition, 2004.

References:

1. Narayana, K.L. and P Kannaiah, "Engineering Drawing", Scitech Publishers, 2008.
2. CAD Software Theory and User Manuals.

(Total Periods:45)

CSHL104 DESIGN THINKING

L	T	P	C
0	0	2	1

Course Objective:

- To understand the new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products.

Course Outcomes:

- To compare and classify the various learning styles and memory techniques and apply them in their engineering education.
- To analyze emotional experience and inspect emotional expressions to better understand users while designing innovative products.
- To develop new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products.
- To explore real-time innovative engineering product designs and choose appropriate frameworks, strategies,techniques during prototype development.
- To perceive individual differences, its impact on everyday decisions and create a better customer experience.

UNIT I (9 Hrs)

AN INSIGHT TO LEARNING: Understanding the Learning Process - Kolb's Learning Styles - Assessing and Interpreting - Remembering Memory:Understanding the Memory process, Problems in retention - Memory enhancement techniques - Emotions - Experience and Expression - Understanding Emotions - Experience and Expression -Assessing Empathy, Application with Peers.

UNIT II (9 Hrs)

BASICS OF DESIGN THINKING: Definition of Design Thinking - Need for Design Thinking - Objective of Design Thinking - Concepts and Brainstorming - Stages of Design Thinking Process (explain with examples) – Empathize - Define - Ideate - Prototype - Test. Being Ingenious and Fixing Problem - Understanding Creative thinking process - Understanding Problem Solving - Testing Creative Problem Solving.

UNIT III (9 Hrs)

PROCESS OF PRODUCT DESIGN: Process of Engineering Product Design - Design Thinking Approach - Stages of Product Design - Examples of best product designs and functions - Assignment – Engineering Product - Design Prototyping and Testing- Rapid Prototype Development process - Testing - Sample Example, Test Group Marketing.

UNIT IV (9 Hrs)

CELEBRATING THE DIFFERENCE: Understanding Individual differences and Uniqueness - Group Discus- sion and Activities to encourage the understanding - acceptance and appreciation of Individual differences. Design Thinking and Customer Centricity - Practical Examples of Customer Challenges - Use of Design Thinking to Enhance Customer Experience - Parameters of Product experience - Alignment of Customer Expectations with Product Design.

UNIT V (9 Hrs)

FEEDBACK, RE-DESIGN AND RE-CREATE: Feedback loop - Focus on User Experience - Address ergonomic challenges - user focused design - rapid prototyping and testing - final product - final Presentation - Solving Practical Engineering Problem through Innovative Product Design and Creative Solution.

Text Books:

1. Burgelman, Christensen, and Wheelwright, "Strategic Management of Technology and Innovation", 5th Edition, McGraw Hill Publications, 2017.
2. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons, 2013.

References:

1. E Balaguruswamy, "Developing Thinking Skills (The way to Success)", Khanna Book Publishing Company, 2022.
2. Hasso Plattner, Christoph Meinel and Larry Leifer , "Design Thinking: Understand –Improve– Apply", Springer, 2011.
3. Jeanne Liedtka, Andrew King and Kevin Bennett, "Book - Solving Problems with Design Thinking - Ten Stories of What Works", Columbia Business School Publishing, 2013.

(Total Periods:45)

CSAU105 IDEA WORKSHOP LAB

L	T	P	C
2	0	4	0

Course Objective:

- To learn skill tools and inventory associated with the IDEA Lab. To build useful standalone system/ project with Mechanical and Electronic fabrication process.

Course Outcomes:

- To understand the working of tools and inventory associated with the IDEA lab
- To understand the working of mechanical and electronic fabrication processes and designing the standalone project and report preparation.

UNIT I

DESIGNING AND INTRODUCTION TO HAND AND POWER TOOLS: Electronic component familiarization, Electronic system design flow.Schematic design and PCB layout and Gerber creation using Eagle CAD. Documentation: Doxygen, Google Docs, Overleaf. Version control tools - GIT and GitHub. Basic 2D and 3D designing using CAD tools: FreeCAD, Sketchup, Prusa Slicer, FlatCAM, Inkspace, OpenBSP and VeriCUT. Introduction to basic hand tools: Tape measure, combination square, Vernier caliper, hammers, fasteners, wrenches, pliers, saws, tube cutter, chisels, vice and clamps, tapping and threading. Adhesives Introduction to Power tools: Power saws, band saw, jigsaw, angle grinder, belt sander, bench grinder, rotary tools. Various types of drill bits.

UNIT II

CIRCUIT PROTOTYPING AND MECHANICAL CUTTING AND JOINING PROCESS: Familiarization and use of basic measurement instruments - DSO including various triggering modes, DSO probes, DMM, LCR bridge, Signal and function generator. Logic analyzer and MSO. Bench power supply (with 4-wire output) Circuit prototyping - breadboard, Zero PCB, Manhattan' style, custom PCB. Single, double and multilayer PCBs. Single and double-sided PCB prototype fabrication in the lab. Soldering using soldering iron/station. Soldering using a temperature controlled reflow oven. Automated circuit assembly and soldering using pick and place machines. Mechanical cutting processes - 3-axis CNC routing, basic turning, milling, drilling and grinding operations, Laser cutting, Laser engraving etc. Basic welding and brazing and other joining techniques for assembly. Concept of Lab aboard a Box.

UNIT III

ELECTRONIC CIRCUIT BUILDING AND 3D PRINTING: Electronic circuit building blocks including common sensors. Arduino and Raspberry Pi programming and use. Digital Input and output. Measuring time and events. PWM. Serial communication. Analog input. Interrupts programming. Power Supply design (Linear and Switching types), Wireless power supply, USB PD, Solar panels, Battery types and charging. 3D printing and prototyping technology –3D printing using FDM, SLS and SLA. Basics of 3D scanning, point cloud data generation for reverse engineering. Prototyping using subtractive cutting processes. 2D and 3D Structures for prototype building using Laser cutter and CNC routers. Basics of IPR and patents; Accessing and utilizing patent information in IDEA Lab.

UNIT IV

Discussion and implementation of a mini project.

UNIT V

Documentation of the mini project (Report and video).

Laboratory Activities:

List of Lab activities and experiments

1. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2. Machining of 3D geometry on soft material such as soft wood or modelling wax.
3. 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4. 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter and engraver.
5. 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6. Familiarity and use of welding equipment.
7. Familiarity and use of normal and wood lathe.
8. Embedded programming using Arduino and/or Raspberry Pi.
9. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.

Text Books:

1. Chris Hackett, Weldon Owen, "The Big Book of Maker Skills: Tools and Techniques for Building Great Tech Projects", 2018.
2. Sean Michael Ragan, Weldon Owen "The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product", 2017.
3. Paul Horowitz and Winfield Hill, "The Art of Electronics", Cambridge University Press, 3rd Edition.

References:

1. Paul Sherz and Simon Monk. "Practical Electronics for Inventors" McGraw Hill, 4thEdition, 2016.
2. Charles Platt, "Encyclopedia of Electronic Components (Volume 1,2 and 3)", Shroff Publishers, 2012.
3. John H. Moore, Christopher C. Davis, Michael A. Coplan and Sandra C. Greer, "Building Scientific Apparatus",Cambridge University Press, 4th Edition, 2009.
4. Simon Monk "Programming Arduino: Getting Started with Sketches", McGraw Hill, 2ndEdition, 2016.
5. Simon Monk and Duncan Amos, "Make Your Own PCBs with EAGLE: From Schematic Designs to Finished-Boards", McGraw Hill Education, 2017.

CSHS201 ENGLISH

L	T	P	C
2	0	2	3

Course Objective:

- Build the competence in English grammar and vocabulary for effective communication by developing Reading, Writing, Listening and Speaking skills of students.

Course Outcomes:

- To enhance communication skills through formal and informal mode.
- To apply the technical writing and communication skills in their academic and professional life.
- To gain self-confidence with improved command over English.
- To understand the technical aspects of communication for better performance in extra curricular activities, recruitment process and prospective jobs.
- To develop and deliver professional presentations.

UNIT I (9 Hrs)

FUNDAMENTALS OF COMMUNICATION SKILLS: Importance of communication through English - Process of communication and factors that influence speaking - Importance of audience and purpose - Principles of communication - comparing general communication and business communication - Professional communication - barriers to communication - strategies to overcome communication barriers - formal and informal communication.

UNIT II (9 Hrs)

WRITING SKILLS: Basics of Grammar - Placing of Subject and Verb - Sentence Structures - Use of Phrases and Clauses in sentences - Importance of proper punctuation - Creating coherence - Techniques for writing precisely - Parts of Speech - Uses of Tenses - Active and Passive - Modes of Writing.

UNIT III (9 Hrs)

VOCABULARY BUILDING AND WRITING: The Concept of Word Formation - Root words from foreign languages and their use in English - Acquaintance with prefixes and suffixes - Synonyms & Antonyms -Words often confused - One-word substitutes - Idioms and Phrasal Verbs - Abbreviations of Scientific and Technical Words.

UNIT IV (9 Hrs)

SPEAKING SKILLS: Introduction to Phonetic Sounds & Articulation - Word Accent - Rhythm and Intonation - Interpersonal Communication - Oral Presentation - Body Language and Voice Modulation (Para linguistics and Non-Verbal) - Negotiation and Persuasion - Group Discussion - Interview Techniques (Telephonic and Video Conferencing).

UNIT V (9 Hrs)

TECHNICAL WRITING: Job Application - CV Writing - Business Letters - Memos - Minutes - Notices - Report Writing Structures - E-mail Etiquette - Blog Writing.

Text Books:

1. Ludlow R. and Panton F., "The Essence of Effective Communication", Prentice Hall, 2020.
2. Kul Bhushan Kumar & R. S. Salaria, "Effective Communication Skills", Khanna Publishing House, 2018.
3. Dr. Bikram K. Das et al., "An Introduction to Profession English and Soft Skills", Cambridge University Press, 2009.

References:

1. Michael Mccarthy and Felicity O Dell, "English Vocabulary in Use", McCarthy M, Cambridge University Press, 3rd Edition, 2017.
2. Raman M. Sharma S, "Technical Communication: Principles and Practice", Raman, Oxford University Press, 2nd Edition, 2012.

ONLINE/ NPTEL Courses:

1. English Language and Literature: https://nptel.ac.in/courses/109103020
2. Business English Communication: https://nptel.ac.in/courses/109106129
3. Technical English: https://nptel.ac.in/courses/109106066

CSBS202 MATHEMATICS-II

L	T	P	C
3	1	0	4

Course Objective:

- To formulate and solve partial differential equations, Laplace, Fourier transforms within the Engineering domain.

Course Outcomes:

- To formulate and solve various types of partial differential equations.
- To understand the Laplace transform and its properties.
- To apply Laplace transforms to solve ordinary differential equations with constant coefficients and simultaneous ordinary differential equations.
- To understand and apply Fourier transform techniques, including Fourier integral theorem, properties of Fourier transforms, convolution, and Parseval's identity.
- To apply Fourier series and harmonic analysis, enabling them to analyze and synthesize periodic signals and functions in various engineering and mathematical applications.

UNIT I (12 Hrs)

PARTIAL DIFFERENTIAL EQUATIONS: Formation of partial differential equations, Solutions of standard types of first order partial differential equations, Lagrange s linear equation, Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II (12 Hrs)

LAPLACE TRANSFORM: Existence conditions, Transforms of elementary functions , Properties, Transform of unit step function and unit impulse function , Transforms of derivatives and integrals , Transforms of Periodic Functions ,Initial and final value theorems.

UNIT III (12 Hrs)

INVERSE LAPLACE TRANSFORM: Inverse Laplace Transforms Properties, Convolution theorem, Application - Solution of ordinary differential equations with constant coefficients - Solution of simultaneous ordinary differential equations.

UNIT IV (12 Hrs)

FOURIER TRANSFORM: Fourier Integral theorem (statement only) , Fourier transform and its inverse, Properties: Fourier sine and cosine transforms, Properties, Convolution and Parseval's identity.

UNIT V (12 Hrs)

FOURIER SERIES: Dirichlet s conditions , Expansion of periodic functions into Fourier series- Change of interval, Half-range Fourier series, Root mean square value - Parseval's theorem on Fourier coefficients, Harmonic analysis.

Text Books:

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2015.
2. Veerarajan T, "Transforms and Partial Differential Equations", Tata McGraw-Hill, New Delhi, 2012.

References:

1. Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd, 2011.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 9th Edition, 2011.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.

ONLINE / NPTEL Courses:

1. Laplace Transform: https://nptel.ac.in/courses/111106139
2. Partial Differential Equations: https://nptel.ac.in/courses/111101153
3. Advanced Engineering Mathematics: https://nptel.ac.in/courses/111107119

CSBS203 CHEMISTRY

L	T	P	C
3	0	0	3

Course Objective:

- To understand the concepts of atomic structures, spectroscopic techniques, chemical equilibrium, periodic properties and stereo chemistry.

Course Outcomes:

- To analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- To rationalise bulk properties and processes using thermodynamic considerations.
- To distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- To rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- To understand the major chemical reactions those are used in the synthesis of molecules.

UNIT I (9 Hrs)

ATOMIC AND MOLECULAR STRUCTURE: Schrodinger equation - Particle in a box solutions and their applications for conjugated molecules and nano particles - Forms of the hydrogen atom wave functions and the plots to explore their spatial variations - Molecular orbitals of diatomic molecules and plots of the multicentre orbitals - Pi-molecular orbitals of butadiene and aromaticity - Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties - Band structure and role of doping of solids.

UNIT II (9 Hrs)

SPECTROSCOPIC TECHNIQUES AND APPLICATIONS: Principles of spectroscopy and selection rules - Electronic spectroscopy of Fluorescence and its applications in medicine - Applications of Vibrational and rotational spectroscopy of diatomic molecules - Nuclear magnetic resonance imaging and surface characterization techniques.

UNIT III (9 Hrs)

USE OF FREE ENERGY IN CHEMICAL EQUILIBRIUM: Thermodynamic functions-energy, entropy and free energy- Applications of Cell potentials - Nernst equation, acid-base, oxidation-reduction and solubility equilibrium - Use of free energy considerations in metallurgy through Ellingham diagrams. Inter molecular forces and poten- tial energy: surfaces- Ionic, dipolar and Van Der Waals interactions - Equations on state of real gases and critical phenomena.

UNIT IV (9 Hrs)

PERIODIC PROPERTIES: Effective nuclear charge - variations of s, p, d and f orbital and energies of atoms in the periodic table, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability and molecular geometries.

UNIT V (9 Hrs)

STEREO CHEMISTRY: Representations of 3 dimensional structures - structural isomers and stereoisomers, symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis- Organic reactions and synthesis of a drug molecule: Introduction to reactions involving substitution, addition, elimination, oxidation and reduction - Synthesis of a commonly used drug molecule.

Text Books:

1. Manisha Agrawal, "Chemistry-I", Khanna Book Publishing Co., 1st Edition, 2021.
2. P.W.Atkins, Julio de Paula and James Keeler, "Physical Chemistry", Oxford University, 11th Edition, 2018.
3. B. H. Mahan, "University chemistry", Pearson Education, 4th Edition, 2013.
4. C.N.Banwell, "Fundamentals of Molecular Spectroscopy", 3rd Edition, 2008.

References:

1. K.P.C. Volhardt and N. E. Schore, "Organic Chemistry: Structure and Function", 5th Edition, 2022.

ONLINE/ NPTEL Courses:

1. Spectroscopic Techniques for Pharmaceutical and Biopharmaceutical Industries: https://nptel.ac.in/courses/104102113
2. Engineering Chemistry I: https://archive.nptel.ac.in/courses/122/106/122106028
3. Quantum Chemistry of Atoms and Molecules: https://nptel.ac.in/courses/104101124

CSES204 PROGRAMMING FOR PROBLEM SOLVING

L	T	P	C
3	0	0	3

Course Objective:

- To acquire the knowledge of programming in Python. To learn the concepts, principles, functions and develop an application.

Course Outcomes:

- To understand the basic concepts and working principles of Python Programming.
- To develop algorithmic solutions to simple computational problems.
- To understand the structure of solving problems using programming.
- To explore the concepts of compound data using Python lists, tuples, dictionaries.
- To explore the various multimedia features using python.

UNIT I (9 Hrs)

INTRODUCTION: History - Features - Working with Python - Installing Python - basic syntax - Data types - variables - Manipulating Numbers - Text Manipulations - Python Build in Functions.

UNIT II (9 Hrs)

COMPONENTS OF PYTHON PROGRAMMING: Python objects and other languages - operator Basics - Numbers - String - List - Tuples - Dictionaries - Files - Object Storage - Type Conversion - Type Comparison - Statements - Assignments - Control Statements.

UNIT III (9 Hrs)

FUNCTIONS AND MODULES: Functions Definition and Execution - Arguments - Return Values - Advanced Function Calling - Modules - Importing modules - Packages - Creating a module.

UNIT IV (9 Hrs)

OBJECT ORIENTED AND EXCEPTION HANDLING: Classes and Objects - creating a class - class methods - class inheritance. Exceptions Handling-Build in Exceptions- Files, File operations, reading a file content, writing a file, change position, controlling file I/O, Manipulating file paths.

UNIT V (9 Hrs)

APPLICATIONS: Working with PDF and Word Documents - Working with CSV Files and JSON Data - Sending Email and Text Messages - Manipulating Images - Using Python for Multimedia.

Text Books:

1. Allen B.Downey, "Think Python: How to Think Like a Computer Scientist", Shroff O Reilly Publishers, 2nd Edition, 2016.
2. Guido Van Rossum and Fred L. Drake Jr, "An Introduction to Python", Network Theory Ltd., 2011.
3. Martin C.Brown, "The Complete reference - Python", Tata McGraw Hill Indian Edition, 2010.

References:

1. Eric Matthes, "A Hands-On, Project-Based Introduction To Programming", 2nd Edition, 2019.
2. Budd T A, "Exploring Python", Tata McGraw Hill Education, 2011.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.

ONLINE/ NPTEL Courses:

1. Programming, Data Structures and Algorithms using Python: https://nptel.ac.in/courses/106106145
2. The Joy of Computing using Python: https://nptel.ac.in/courses/106106182
3. Python for Data Science: https://nptel.ac.in/courses/106106212

CSHS205 UNIVERSAL HUMAN VALUES II

L	T	P	C
2	1	0	3

Course Objective:

- To highlight the plausible implications of such a holistic understanding in terms of ethical human conduct, trustful, mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

- To have a holistic vision of life.
- To enhance a socially responsible behavior.
- To understand the responsibility of an environmental work.
- To understand the Competence and Capabilities for Maintaining Health and Hygiene.
- To appreciate the aspiration for excellence (merit) and gratitude for all.

UNIT I (9 Hrs)

INTRODUCTION TO VALUE EDUCATION: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity the Basic Human Aspirations, Happiness and Prosperity Current Scenario, Method to Fulfil the Basic Human Aspirations.

UNIT II (9 Hrs)

HARMONY IN THE HUMAN BEING: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

UNIT III (9 Hrs)

HARMONY IN THE FAMILY AND SOCIETY: Harmony in the Family, the Basic Unit of Human Interaction, Trust, Foundational Value in Relationship, Respect, Right Evaluation, Other Feelings, Justice in Human to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

UNIT IV (9 Hrs)

HARMONY IN THE NATURE/EXISTENCE: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion.

UNIT V (9 Hrs)

IMPLICATIONS OF THE HOLISTIC UNDERSTANDING: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Text Books:

1. Premvir Kapoor, "Professional Ethics and Human Values", Khanna Book Publishing Company, New Delhi, 2022.
2. R R Gaur,R Asthana, G P Bagaria, "The Textbook - A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, 2nd Revised Edition, 2019.
3. RR Gaur, R Asthana, G P Bagaria, "The Teacher's Manual- Teachers Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, 2019.

References:

1. Annie Leonard, "The Story of Stuff", 2011.
2. A.N. Tripathi,"Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. Mohandas Karamchand Gandhi, "The Story of My Experiments with Truth", FP classic, 2009.
4. A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, "VanVidya: EkParichaya", 1999.

CSBL201 CHEMISTRY LAB

L	T	P	C
0	0	4	2

Course Objective:

- To experiment various methods of volumetric analysis - Redox, Iodometric, complexometric, Neutralization etc. and use of conductivity meter for measurement of conductance of water sample..

Course Outcomes:

- To illustrate the principles of physical chemistry relevant to the study of rate of reactions.
- To estimate rate constants of reactions from concentration of reactants/products as a function of time.
- To measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
- To understand the changes in matter and acquire scientific skills in the laboratory.
- To synthesize a small drug molecule and analyze a salt sample.

LIST OF EXPERIMENTS

1. Determination of surface tension and viscosity.
2. Thin layer chromatography.
3. Ion exchange column for removal of hardness of water.
4. Determination of chloride content of water.
5. Determination of cell constant and conductance of solutions.
6. Potentiometry - determination of redox potentials and emfs.
7. Synthesis of a polymer/drug.
8. Determination of the partition coefficient of a substance between two immiscible liquids.
9. Saponification/acid value of an oil.
10. Chemical analysis of a salt.
11. Lattice structures and packing of spheres.
12. Determination of the rate constant of a reaction.
13. Colligative properties using freezing point depression.
14. Models of potential energy surfaces.
15. Chemical oscillations- Iodine clock reaction.
16. Adsorption of acetic acid by charcoal.
17. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

(Total Periods : 45)

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. No.	Experiment Name	Experiment Link(s)
1	Determination of surface tension and viscosity.	http://pcv-au.vlabs.ac.in/ physical- which has to be broken of_Organic_Solvents/
2	Ion exchange column for removal of hardness of water.	http://icv-au.vlabs.ac.in/inorganic-chemistry/Water_Analysis_Determination_of_Chemical_Parameters/
3	Determination of chloride content of water.	http://vlabs.iitb.ac.in/vlabs dev/labs/nitk_labs/Environmental_Engineering_1/ experiments/determination-of-chloride-nitk/simulation.html
4	Colligative properties using freezing point depression.	http://pcv-au.vlabs.ac.in/ physical- chemistry/Cryoscopy/
5	Determination of the rate constant of a reaction.n.	http://pcv-au.vlabs.ac.in/ physical- chemistry/EMF_Measurement/
6	Determination of cell constant and conductance of solutions.	http://icv-au.vlabs.ac.in/ inorganic- chemistry/ Water_Analysis_Determination_of_Physical_Parameters/
7	Potentiometry - determination of redox potentials and emfs.	http://pcv-au.vlabs.ac.in/ physical- chemistry/EMF_Measurement/
8	Saponification/acid value of an oil	http://biotech01.vlabs.ac.in/bio chemistry/ Estimation_of_Saponification_Value_of_Fats_or_Oils/
9	Lattice structures and packing of spheres.	https://vlab.amrita.edu/ ?sub=1&brch=2 82&sim=370&cnt=1

CSEL202 PROGRAMMING FOR PROBLEM SOLVING LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic Programming language

Course Objective:

- To develop a application using python libraries and packages.

Course Outcomes:

- To develop a application for simple real life problems.
- To write programs using python statements and expressions.
- To write programs by implementing functions and strings in python.
- To demonstrate a application by dealing with an exceptions
- To explore Pygame tool by developing a gaming application.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems. (Electricity Billing, Retail shop billing, Sin series etc).
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets &Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, Scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter s age validity, student mark range validation)
11. Exploring Pygame tool.Developing a game activity using Pygame like bouncing ball, car race etc.

(Total Periods:45)

CSEL203 WORKSHOP/MANUFACTURING LAB

L	T	P	C
1	0	4	3

Course Objective:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

Course Outcomes:

- To fabricate components with their own hands.
- To relate practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- To design small devices of their interest by assembling different components.
- To practice Arc Welding and Gas Welding.
- To develop a casted products.

Course Content:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods.
2. CNC machining, Additive manufacturing.
3. Fitting operations & power tools.
4. Electrical & Electronics.
5. Carpentry.
6. Plastic moulding, glass cutting.
7. Metal casting.
8. Welding (arc welding & gas welding), brazing.

Practicals:

1. Machine shop
2. Fitting shop
3. Carpentry
4. Electrical & Electronics
5. Welding shop (Arc welding + Gas welding)
6. Casting
7. Smithy
8. Plastic moulding & Glass Cutting

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. No.	Experiment Name	Experiment Link(s)
1	Welding shop (Arc welding + Gas welding).	http://mm- coep.vlabs.ac.in/ LaserSpotWelding/Theory.html? domain=Mechanical%20Engineering &lab=Welcome %20to %20Micromachining %20laboratory
2	Casting	http://fab- coep.vlabs.ac.in/exp7/Theory.html? domain=Mechanical %20Engineering&lab=Welcome%20tO %20FAB%20laboratory

(Total Periods:45)

CSAU204 SPORTS AND YOGA

L	T	P	C
2	0	0	0

Course Objective:

- To expose the students in variety of physical, yogic activities and stimulating their continued inquiry about Yoga, physical education, health and fitness.

Course Outcomes:

- To practice physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.
- To learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
- To learn breathing exercises and healthy fitness activities.
- To understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.
- To perform yoga movements in various combination and forms.

UNIT I

Introduction to Physical Education - Olympic Movement - Physical Fitness - Wellness and Lifestyle.

UNIT II

Fundamentals of Anatomy & Physiology in Physical Education - Sports and Yoga - Kinesiology - Biomechanics & Sports

UNIT III

Postures - Yoga - Yoga & Lifestyle

UNIT IV

Training and Planning in Sports - Psychology & Sports - Doping

UNIT V

Sports Medicine - Sports/Games

References:

1. Dr. Sudhakara.G, “Modern Trends in Physical Education, Sports and Yogic Science”, 2020.
2. Swami Vivekananda, “PatanjaliÆs Yoga Sutras”, paperback, 2019.
3. B.K.S. Iyengar, “Light On Yoga”, 2006.
4. Health and Physical Education NCERT (11^{th} and 12^{th}Classes)

CSES301 MICROPROCESSOR AND MICROCONTROLLER

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic Electronics Engineering

Course Objective:

- To learn the fundamentals of microprocessors and applications, interfacing the external devices to the processor according to the user requirements, enabling to create novel products and solutions for real time problems.

Course Outcomes:

- To understand the inner working components of 8085 Microprocessor.
- To understand 8085 Interrupts and 8237 DMA controller.
- To understand different types of Memory mapping and Interfacing.
- To understand the components of 8086 Microprocessor.
- To understand the organization of 8051 Microcontroller and Interfacing.

UNIT I (9 Hrs)

INTEL 8085 MICROPROCESSOR: Introduction - Need for Microprocessors, Evolution, Intel 8085 Hardware - Architecture, Pin description, Internal Registers, Arithmetic and Logic Unit, Control Unit, Instruction word size - Addressing modes, Instruction Set, Assembly Language Programming - Stacks and Subroutines, Timing Diagrams, Evolution of Microprocessors, 16-bit, 32-bit microprocessors and 64 bit microprocessor.

UNIT II (9 Hrs)

INTEL 8085 INTERRUPTS AND DMA: 8085 Interrupts - Software and Hardware Interrupts - 8259 Programmable Interrupt Controller - Data Transfer Techniques - Synchronous - Asynchronous and Direct Memory Access (DMA) and 8237 DMA Controller- 8253 Programmable Interval Timer.

UNIT III (9 Hrs)

MEMORY & I/O INTERFACING: Types of memory - Memory mapping and addressing , Concept of I/O map, types - I/O decode logic, Interfacing key switches and LEDs - 8279 Keyboard/Display Interface - 8255 Programmable Peripheral Interface - Concept of Serial Communication - 8251 UART/ USART - RS232C Interface.

UNIT IV (9 Hrs)

INTEL 8086 MICROPROCESSOR: Introduction - Intel 8086 Hardware, Pin description, External memory Addressing, Bus cycles, Interrupt Processing - Addressing modes, Instruction set, Assembler Directives.

UNIT V (9 Hrs)

MICROCONTROLLER: Intel 8051 Microcontroller - Introduction Architecture, Memory Organization, Special Function Registers, Pins and Signals, Timing and control, Port Operation - Memory and I/O interfacing, Interrupts - Instruction Set and Programming.

Text Books:

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085", Penram International Publications, 6th Edition, 2020.
2. Krishna Kant, "Microprocessors and Microcontrollers – Architectures, Programming and System Design 8085, 8086, 8051, 8096", PHI, 2008.

References:

1. A. P. Godse and D.A Godse, "Microprocessors and Microcontrollers", Technical Publications, 3rd Edition, 2023.
2. Barry B. Brey, "The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386 and 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III Pentium 4 – Architecture, Programming and Interfacing", PHI, 8th Edition, 2019.
3. N. Senthil Kumar, M Saravanan and S. Jeevananthan, "Microprocessors and Microcontrollers" , Oxford University Press, 2nd Edition, 2016.
4. Ajay V Deshmukh, "Microcontrollers – Theory and Applications", Tata McGraw- Hill, 7th Edition, 2007.

ONLINE/ NPTEL Courses:

1. Microelectronics: Devices To Circuits: https://onlinecourses.nptel.ac.in/noc21_ee86
2. Microelectronics: Devices To Circuits: https://nptel.ac.in/courses/108107142
3. Basics of software defined Radios: https://onlinecourses.nptel.ac.in/noc22_ee78

CSPC302 DATA STRUCTURE AND ALGORITHMS

L	T	P	C
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Course Objective:

- To impart knowledge about the importance of data structures in programming and to familiarise basic searching and sorting algorithms.

Course Outcomes:

- To comprehend the basics of algorithms and understand the operations performed using arrays.
- To understand the linear data structures and its applications.
- To realize the properties of tree data structure and its importance in searching large database.
- To understand graph data structure and its applications.
- To know the need for hash tables.

UNIT I (9 Hrs)

INTRODUCTION: Data structures: Definition, Types - Algorithm: Definition, Properties, Analyzing algorithms: Space and Time Complexity-Arrays: One dimensional array, multidimensional array, Applications. Searching Algorithms: Linear search, Binary Search, Fibonacci search. Sorting Algorithms: Selection Sort, Bubble Sort, Quick Sort, Insertion sort, Heap Sort and Merge Sort.

UNIT II (9 Hrs)

STACK,QUEUE AND LINKED LISTS: Stacks: Definition – Operations - Applications of stack. Queues: Definition - Operations - Priority queues – De-queues – Applications of queue. Linked List: Singly Linked List, Doubly Linked List, Circular Linked List, Linked stacks, Linked queues, Applications of Linked List – Dynamic storage management.

UNIT III (9 Hrs)

TREE: Definition - Binary tree – Terminology – Representation – Operations - Applications – Binary search tree – AVL tree. B Trees: B Tree indexing - Operations on a B Tree - B + Tree Indexing. Trie - Trie operations.

UNIT IV (9 Hrs)

GRAPH: Definition – Terminology – Representation - Traversals – Applications - Spanning tree, Shortest path and Transitive closure, Topological sort. Set: Definition - Representation - Operations on sets – Applications

UNIT V (9 Hrs)

HASH TABLE: Tables: Rectangular tables - Jagged tables – Inverted tables - Symbol tables – Static tree tables - Dynamic tree tables - Hash tables-Overflow handling- Files: Sequential organization – Indexed organization.

Text Books:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures, Galgotia Book Source, Pvt. Ltd., 2004.
2. D. Samanta, Classic Data Structures, 2nd, Prentice-Hall of India, Pvt. Ltd., India, 2012.

References:

1. Thomas Cormen, Charles Lieserson, Ronald L Rive stand Clifford Stein, "Introduction to Algorithms", MIT Press/McGraw-Hill, 4th Edition, 2022.
2. John Canning, Alan Broder, Robert Lafore, "Data Structures & Algorithms in Python", Addison-Wesley Professional,1st Edition, 2022.

ONLINE/ NPTEL Courses:

1. Programming, Data Structures and Algorithms Using Python: https: //onlinecourses.nptel.ac. in/noc23 cs95
2. Introduction to Programming, Data Structures and Algorithms Using Python: https: //onlinecourses.nptel.ac.in/noc2 3_cs15
3. Programming, Data Structures and Algorithms using Python for beginners: https: //nptel.ac.in /courses/106106145

CSES303 DIGITAL ELECTRONICS AND SYSTEM

L	T	P	C
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Course Pre-requisite:

- Basic Electronics Engineering

Course Objective:

- To design combinational logic circuits and Sequential logic circuits, including multiplexers, decoders, encoders, adders, subtractors, Flip Flops and Latches. To learn the basics of IoT devices and types of boards.

Course Outcomes:

- To understand various combinational digital circuits using logic gates.
- To understand sequential circuits and analyze the design procedures.
- To understand Verilog HDL and hierarchial modeling concepts.
- To understand various protocols of IoT using various sensors and actuators.
- To design and develop system using Rasperry Pi/Arduino.

UNIT I (9 Hrs)

COMBINATIONAL LOGIC: Combinational Circuits – Karnaugh Map, Analysis and Design Procedures of combinational circuit, Magnitude Comparator, Parity generator/checker, Decoder, Encoder, Implementation of combinational logic using Multiplexers, Demultiplexers.

UNIT II (9 Hrs)

SYNCHRONOUS SEQUENTIAL LOGIC: Introduction to Sequential Circuits – Flip-Flops, operation and excitation tables, Triggering of Flip Flop, Analysis and design of clocked sequential circuits – Design of Moore/Mealy models, state minimization, state assignment, circuit implementation- Implementation of combinational logic/sequential logic design using standard ICs, PROM, PLA and PAL.

UNIT III (9 Hrs)

DIGITAL DESIGN WITH VERILOG HDL: Modules – instances – Data types – Arrays – System tasks – directives – Modules and Ports – Gate-Level Modeling – Dataflow Modeling – Behavioral Modeling - Design of Multiplexers, counters and full adders – Introduction - Hierarchical Modeling concepts – 4-bit ripple carry counter.

UNIT IV (9 Hrs)

SENSORS AND ACTUATORS: Introduction to the Concept of IoT Devices – IoT Devices Versus Computers, IoT Configurations, IoT Basic Components, IoT Architecture - State of the Art,Functional View, Information View, Deployment and Operational View, Integration of Sensors and Actuators with Arduino.

UNIT V (9 Hrs)

DESIGN AND DEVELOPMENT: Introduction to Arduino – Arduino Board, Arduino types - Micro, UNO, NANO, Modules - WiFi, Bluetooth Node ESP, Raspberry: Raspberry Pi Board Types, IDE programming - Interfaces and Raspberry Pi with Python Programming.

Text Books:

1. A. P. Godse and D. A. Godse, "Digital Principles and System Design", Technical Publications, 4th Edition, 2021.
2. M. Morris Mano, Michael D. Ciletti, "Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog", Pearson Education, 6th Edition, 2018.
3. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

References:

1. Charles H. Roth, Larry L. Kinney and Raghunandan G. H, "Fundamentals of Logic Design", Cengage India Private Limited, 1st Edition, 2019.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
3. Jan Holler, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand, David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012 (for Unit 4).

ONLINE/ NPTEL Courses:

1. Digital Circuits: https://onlinecourses.nptel.ac.in/noc23_ee115
2. Digital Circuits Design: https://onlinecourses.nptel.ac.in/noc22_ee110
3. Microelectronics: Devices To Circuits: https://nptel.ac.in/courses/108107142

CSBS304 MATHEMATICS - III

L	T	P	C
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Pre-requisite:

- Basic Knowledge in Maths & Statistics

Course Objective:

- To learn the foundations of probabilistic and statistical methods in engineering field.

Course Outcomes:

- To understand the fundamental concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- To understand and apply measures of central tendency, dispersion, moments, skewness, kurtosis, correlation, regression, and rank correlation for effective data analysis and interpretation.
- To attain proficiency in curve fitting techniques and conduct significance tests for large samples.
- To perform t-tests for means, correlation tests, F - test, and Chi-square tests for goodness of fit and independence of attributes.
- To apply the fundamental principles of experimental design classifications in the field of engineering.

UNIT I (9 Hrs)

BASIC PROBABILITY: Sample Space and Events, Axioms of Probability, Conditional Probability, Bayes' Theorem, Independent Events, Random Variables, Discrete and Continuous Random Variables – Probability Mass Function - Probability Density Function – Cumulative Distribution Function - Expectation and Variance, Standard Probability Distributions (Problems only): Bernoulli, Binomial, Poisson, Geometric, Multinomial, Uniform , Exponential, Gamma, Erlang and Normal Distribution.

UNIT II (9 Hrs)

BASIC STATISTICS: Measures of Central tendency – Mean – Median – Mode; Measure of Dispersion – Range – Variance – Standard Deviation; Moments, Skewness and Kurtosis, Correlation and regression, Rank Correlation.

UNIT III (9 Hrs)

APPLIED STATISTICS (LARGE SAMPLES): Curve Fitting by the Method of Least Squares- Fitting of straight lines, second degree parabolas and more general curves. **Test of Significance:** Large Sample Test for Single Proportion, Difference of Proportions, Single Mean, Difference of Means and Difference of Standard Deviations.

UNIT IV (9 Hrs)

APPLIED STATISTICS (SMALL SAMPLES): Student's' t-Tests - Test for Single Mean, Difference of Means and Correlation Coefficients, Test for ratio of variances (F - Test), Chi-square Test for goodness of fit and Independence of Attributes.

UNIT IV (9 Hrs)

DESIGN OF EXPERIMENTS: One-Way and Two-way Classifications- Completely randomized design- Randomized block design- Latin square design -2 factorial designs.

Text Books:

1. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
2. S. Ross, "A First Course in Probability", Pearson Education India,9th Edition, 2013.

References:

1. Bali N.P and Manish Goyal, "A Textbook Of Engineering Mathematics", Laxmi Publications(P) Ltd, 10th Edition, 2019.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10th Edition, 2018.
3. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2017.
4. William Feller, "An Introduction to Probability Theory and its Applications", (WSE) Vol. 1, 3rd Edition, 2013.

ONLINE/ NPTEL Courses:

1. Probability and Statistics: https://nptel.ac.in/courses/111105090
2. Advanced Engineering Mathematics: https://nptel.ac.in/courses/111107119
3. Introduction to Probability Theory and Statistics: https://nptel.ac.in/courses/111102160

CSHS305 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

Course Objective:

- To provide a foundational understanding of Management principles and practices. To introduce the field of management, its historical development and its importance in organizations.

Course Outcomes:

- To understand the introductory management concepts.
- To understand the basic knowledge on international aspect of management.
- To understand the organization structure and Human resource management.
- To understand motivation theories leadership and communication process.
- To understand the controlling concept of management.

UNIT I (9 Hrs)

INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS: Definition of Management - Science or Art, Manager Vs Entrepreneur, types of managers managerial roles and skills, Evolution of Management - Scientific, human relations, system and contingency approaches, Types of Business organization - Sole proprietorship, partnership, company, public and private sector enterprises, Organization culture and Environment - Current trends and issues in Management.

UNIT II (9 Hrs)

PLANNING: Nature and purpose of planning - Planning process, Types of planning, Objectives - Setting objec- tives, Policies, Planning premises, Strategic Management, Planning Tools and Techniques, Decision making steps andprocess - types of decisions and decision making conditions, Decision making styles, Effective decision making.

UNIT III (9 Hrs)

ORGANISING: Nature and purpose - Formal and informal organization, Organization chart, Organization structure, Types, Line and staff authority - Departmentalization, delegation of authority, Centralization and decentralization, Job Design, Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT IV (9 Hrs)

LEADING: Foundations of individual and group behaviour - Motivation, Motivation theories, Motivational techniques, Job satisfaction - Job enrichment, Leadership, types and theories of leadership, Communication - Process of communication, Barrier in communication, Effective communication, Communication and IT.

UNIT V (9 Hrs)

CONTROLLING: System and process of controlling - Budgetary and non, Budgetary control techniques, Use of computers and IT in Management control, Productivity problems and management, Control and performance, Direct and preventive control, Reporting.

Text Books:

1. Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals of Management", Pearson Education, 11th Edition, 2019.
2. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall India Pvt. Ltd., 13th Edition, 2017.

References:

1. PC Tripathy, PN Reddy and Ashish Bajpai, "Principles of Management", Tata Mcgraw Hill, 7thEdition, 2021.
2. Harold Koontz and Heinz Weihrich, "Essentials of management", Tata McGraw Hill, 11thEdition, 2020.
3. Robert Kreitner and Mamata Mohapatra, "Management", Biztantra, 2008.

ONLINE/ NPTEL Courses:

1. Management Information System: https://onlinecourses.nptel.ac.in/noc23_mg87
2. Management Information System: https://nptel.ac.in/courses/110105148

CSEL301 MICROPROCESSOR AND MICROCONTROLLER LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic Electronics Engineering

Course Objective:

- To enrich assembly language programming knowledge using 8085, 8086,8051 microprocessor and microcontroller.

Course Outcomes:

- To understand the inner working components of the microprocessor and microcontrollers.
- To develop assembly language program using 8085 instruction set.
- To develop assembly language program using 8086 instruction set.
- To develop assembly language program using 8051 instruction set.
- To develop various I/O programs for 8085, 8086 and 8051.

LIST OF EXPERIMENTS

Experiment using 8085 Microprocessor:

1. Study of 8085 Microprocessor Trainer Kit
2. 8-bit Arithmetic Operations (Addition, Subtraction, Multiplication and Division)
3. Block Operations (Move, Exchange, Compare, Insert and Delete)
4. Code Conversions
5. Digital Clock simulation
6. Moving Display
7. Serial Communication
8. Interrupt Programming
9. Elevator Simulation
10. Traffic Light Control

Experiments using 8086 Microprocessor with MASM:

11. Arithmetic Operations
12. Sorting and Searching

Experiments using 8051 Microcontroller

13. Arithmetic operations
14. ADC & DAC Interfacing
15. Stepper Motor and DC Motor Interface

(Total Periods:45)

CSPL302 DATA STRUCTURE AND ALGORITHMS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic knowledge in programming

Course Objective:

- To enable students write programs using various data structures, analyse and understand the benefits of choosing the right data structure.

Course Outcomes:

- To write programs for search and sorting algorithms.
- To write programs for implementing stacks, queues and linked list.
- To write programs for searching using tree data structure.
- To write programs for identifying shortest path in a network.
- To write programs that implements hash tables.

LIST OF EXPERIMENTS

1. Searching Algorithms (With the Number of Key Comparisons) - Sequential, Binary and Fibonacci Search Algorithms on an Ordered List
2. Sorting Algorithms: Insertion Sort, Selection Sort, Bubble Sort, Quick Sort, Heap Sort and Merge Sort.
3. Implementation of Stack and Its Operations.
4. Application of Stack for Converting an Arithmetic Expression into Postfix Form and Evaluation of Postfix Expression.
5. Implementation of Queue, Circular Queue, Priority Queue, Dequeue and Their Operations.
6. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List.
7. Implementation of Binary Tree and Binary Traversal Techniques.
8. Implementation of Graph Traversal Techniques.
9. Implement Dijkstra's Algorithm to Obtain the Shortest Paths.
10. Implementation of Hash Tables and its Operations.

(Total Periods:45)

CSEL303 DIGITAL ELECTRONICS AND SYSTEM LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic Electronics and Engineering

Course Objective:

- To design the combinational circuits, sequential circuits and implementation using arduino/raspberry pi board modules.

Course Outcomes:

- To understand the binary number systems and Boolean algebra.
- To design combinational logic using only of universal gates, MSI gates and PLDs.
- To design and implement sequential logic circuits of any complexity.
- To design and implement real time application using Raspberry Pi.
- To design and implement GPS module Interfacing.

LIST OF EXPERIMENTS

DIGITAL ELECTRONICS:

1. Implementation of binary adder/subtractor circuits.
2. Implementation of code converters.
3. Implementation of encoder and decoder circuits.
4. Implementation of functions using Multiplexers/Demultiplexers.
5. Implementation of shift register.
6. Implementation of the synchronous/Asynchronous counters.

ARDUINO/ RASPBERRY Pi:

7. Introduction to Arduino platform and programming.
8. Communicate between Arduino and Raspberry Pi using any wireless medium.
9. Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi.
10. Raspberry Pi Based Oscilloscope.
11. Controlling Raspberry Pi with WhatsApp.
12. Setting up Wireless Access Point using Raspberry Pi.

(Total Periods:45)

CSPL304 IT WORKSHOP (SCI LAB / MATLAB)

L	T	P	C
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Course Pre-requisite:

- Programming for problem solving

Course Objectives:

- To introduce the students with the basic features of SCI LAB/MATLAB for problem solving using array operations, control structures and Mathematical functions like matrix generation, Plotting with multiple data sets, line styles, colors.

Course Outcomes:

- To write fundamental programs in SCI LAB/MATLAB, creating variables and mathematical functions.
- To understand how to program matrix operations, array operations and how to solve the system of linear equations.
- To understand the fundamentals concepts of basic Plotting consisting of simple and multiple data sets in one plot.
- To understand how to program M-file scripts, M- file functions, Input –output Arguments and program control flow operators, loops, flow structures.
- To develop the debugging process and debugging M-files.

LIST OF EXPERIMENTS

1. Programs using mathematical, relational expressions and the operators.
2. Vectors and Matrices: Programs using array operations and matrix operations (such as matrix multiplication).
3. Selection Statements: Experiments on if statements, with else and elseif clauses and switch statements.
4. Programs using control Structures.
5. Programs based on scripts and user-defined functions.
6. Programs on Built-in text manipulation functions and conversion between string and number types.
7. Programs based on two main data structures: cell arrays and structures.
8. Programs based on Data Transfer.
9. Programs based on Advanced Functions.
10. Introduction to Object-Oriented Programming and Graphics.
11. Programs based on Advanced Plotting Techniques.
12. Programs based on sound files and image processing.
13. Solving problems listed in Mathematics I/II/III.

(Total Periods:45)

CSPC401 DISCRETE MATHEMATICS

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Mathematics I, II

Course Objectives:

- To learn the fundamentals of set operations, Cartesian products, binary equivalence relations, functions, and their properties.
- To learn the fundamental concepts of Combinatorics and Graph theory.

Course Outcomes:

- To analyse and comprehend Cantor's diagonal argument and understand the Power Set theorem.
- To apply the Chinese Remainder Theorem to solve systems of congruences and real-world problems.
- To solve the problems on combinatorial concepts such as permutations, combinations and matching algorithms to graph theory problems.
- To interpret and evaluate formulas using interpretations in first-order logic.
- To analyse the homomorphism and isomorphism between algebraic structures and Calculate expectations, variances, probabilities in Bernoulli trials and conditional probability scenarios using Bayes' Theorem.

UNIT I (12 Hrs)

SET, RELATIONS, FUNCTIONS: Operations and Laws of Sets, Cartesian Products,Binary Relation and functions, Partial Ordering Relation - Equivalence Relation - Image and Size of a Set - Sum and Product of Functions - Bijective functions - Inverse and Composite Function - Finite and infinite Sets - Countable and uncountable Sets-Cantor's diagonal argument and The Power Set theorem.

UNIT II (12 Hrs)

PROOF STRATEGIES AND MODULAR ARITHMETIC: Proof Methods and Strategies- Forward Proof - Proof by Contradiction - Proof by Contraposition - Proof of Necessity and Sufficiency - Case analysis - Induction -Extended Euclid's Greatest Common Divisor algorithm - The Fundamental Theorem of Arithmetic - Modular arithmetic - Co-primality (or Euler's totient function)- Chinese Remainder Theorem.

UNIT III (12 Hrs)

COMBINATORICS AND GRAPHS: Permutation and Combination - Inclusion-Exclusion - pigeon-hole principle -generating functions - Recurrence - Connected components - Paths - Cycles - Trees - Hamiltonian/Eulerian Walks - Coloring - Planarity - Matching.

UNIT IV (12 Hrs)

LOGIC: Languages of Propositional logic and First-order logic - expressing natural language sentences in languages of propositional and first-order logic - expressing natural language predicates in the language of first-order logic. Semantics of First-order logic- interpretation and its use in evaluating a formula.

UNIT V (12 Hrs)

ALGEBRA: Group, Permutation Groups, Cosets, Normal Subgroups, Ring, Field, Finite fields, Fermat's little theorem, Homomorphisms, Isomorphisms.

Text Books:

1. Rosen, K. H, "Discrete Mathematics and Its Applications", 8th Edition, 2019.
2. Liu, C.L. and Mohapatra, D.P., "Elements of Discrete Mathematics", Tata McGraw-Hill, 2008.
3. Huth, M.and Ryan M., "Logic in Computer Science: Modelling and Reasoning about Systems", Cambridge University Press, 2nd Edition, 2004.

References:

1. Mitzenmacher.M, and Upfal.E, "Probability and computing: Randomization and probabilistic techniques in algorithms and data analysis", Cambridge University Press, 2017.
2. Shoup.V, "A computational introduction to number theory and algebra", Cambridge University Press, 2009.
3. Bóna.M, "A Walk Through Combinatorics: An Introduction to Enumeration and Graph Theory", 2006.
4. Herstein.I.N, "Topics in algebra", John Wiley and Sons, 2006.

ONLINE/NPTEL Courses:

1. Discrete Mathematics: https://nptel.ac.in/courses/106103205
2. Introduction-Discrete Mathematics: https://nptel.ac.in/courses/106108227
3. Discrete Mathematics: https://nptel.ac.in/courses/111106086

CSPC402 COMPUTER ORGANIZATION AND ARCHITECTURE

L	T	P	C
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Course Pre-requisite:

- Problem solving and programming

Course Objective:

- To learn the basic components of computer, instruction set architecture, memory hierarchy, super scalar processor and multicore systems.

Course Outcomes:

- To understand the components of a basic computer.
- To understand the key components of a CPU and how the instructions are executed.
- To analyze the execution time taken in a pipelined processor.
- To understand the need of memory hierarchy and efficiency achieved due to the use of cache.
- To interpret how the data is stored and input-output is performed in computers.

UNIT I (9 Hrs)

INTRODUCTION: Role of abstraction, Basic functional units of a computer, Von-Neumann model of computation, Moore's law, form Notion and perance- Data representation and basic operations.

UNIT II (9 Hrs)

INSTRUCTION SET ARCHITECTURE (RISC-V): CPU registers, Instruction format and Encoding, addressing modes, Instruction set, Instruction types, Instruction Decoding and Execution, Basic Instruction cycle, Reduced Instruction Set Computer (RISC), Complex Instruction Set Computer (CISC), RISC-V instructions - X86 Instruction set.

UNIT III (9 Hrs)

PROCESSOR: Revisiting clocking methodology, Amdahl's law, Building a data path and control, single cycle processor, multi-cycle processor, instruction pipelining, Notion of ILP, data and control hazards and mitigations - Limits of ILP.

UNIT IV (9 Hrs)

MEMORY HIERARCHY: SRAM/DRAM, Locality of reference, Caching - different indexing mechanisms, trade-offs related to block size, associativity, cache size, processor, cache interactions for a read/write request, basic optimizations - write through/writeback caches, average memory access time, cache replacement policies, memory interleaving.

UNIT V (9 Hrs)

STORAGE AND I/O: Introduction to magnetic disks, flash memory- I/O mapped I/O and memory mapped I/O - I/O data transfer techniques - programmed I/O, Interrupt-driven I/O and DMA.

Text Books:

1. Carl Hamacher, "Computer Organization and Embedded Systems", McGrawHill Higher Education, 6th Edition, 2022.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Elsevier, 5th Edition, 2014.

References:

1. Vincent P. Heuring and Harry F. Jordan, "Computer System Design and Architecture", Pearson Education, 2nd Edition, 2016.
2. Smruti Ranjan Sarangi, "Computer Organisation & Architecture", McGraw Hill, 2014.
3. Mano M. Morris, "Computer System Architecture", Pearson, 2007.

Online Simulators and Tools:

1. RIPES: https://freesoft.dev/program/108505982
2. GEM5:https://www.gem5.org/documentation/learning_gem5/introduction

ONLINE/NPTEL Courses:

1. Introduction to computer System and its submodules: https://nptel.ac.in/courses/106103068
2. Computer Organization and Architecture: https://nptel.ac.in/courses/106106166
3. Computer Organization and Architecture A Pedagogical Aspect:https://nptel.ac.in/courses/106103180

CSPC403 DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	C
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Course Pre-requisite:

- Basic Knowledge in Data Structure.

Course Objective:

- To demonstrate various algorithm analysis and design techniques by applying them to find solutions to real world problems.

Course Outcomes:

- To understand and derive the time and space complexities of algorithms.
- To understand the divide-and-conquer and greedy techniques.
- To formulate and design the Dynamic Programming approach.
- To apply Backtracking technique to solve real world problems.
- To design and analyze Branch and Bound technique.

UNIT I (9 Hrs)

INTRODUCTION: Algorithm: Definition and Pseudocode - Asymptotic Notations – Worst Case, Best Case And Average Case Analysis; Big Oh, Omega and Theta Notations; Analyzing Control Structures. Analysis of Sorting and Searching algorithms: Heap, Shell, Radix, Insertion, Selection and Bubble Sort; Sequential, Binary And Fibonacci Search. Recursive Algorithms, Analysis of Non-Recursive and Recursive Algorithms, Solving Recurrence Equations.

UNIT II (9 Hrs)

DIVIDE AND CONQUER,GREEDY APPROACHES: Divide and Conquer: General Method – Binary Search – Maximum And Minimum – Merge Sort - Quick Sort – Strassen's Matrix Multiplication. Greedy Method: General Method – Knapsack Problem – Minimum Spanning Tree Algorithms – Single Source Shortest Path Algorithm – Scheduling, Optimal Storage on Tapes, Optimal Merge Patterns.

UNIT III (9 Hrs)

DYNAMIC PROGRAMMING: General Method – Multi-Stage Graphs – All Pair Shortest Path Algorithm – 0/1 Knapsack and Travelling Salesman Problem – Chained Matrix Multiplication.

UNIT IV (9 Hrs)

BACKTRACKING : The General Method – 8-Queens Problem – Sum of Subsets – Graph Coloring – Hamiltonian Cycle – Knapsack Problem.

UNIT V (9 Hrs)

BRANCH AND BOUND: Least Cost (LC) Search – The 15-Puzzle Problem – Control Abstractions For LC-Search – Bounding – FIFO Branch and-Bound - 0/1 Knapsack Problem – Travelling Salesman Problem. Introduction to NP-Hard and NP-Completeness.

Text Books:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Galgotia Publications, Pvt. Ltd., 2nd Edition, 2008.
2. Gilles Brassard and Paul Bratley, Fundamentals of Algorithmics, Theory and Practice PHI, 2010.
3. Thomas H. Corman, Charles E. Leiserson, Ronald and L. Rivest, Introduction to Algorithms, Prentice-Hall of India, 2nd Edition, 2003.

References:

1. Gajendra Sharma, "Design and Analysis of Algorithms", Khanna Publishing House, New Delhi, 4th Edition, 2015.
2. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis, and Internet Examples", Wiley, 2nd Edition, 2006.

ONLINE/NPTEL Courses:

1. Design and Analysis of Algorithms: https://nptel.ac.in/courses/106101059
2. Introduction Design and Analysis of Algorithms: https://nptel.ac.in/courses/106106131
3. Overview of DAA: https://nptel.ac.in/courses/106101060

CSPC404 ADVANCED PROGRAMMING IN JAVA

L	T	P	C
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Course Pre-requisite:

- Basic knowledge in programming

Course Objective:

- To learn the concepts of OOPS principles, packages, interfaces, generic classes and GUI applications using JavaFX.

Course Outcomes:

- To apply the concepts of classes and objects to solve simple problems.
- To develop programs using inheritance, packages and interfaces.
- To apply exception handling mechanisms and multithreaded model to solve real world problems.
- To build Java applications with I/O packages, string classes, Collections and generics concepts.
- To integrate the concepts of event handling and JavaFX components and controls for developing GUI based applications.

UNIT I (9 Hrs)

INTRODUCTION TO OOP AND JAVA: Overview of OOP – Object oriented programming paradigms, Features of Object Oriented Programming, Java Buzzwords- Overview of Java - Data Types, Variables and Arrays, Operators, Control Statements, Programming Structures in Java, Defining classes in Java, Constructors- Methods -Access specifiers.

UNIT II (9 Hrs)

INHERITANCE, PACKAGES AND INTERFACES: Overloading Methods – Objects as Parameters, Returning Objects, Static, Nested and Inner Classes- Inheritance: Basics, Types of Inheritance, Super keyword, Method Overriding, Dynamic Method Dispatch, Abstract Classes, final with Inheritance - Packages and Interfaces- Packages, Packages and Member Access, Importing Packages, Interfaces.

UNIT III (9 Hrs)

EXCEPTION HANDLING AND MULTITHREADING: Exception Handling basics, Multiple catch Clauses, Nested try Statements, Java's Built-in Exceptions, User defined Exception- Multithreaded Programming- Java Thread Model, Creating a Thread and Multiple Threads, Priorities, Synchronization, Inter Thread Communication, Multithreading.

UNIT IV (9 Hrs)

GENERIC PROGRAMMING AND STRING HANDLING: I/O Basics, Reading and Writing Console I/O, Reading and Writing Files- Generics, Generic Programming, Generic classes, Generic Methods, Bounded Types, Restrictions and Limitations - Strings: Basic String class, methods and String Buffer Class.

UNIT V (9 Hrs)

JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS: JavaFX Events and Controls- Event Basics, Handling Key and Mouse Events- Controls, Checkbox, ToggleButton, RadioButtons , ListView, ComboBox, Choice-Box, Text Controls, ScrollPane. Layouts, FlowPane, HBox and VBox, BorderPane, StackPane, GridPane Menus: Basics, Menu, Menu bars, MenuItem.

Text Books:

1. Herbert Schildt, "Java: The Complete Reference", McGraw Hill Education, 11th Edition, 2019.
2. Herbert Schildt, "Introducing JavaFX 8 Programming", McGraw Hill Education, 1st Edition, 2015.

References:

1. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, Prentice Hall, 11th Edition, 2018.

ONLINE/NPTEL Courses:

1. Object Oriented System Development using UML: https://nptel.ac.in/courses/106105224
2. Java: https://nptel.ac.in/courses/106105225

CSHS405 ORGANIZATIONAL BEHAVIOUR

L	T	P	C
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Course Pre-requisite:

- Basic knowledge in organization and management

Course Objectives:

- To learn organizational behaviour,management practices and solving organizational challenges to understand the important issues pertaining to individual.

Course Outcomes:

- To analyze the inter personnel communication process to increase their effectiveness
- To evaluate the development of basic conflict resolutions
- To examine what makes an organization, how organization evolve and what makes them effective
- To appraise their ability to manage, lead and work with other people in an organizational setting
- To understand the organizational behaviour in dynamics.

UNIT I (9 Hrs)

FOCUS AND PURPOSE: Definition, need and importance of organizational behaviour – Nature and scope – Frame work – Organizational behaviour models.

UNIT II (9 Hrs)

INDIVIDUAL BEHAVIOUR: Personality, types, Factors influencing personality, Theories – Learning,Types of learners,The learning process, Learning theories – Organizational behavior modification, Misbehaviour, Types, Management Intervention- Emotions Emotional Labour, Emotional Intelligence, Theories- Attitudes, Characteristics, Components, Formation, Measurement Values- Perceptions, Importance, Factors influencing perception, Interpersonal perception, Impression Management Motivation,importance,Types – Effects on work behavior.

UNIT III (9 Hrs)

GROUP BEHAVIOUR: Organization structure – Formation – Groups in organizations, Influence, Group dynamics – Emergence of informal leaders and working norms, Group decision making techniques, Team building, Interpersonal relations, Communication – Control.

UNIT IV (9 Hrs)

LEADERSHIP AND POWER: Meaning, Importance, Leadership styles – Theories, Leaders Vs Managers – Sources of power, Power centers – Power and Politics.

UNIT V (9 Hrs)

DYNAMICS OF ORGANIZATIONAL BEHAVIOUR: Organizational culture and climate, Factors affecting organizational climate, Importance- Job satisfaction, Determinants, Measurements, Influence on behavior- Organizational change, Importance, Stability Vs Change , Proactive Vs Reaction change, the change process, Resistance to change, Managing change- Stress, Work Stressors, Prevention and Management of stress, Balancing work and Life- Organizational development, Characteristics,objectives.

Text Books:

1. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, “Essentials of Organizational Behaviour”, Pearson, 2019.

References:

1. K. Aswathappa, “Organizational Behavior”, Himalaya Publishing House, 2018.
2. Richard L, “Organization Theory and Design”, South Western College Publishing, 11th Edition, 2012.
3. S.TrevisCerto, “Modern Management Concepts and Skills”, Pearson Education, 2018.

ONLINE/NPTEL Courses:

1. Understanding Organizational Behaviour: https://nptel.ac.in/courses/110105033
2. Organizational Behaviour: https://nptel.ac.in/courses/110106145
3. Organizational Behaviour - II: https://nptel.ac.in/courses/110105154

CSMC406 ENVIRONMENTAL SCIENCES

L	T	P	C
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Course Pre-requisite:

- Basic Science Courses

Course Objective:

- To work and produce most efficient, economical, eco-friendly finished products, to solve various engineering problems applying ecosystem to produce eco–friendly products.

Course Outcomes:

- To understand the basic concepts of industrial management.
- To understand the importance of air and noise pollution.
- To analyze the importance of solid and water pollution.
- To understand the importance of renewable sources of solar energy.
- To understand the environmental management in fabrication industry and solid waste management.

UNIT I (9 Hrs)

ECOSYSTEM: Structure of ecosystem-Biotic & Abiotic components- Food chain and food web- Aquatic (Lentic and Lotic) and terrestrial ecosystem- Carbon, Nitrogen, Sulphur, Phosphorus cycle- Global warming, Causes, effects, process, Green House Effect, Ozone depletion.

UNIT II (9 Hrs)

AIR AND, NOISE POLLUTION: Definition of pollution and pollutant-Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler)- Air Pollutants: Types, Particulate Pollutants- Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator)- Gaseous Pollution Control, Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler- Noise pollution, sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000.

UNIT III (9 Hrs)

WATER AND SOIL POLLUTION : Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD- Definition, calculation- Waste Water Treatment, Primary methods, sedimentation, froth flotation, Secondary methods- Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method- Membrane separation technology, RO (reverse osmosis).

UNIT IV (9 Hrs)

RENEWABLE SOURCES OF ENERGY SOLAR ENERGY: Basics of Solar energy- Flat plate collector (Liquid & Air). Theory of flat plate collector- Importance of coating- Advanced collector- Solar pond- Solar water heater, solar dryer- Solar stills- Biomass: Overview of biomass as energy source- Thermal characteristics of biomass as fuel- Anaerobic digestion- Biogas production mechanism- Utilization and storage of biogas- New Energy Sources, Need of new sources- Different types new energy sources- Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion) Concept, origin and power plants of geothermal energy.

UNIT V (9 Hrs)

SOLID WASTE MANAGEMENT, ISO 14000 & ENVIRONMENTAL MANAGEMENT: Solid waste generation- Sources and characteristics of Municipal solid waste, E- waste, Biomedical waste- Air quality act 2004, air pollution control act 1981 and Water Pollution and Control Act 1996- Structure and role of Central and state pollution Control Board- Concept of Carbon Credit, Carbon Footprint- Environmental management in fabrication industry- ISO14000: Implementation in industries, Benefits.

Text Books:

1. S.C. Sharma & M.P. Poonia, "Environmental Studies", Khanna Publishing House, New Delhi, 2021.
2. Arceivala, Soli Asolekar, Shyam, "Waste Water Treatment for Pollution Control and Reuse", Mc-Graw Hill Education India Pvt. Ltd., New York, 2007.
3. Nazaroff, William, Cohen, Lisa, "Environmental Engineering Science", Willy, New York, 2000.
4. O.P. Gupta, "Elements of Environmental Pollution Control", Khanna Publishing House, New Delhi.

References:

1. Aldo Vieira, Da Rosa, "Fundamentals of renewable energy processes", Academic Press Oxford, 2013.
2. Patvardhan, A.D, "Industrial Solid Waste", Teri Press, 2013.
3. Metcalf and Eddy, "Waste Water Engineering", Mc-Graw Hill, 2013.
4. Keshav Kant, "Air Pollution & Control", Khanna Publishing House, 2018.

ONLINE/NPTEL Courses:

1. Introduction to Environmental Engineering: https://nptel.ac.in/courses/103107084
2. Environmental Quality Monitoring & Analysis: https://nptel.ac.in/courses/103106162
3. Basic Environmental Engineering and Pollution Abatement: https://nptel.ac.in/courses/103107215
4. Environmental Air Pollution: https://nptel.ac.in/courses/105104099

CSPL401 COMPUTER ORGANIZATION AND ARCHITECTURE LAB

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Course Pre-requisite:

- Digital Electronics and Systems

Course Objective:

- To learn the performance issues related to pipelining, cache using architectural simulator and analyze the memory access patterns and its impact

Course Outcomes:

- To analyze the behaviour of memory, ports and add-on cards.
- To execute ARM/RISC assembly language program 4-function calculator etc.,
- To design Arithmetic logic units and different types of memory blocks.
- To analyze the operational behaviour of FPGA.
- To analyze the impact of standard programs or benchmarks using architectural simulators.

LIST OF EXPERIMENTS

1. Computer Anatomy-Memory, Ports, Motherboard and add-on cards.
2. Write programs in ARM/RISC assembly language and test these on an instruction set simulator.
3. Generate some interesting numbers (example - Happy numbers,Autonomic numbers, Hardy- Ramanujan numbers etc.)
4. Implement a 4-function calculator.
5. Sort an integer array using merge sort (recursive).
6. Evaluate an arithmetic expression specified as a string (using recursive functions).
7. Implement a simple game.
8. Write or generate sequence of instructions and observe the overall pipeline stalls with and without data hazards, control hazards, and with/without data forwarding.
9. Rearrange the sequence of instructions or the program so that the pipeline stalls will be minimized.
10. Configure the simulator [gem5 is preferred] to operate on the binaries of the benchmark as the input.
11. Design a simple ARM/RISC processor for a small subset of instructions and implement on FPGA board.

(Total: 45 Periods)

CSPL402 DESIGN AND ANALYSIS OF ALGORITHM LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic Knowledge in data structures and programming

Course Objective:

- To enable students write programs using various algorithms design techniques and understand their significance.

Course Outcomes:

- To choose and implement the searching/sorting techniques
- To find solutions using right algorithm design technique.
- To implement backtracking algorithms for solving Knapsack problem.
- To analyze the algorithm complexity and the computation time of algorithms.
- To apply branch and bound technique to solve optimisation problems.

LIST OF EXPERIMENTS

Programs to implement the following :

1. Implement binary search using Divide-and-Conquer technique.
2. Implement quick sort and merge sort using Divide-and-Conquer technique.
3. Find the maximum and minimum element in an array using Divide-and-Conquer technique.
4. Implement and analyse the time complexity of any of the sorting algorithm and represent it graphically.
5. Implement Strassen's multiplication using Divide and Conquer technique.
6. Implement Knapsack problem using Greedy technique.
7. Implement Single-Source Shortest Path algorithm using Greedy technique.
8. Implement Prim's algorithm using greedy technique.
9. Implement Kruskal algorithm using greedy technique.
10. Implement Multi-Stage Graphs using Dynamic Programming technique.
11. Implement Floyd's algorithm using Dynamic Programming technique.
12. Implement Traveling Salesman algorithm using Dynamic Programming technique.
13. Implement 8 Queens algorithm using Backtracking technique.
14. Implement Hamiltonian cycle algorithm using Backtracking technique.
15. Implement Traveling Salesman problem using Branch-and-Bound technique.

(Total: 45 Periods)

CSPL403 JAVA PROGRAMMING LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Programming for Problem solving

Course Objective:

- To write program for implementing constructors and destructors and develop applications using database connectivity.

Course Outcomes:

- To demonstrate the usage of control structure, modularity, classes, I/O and the scope of the class members
- To develop solutions to problems demonstrating usage of data abstraction,encapsulation.
- To develop an simple application using Inheritance concepts.
- To implement solutions to various I/O operations,Threads,Exceptions and String manipulations
- To develop applications using event handling.
- To develop a design for simulating calculator application.

LIST OF EXPERIMENTS

1. Program to implement constructors and destructors with array of objects.
2. Program to demonstrate function overloading.
3. Program to implement different types of inheritances like multiple, Multilevel and hybrid.
4. I/O Program to demonstrate the use of abstract classes.
5. Program to demonstrate I/O streams and functions.
6. Program to perform all possible type conversions.
7. Program to demonstrate exception handling technique.
8. Program to implement networking concepts.
9. Program to design and implement JDBC.
10. Program to design an event handling event for simulating a simple calculator.
11. Build GUI based application development using JavaFX.

(Total: 45 Periods)

CSPC501 COMPUTER NETWORKS

L	T	P	C
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Course Pre-requisite:

- Basic knowledge in computer.

Course Objective:

- To learn the fundamental concepts of networks and OSI layers. To analyze various routing algorithms and security algorithms in networks.

Course Outcomes:

- To understand the fundamentals of network and transmission media.
- To understand the error detection, correction codes and datalink layer protocols.
- To understand the various routing algorithms and Internetworking.
- To enhance the knowledge of sockets and congestion control techniques.
- To enhance the knowledge in IDS and cryptographic techniques.

UNIT I (9 Hrs)

PHYSICAL LAYER: Introduction- Uses, Network Hardware, Software, Reference Models - Theoretical Basis for Communication - Electromagnetic Spectrum, Radio Transmission, Digital Modulation, Baseband Transmission - Transmission Media, Wireless Transmission.

UNIT II (9 Hrs)

DATALINK LAYER: Design Issues - Services, Framing, Error Control, Flow Control - Error Detection and Correction Codes, Hamming Code, Cyclic Redundancy Check - Data Link Layer Protocols, Simplex Protocol , Slid- ing Window Protocols - Medium Access Control Sublayer, Channel Allocation Problem, Multiple Access Protocols, ALOHA, CSMA Protocols, Collision-Free Protocols, Wireless LAN Protocols - Ethernet MAC Sublayer Protocol, 802.11 MAC Sublayer Protocol - Data Link Layer Switching, Uses of Bridges, Learning Bridges, Repeaters, Hubs, Bridges, Switches, Routers and Gateways.

UNIT III (9 Hrs)

NETWORK LAYER: Design Issues- Routing Algorithms, The Optimality Principle, Shortest Path Algorithm, Flood- ing, Distance Vector Routing, Link State Routing - Congestion Control Approaches, Traffic-Aware Routing, Admis-sion Control, Traffic Throttling, Load Shedding - Internetworking, Tunneling, Internetwork Routing, IPv4, IP Ad- dresses, IPv6.

UNIT IV (9 Hrs)

TRANSPORT LAYER: Services- Berkeley Sockets, Example - Elements of Transport Protocols Addressing, Connection Establishment, Connection Release, Flow Control and Buffering, UDP – TCP Segment Header, Connection Establishment, Connection Release, Sliding Window, Timer Management - Congestion Control.

UNIT V (9 Hrs)

APPLICATION LAYER: DNS, E-Mail, WWW, Architecture, HTTP, Content Delivery, Server Farms and Web Prox- ies, Peer-To-Peer Networks, Firewalls - Intrusion Detection System - Network Security - Introduction to Cryptography, Substitution Ciphers, Transposition Ciphers, Public Key Algorithms, RSA, Symmetric Algorithm.

Text Books:

1. A.S.Tanenbaum and D.J.Wetherall, "Computer Networks" , Pearson, 6th Edition, 2021.
2. Behrouz A. Ferouzon "Data Communication and Networking with TCP/IP Protocol Suite", McGraw Hill, 6th Edition, 2022.

References:

1. J.F.Kurose and K.W. Ross, "Computer Networking: A Top-down approach", Pearson, 7th Edition , 2017.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks- A System Approach", Elsevier, 5th Edition, 2012.

ONLINE / NPTEL Courses:

1. Computer Networks: https://nptel.ac.in/courses/106105080
2. Emergence of Networks & Reference Models: https://nptel.ac.in/courses/106105081
3. Introduction on Computer Networks: https://nptel.ac.in/courses/106106091

CSPC502 DATABASE SYSTEMS

L	T	P	C
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Pre-requisite:

- Knowledge in Engineering

Course Objective:

- To design and implement database schema, query languages for an application using RDBMS concepts such as transactions and concurrency control.

Course Outcomes:

- To understand RDBMS concepts.
- To design and develop database applications.
- To design ER-models to represent simple database application and improve the database design by normalization.
- To understand the working of database including data storage, indexing and query processing.
- To study non-relational and distributed database management systems with a focus on query optimization.

UNIT I: (9 Hrs)

INTRODUCTION: Introduction to Data Models (Relational, Semi structured, ER), Relational Data Model- Relational Algebra, Relational Calculus or Connection to First Order Logic (Optional).

UNIT II: (9 Hrs)

SQL INTERACTING WITH DATABASE: DDL, Insert/Delete/Update, Simple Queries (select/ project/ join/ aggregate queries), Complex queries (With Clause, Nested Sub queries, Views) - Programming in a standard language and interfacing with a DB backend.

UNIT III: (9 Hrs)

DATABASE DESIGN AND BIG DATA: Key-value Stores and Semi-structured Data, JSON and Mongo DB, other combinations. Introduction to ER model: Mapping from ER to relational model, Functional Dependencies, Normalization (BCNF, Optionally 3NF).

UNIT IV: (9 Hrs)

PHYSICAL DESIGN AND QUERY PROCESSING: Overview of Physical Storage (Hard Disks, Flash/SSD/RAM) – sequential vs random I/O, Reliability via RAID, Storage Organization (Records, Pages and Files) – Database Buffers, Database Metadata, Indexing, B+-Trees- Query Processing: External sort, Joins using nested loops, indexed nested loops.

UNIT V: (9 Hrs)

QUERY OPTIMIZATION AND TRANSACTION PROCESSING: Overview of Query Optimization - equivalent expressions, concept of cost based optimization, Concept of transactions and schedules, ACID properties, Conflict - Serializability, Concurrency control- locks, 2PL, Strict 2PL, optional- isolation level, Recovery using undo and redo logs.

Text Books:

1. Silberschatz, Korth and Sudarshan, "Database System Concepts", McGraw-Hill (Indian Edition released), 7th Edition, 2021.
2. RP Mahapatra, "Database Management Systems", Khanna Publishing House, 2020.
3. Krishnan, "Database Management Systems", McGraw Hill Higher Education, 3rd Edition, 2002.

References:

1. Relational algebra calculator: https://dbis-uibk.github.io/relax/landing
2. SQL: PostgreSQL/MySQL/MariaDB, or SQLite in browser
3. B+-tree visualization: https://www.cs.usfca.edu/ galles/visualization/BPlusTree.html
4. MongoDB
5. Various DB systems playground: https://www.pdbmbook.com/playground

ONLINE/NPTEL Courses:

1. Introduction to Database Systems: https://nptel.ac.in/courses/106106220
2. Databse Systems: https://nptel.ac.in/courses/106106095
3. Basic Database Queries: https://nptel.ac.in/courses/106104021

CSPC503 THEORY OF COMPUTATION

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Discrete Mathematics, Digital Electronics and System, Design and Analysis of Algorithms

Course Objective:

- To learn the concepts of automata computation, decision problems with limitations of computational models, algebraic formalisms of languages.

Course Outcomes:

- To understand models and abstractions: automata as a basic model of computation
- To understand Link between languages, automata, and decision problems.
- To understand layering as a means of tackling complexity, layering applied to the Internet.
- To understand algebraic formalisms of languages such as regular expressions, context-free grammar.
- To understand algorithms and computability through the lens of Turing machines.

UNIT I (12 Hrs)

FINITE AUTOMATON: Alphabets, formal languages and problems. Regular languages and automata models- Deterministic Finite automaton, Formal argument of correctness, Regular languages -Properties of regular languages, Closure, properties, product construction, Limitations of Automata Nonregularity, Pumping Lemma, Non-Deterministic Finite Automaton, Subset construction, Equivalence with DFAs.

UNIT II (12 Hrs)

REGULAR EXPRESSIONS: Equivalence with regular languages- Algorithms for regular languages, Minimization and its algorithm. Myhill- Nerode relations, Characterization of regular languages.

UNIT III (12 Hrs)

GRAMMARS, CONTEXT-FREE LANGUAGES AND MACHINE MODELS: Grammars and the motivation from language theory- Context-free grammars, closure properties- Chomsky Normal Form for CFGs. PDAs - Empty-stack vs Final state acceptance conditions - Equivalence of PDAs and CFGs. Limitations of PDA computation, non-context-free language - Pumping Lemma for CFLs, Deterministic CFLs and PDAs, CYK Algorithm for parsing of CFLs.

UNIT IV (12 Hrs)

TURING MACHINES AND COMPUTABILITY: Modeling computation using Turing Machines - Equivalent models - Church Turing Hypothesis - Decidability and Turing recognizability (i.e., recursive and recursively enumerable)- Closure properties - Undecidability by diagonalization, Reductions to show undecidability.

UNIT V (12 Hrs)

RESOURCE BOUNDED TURING MACHINES & INTRO TO COMPLEXITY: Basic complexity classes- Time bounded classes Post's correspondence problem, undecidable problems, Polytime reductions, NP -completeness, Cook-Levin Theorem without proof.

Text Books:

1. Michael Sipser, "Introduction to the Theory of Computation", Cengage Publications, 3rd Edition 2012.
2. John Hopcroft, Rajeev Motwani, Jeffrey D. Ullmann, "Introduction to Automata, Theory, Languages and Computation".Pearson Publications, 3rd Edition, 2008.

References:

1. R.B. Patel, "Theory of Computation", Khanna Book Publishing, 2020.
2. Harry Lewis, Christos Papadimitriou, "Elements of the Theory of Computation", Prentice Hall, Pearson Publisher, 2nd Edition, 1997.

ONLINE/NPTEL Courses:

1. What is theory of computation? Set membership problem, basic notions like alphabet, strings, formal languages: https://nptel.ac.in/courses/106104028
2. Introduction- Theory of Computation: https://nptel.ac.in/courses/106104148
3. Grammers and Natural Language Processing: https://nptel.ac.in/courses/106106049

CSPC504 OPERATING SYSTEMS

L	T	P	C
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Course Pre-requisite:

- Programming Languages, Data Structures and Algorithms, Computer Organization and Architecture.

Course Objective:

- To learn the details of the abstractions, interfaces provided by the OS for program execution and execution requirements, processes, threads, memory management, files. To analyse concurrency and related synchronization based solutions.

Course Outcomes:

- To understand the role, functionality of the layering systems software components
- To understand the design and usage of the OS API and OS services.
- To understand process management, concurrency and thread introduction.
- To understand problems arising due to concurrency and related synchronization based solutions.
- To have Hands-on practical experience with usage of the OS API and basics of OS mechanisms.

UNIT I (9 Hrs)

INTRODUCTION TO OPERATING SYSTEMS: Application requirements, The systems stack and role of OS, resources, abstractions and interfaces, Components overview of an OS, Examples of different types of OS - Basic organization of hardware components, Von Neumann architecture -Processes: Process abstraction, Process Control Block (PCB),Design of system calls - Invocation and basic OS handling, Process control system calls, fork, wait, getpid, getppid and variants, The limited direct execution model.

UNIT II (9 Hrs)

MEMORY MANAGEMENT: Address bus and memory access, Memory view of a process, heap, stack, code, data - Process memory usage requirements, virtual memory and related system calls (mmap, munmap, sbrk, mprotect) -Address translation mechanisms: static mapping, segmentation, paging Page faults, page sharing, read/write permissions, swapping, process vs OS memory - Memory bookkeeping and management - motivation and mechanisms (process and OS) - Case studies: malloc and role of OS for program to process.

UNIT III (9 Hrs)

PROCESS MANAGEMENT AND CONCURRENCY: The process lifecycle, source code to execution, The OS mode of execution, limited direct execution recap, interrupts, system calls, switch mechanism and PCB state- Scheduling policies, scheduling metrics, goals and examples (interactive vs. real-time, priority)- Motivation, application, process and OS use cases- Introduction to threads and the pthread API.

UNIT IV (9 Hrs)

SYNCHRONIZATION: Synchronization primitives, limitations of software solutions, atomic Instructions, test-and-set, spinlocks, mutexes, condition variables, semaphores- Introduction to the pthread synchronization API- Case studies, producer-consumer, reader, writers, barriers- Discussion on issues with concurrency: race conditions, deadlocks, order violation.

UNIT V (9 Hrs)

FILE SYSTEMS: Persistence and the File abstraction, Hardware view- Hard disk architecture and its interfacing, Process view - System calls for file handling, Roles and responsibilities of file system, File system design details- file and file system metadata, directory structure, caching optimizations, File System case study (the Unix file system etc.).

Text Books:

1. Andrew S. Tannenbaum and Herbert Bos, "Modern Operating Systems", Pearson Education India, 4th Edition 2014.
2. Avi Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", Wiley India; John Wiley & Sons, 9th Edition, 2013.

References:

1. William Staling, "Operating Systems: Internals and Design Principles", Prentice Hall, 7th Edition, 2012.
2. D M Dhamdhere, "Operating Systems:A Concepts Based Approach", McGraw-Hill Education, 3rd Edition, 2017.

ONLINE/NPTEL Courses:

1. Introduction to Operating Systems: https://nptel.ac.in/courses/106106144
2. Operating System Fundamentals: https://nptel.ac.in/courses/106105214
3. Operating Systems: https://nptel.ac.in/courses/106108101

CSMC505 CONSTITUTION OF INDIA

L	T	P	C
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Pre-requisite:

- Basic Knowledge of Indian History

Course Objective:

- To learn about the Constitution of India and the structure.

Course Outcomes:

- To create the awareness of The Constitution.
- To understand the structures, roles and functions of the Union Government.
- To understand the structures, roles and functions of the State Government.
- To understand the structures, roles and functions of the Local Administration.
- To understand about the Election Commission.

UNIT I

THE CONSTITUTION - INTRODUCTION: The History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its interpretation, Fundamental Rights and Duties and their interpretation- State Policy Principles.

UNIT II

UNION GOVERNMENT: Structure of the Indian Union-President, Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha.

UNIT III

STATE GOVERNMENT: Governor, Role and Power, Chief Minister and Council of Ministers, State Secretariat.

UNIT IV

LOCAL ADMINISTRATION: District Administration, Municipal Corporation, Zila Panchayat.

UNIT V

ELECTION COMMISSION: Role and Functioning, Chief Election Commissioner, State Election Commission.

Text Books:

1. Dr. B. Mahadevan, Chinmaya Vishwa Vidyapeeth, Dr. Vinayak Rajat Bhat, Dr. Nagendra Pavana R.N., Chinmaya Vishwa Vidyapeeth, Dr. Anil Sahasrabudhe, Subhash Kak, Dr. S. Sadagopan, "Introduction to Indian Knowledge System: Concepts and Applications", IIIT Bangalore, 2022.

References:

1. DD Basu Lexis Nexis, "Introduction to the Constitution of India", 23*rd* Edition, 2018.
2. B.L. Fadia Sahitya Bhawan, "The Constitution of India", New Edition, 2017.
3. Rajeev Bhargava, "Ethics and Politics of the Indian Constitution", Oxford University Press, 2008.

CSPL501 COMPUTER NETWORKS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Programming Language

Course Objective:

- Practice the tools like ping and trace route to explore various Internet paths to popular servers using NS-2/NS-3 simulator to evaluate performance of network under various conditions.

Course Outcomes:

- To understand the network configuration of the computer.
- To write socket programming for client server using TCP/UDP.
- To gain knowledge in how to Install and configure some network applications.
- To gain knowledge in how to use tools like ping and trace route to explore various Internet paths to popular server.
- To gain knowledge in how to use NS-2/NS-3 to simulate a mesh of at least 4 nodes and 3 links to evaluate performance under various conditions.

LIST OF EXPERIMENTS

1. Use Linux tools like ifconfig, dig, ethtool, route, netstat, nslookup, and ip to understand the networking configuration of the computer that the student is working on.
2. Check the connectivity of a computer using the ping command.
3. Print the computers that are forwarding the packets from your computer to the server using the command traceroute.
4. Mount the volume of a remote computer using the “net use” command.
5. Examine the packets in the network using Wireshark application.
6. Send messages from one machine to another machine using Socket.
7. Simulate a chatting application using Socket.
8. Implement File Transfer Protocol in Java language.
9. Examine the log files of a web server and find the frequently visited websites.
10. Analyse the Distance Vector Routing protocol in NS2.
11. Analyse the Link State Routing protocol in NS2.
12. Use a tool like Wireshark to capture packets and examine the packets
13. Implementation of a Program For CRC and Hamming Code for Error Handling.
14. Socket programming: write a simple client server program using TCP and UDP sockets.
15. Implementation of a socket program for Echo/Ping/Talk commands.
16. Use tools like ping and trace route to explore various Internet paths to popular servers.
17. Write a code simulating ARP /RARP protocols.

(Total Periods:45)

CSPL502 DATABASE SYSTEMS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Programming language, Basic understanding of DBMS Concepts

Course Objective:

- Design and implement database schema for an application using DBMS concepts using query languages.

Course Outcomes:

- To design and implement database schema for an application using DBMS concepts.
- To write SQL queries for tasks of various complexities.
- To write an application program that uses a database system as the backend.
- To demonstrate the working of a DBMS including Data storage, indexing, Query processing, concurrency control and recovery mechanism.
- To illustrate an application development using MongoDB.

LIST OF EXPERIMENTS

1. Write SQL queries for various tasks. Platform can be PostgreSQL preferably, or MySQL.
2. Practice interfacing with a database from a program using connectors like JDBC/ODBC.
3. Simple exercises on MongoDB.
4. Exercise in ER design for an application starting with natural language description.
5. Convert ER design to tables.
6. Write a PL/SQL block to accept conditions as inputs from the user.
7. Write a PL/SQL block that handles all types of exceptions.
8. Examine query plans for sample queries by using the Explain feature of database systems.
9. Simple exercises to show benefit of indices.
10. Application Development Using MongoDB :Hospital Management System & Railway Reservation System.

(Total Periods:45)

CSPL503 OPERATING SYSTEMS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic Programming language, Data Structures and Algorithms

Course Objective:

- The program execution and requirements processes, threads, memory management, files and to impart Hands-on practical experience in different OS concepts.

Course Outcomes:

- To understand the role, functionality and layering of the system software components.
- To understand the design and usage of OS API and OS services.
- To understand the details of the abstractions and interfaces provided by the OS for program.
- To understand problems arising due to concurrency and related synchronization based solutions.
- To demonstrate the usage of OS API and basics of OS services.

LIST OF EXPERIMENTS

1. Usage of tools — unix shell commands (file commands, ps, ls, top), text editor (nano, vi, gedit, emacs)
2. C programming language refresher — header files, compilation and linking using GCC, program execution, functions, argument passing, structures, pointers, file handling.
3. Usage of tools — GCC, GDB, Objdump, shell scripts
4. Simple strace usage to showcase different interfaces (stdlib, system call)
5. Tools usage — ps, pstree, top
6. Usage of process control system calls to identity process identifiers, create process hierarchies, launch new executables, control exit sequence of parent and child processes.
7. Familiarity with files in the / proc / pid/ directory
8. (Virtual) addresses of variables and initialized pointers.
9. Use of malloc() and demonstration of per-process virtual addresses
10. Tools usage — strace, free, top, htop, vmstat, /proc/pid/maps
11. Free memory statistics correlated with malloc(). Number of system calls and malloc() usage.
12. Implement a custom memory allocator using system calls
13. User mode programs to demonstrate LDE
14. Demonstration of process execution interleaving in different orders
15. Simulation based analysis of scheduling policies
16. Tools usage — nice/proc/pid/status
17. Creation of threads using the pthread API and modification of shared variables with and without Synchronization
18. Using spinlock, mutexes and condition variables to implement semaphores, barriers (using the threads API)

19. Implement solutions to the producer-consumer, readerwriters problems using the different synchronization primitives
20. Develop synchronization solutions for applications that use shared data (e.g., ordering of threads, concurrent hash tables, etc.)
21. Using shared memory and semaphores implement synchronized access to a shared memory area across processes (e.g., a message queue).
22. Command line tools usage - state, file, du, df, fsck
23. Implementation of file utilities (e.g., find, grep) using the system call API.
24. Implement a simple file system to handle files on an emulated disk (via a large file) — file system API, superblock, inode and data block management.

(Total Periods:45)

CSPC601 WEB TECHNOLOGY

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic Programming Language
- Computer Networks

Course Objectives:

- To introduce the basic concepts of web programming and internet protocol.To demonstrate the client-server model, uses of scripting languages,to create of web sites and develop simple web applications.

Course Outcomes:

- To understand HTML, CSS and JavaScript.
- To create simple PHP scripts.
- To design and deploy simple web-applications.
- To create simple database applications.
- To handle multimedia components

UNIT I (9 Hrs)

WEBSITE BASICS: Internet Overview - Fundamental computer network concepts, Web Protocols, URL, Domain Name- Web Browsers and Web Servers- Working principle of a Website, Creating a Website, Client side and server side scripting.

UNIT II (9 Hrs)

WEB DESIGNING: HTML – Form Elements, Input types and Media elements - CSS3, Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Multiple Column Layout, User Interface.

UNIT III (9 Hrs)

CLIENT-SIDE PROCESSING AND SCRIPTING: JavaScript Introduction – Variables and Data Types-Statements – Operators, Literals, Functions Objects, Arrays- Built-in Objects- Regular Expression, Exceptions, Event handling, Validation -JavaScript Debuggers.

UNIT IV (9 Hrs)

SERVER SIDE PROCESSING AND SCRIPTING: PHP - Working principle of PHP, PHP Variables, Constants, Operators, Flow Control and Looping - Arrays - Strings - Functions - File Handling - File Uploading, Email Basics - Email with attachments - PHP and HTML, Simple PHP scripts, Databases with PHP.

UNIT V (9 Hrs)

SERVLETS AND DATABASE CONNECTIVITY: Servlets- Java Servlet Architecture, Servlet Life cycle, Form GET and POST actions - Sessions – Cookies – Database connectivity – JDBC Creation of simple interactive applications, Simple database applications.

Text Books:

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5", O'Reilly publishers, 3rd Edition, 2014.
2. Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet & World Wide Web - How to Program", Pearson Education, 5th Edition, 2012.
3. Jeffrey C. Jackson, "Web Technologies-A Computer Science Perspective", Pearson Education, 2006.

References:

1. James F. Kurose, "Computer Networking: A Top-Down Approach", Pearson Education, 6th Edition, , 2012.
2. Steven Holzener , "PHP – The Complete Reference", Mc-Graw Hill, 1st Edition, 2017.
3. Fritz Schneider, Thomas Powell , "JavaScript – The Complete Reference", McGraw Hill Publishers, 3rd Edition, 2017.

ONLINE/NPTEL Courses:

1. HTML: https://nptel.ac.in/courses/106104072

CSPC602 COMPILER DESIGN

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Programming Languages
- Formal Languages and Automata theory

Course Objective:

- To learn the process involved in functionality, translation and interpretation modules of a compiler.

Course Outcomes:

- To understand the basic components of a compiler and the role of Lexical Analyzer and parser.
- To understand different parsing techniques.
- To demonstrate the use of SDT in code generation.
- To apply code optimization techniques.
- To design and develop a simple code generator.

UNIT I (9 Hrs)

INTRODUCTION TO COMPILERS: Compiler, Interpreter, phases of Compilation, bootstrapping,cross-compilation, Lexical analysis, Regular Expressions (RE), Deterministic finite automata (DFA), Traversing a DFA for recognizing tokens, Generating a lexical analyzer using LEX/Flex, Parsing- Concept of parsing, CFG, Derivation, Parse tree, Ambiguity.

UNIT II (9 Hrs)

PARSING TECHNIQUES: Overview of top-down, bottom-up parsing, Handles and pruning, Introduction to shift reduce parsing, Constructing SLR parsing tables, SLR, CLR, LALR, Top-down parsing, Left factoring, Elimination of Left-recursion, Backtracking, Predictive parsing, Recursive descent parsing, LL(1) parsing, Generating a parser using a parser generator such as ANTLR, JavaC, YACC/BISON.

UNIT III (9 Hrs)

SYNTAX DIRECTED TRANSLATION: Syntax trees, S,L attributes definition, the need of semantic analysis, syntax directed translation schemes (SDTS), Intermediate Code generation, Intermediate forms,Polish notation & 3AC, types, Translation of assignment, Boolean expression & Flow of control statements.

UNIT IV (9 Hrs)

CODE OPTIMIZATION: Organization of code Optimizer, Basic blocks, flow graphs, Optimization of basic blocks, sources of optimization, DAG, Representation of Basic blocks, Global data flow analysis.

UNIT V (9 Hrs)

CODE GENERATION: Machine dependent code generation, The target machine, Simple code generator, Register allocation and assignment, Peephole Optimization.

Text Books:

1. Alfred V.Aho, Lam, Ravi Sethi, and Jeffrey D. Ullman, "Compilers: Principles, Techniques, and Tools", Addison-Wesley, 2nd Edition, 2006.

References:

1. Andrew Appel and Jens Palsberg, "Modern Compiler Implementation in Java", Cambridge University Press, 2nd Edition, 2002.

ONLINE/NPTEL Courses:

1. Overview of Compiler: https://nptel.ac.in/courses/106108113
2. Compiler Design: https://nptel.ac.in/courses/106105190

CSPC603 DISTRIBUTED COMPUTING SYSTEM

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer Networks
- Operating System

Course Objective:

- To familiarize with concepts of distributed computing, including its models, system architectures, communication protocols and fault tolerance mechanisms.To learn the agreement protocols and introduce the basic cloud computing concepts.

Course Outcomes:

- To explain the foundations of distributed systems.
- To solve synchronization and state consistency problems.
- To understand resource sharing techniques in distributed systems.
- To apply working model of consensus and reliability of distributed systems.
- To explain the fundamentals of cloud computing.

UNIT I: (9 Hrs)

INTRODUCTION: Definition- Relation to Computer System Components, Motivation, Message, Passing Systems versus Shared Memory Systems, Primitives for Distributed Communication, Synchronous versus Asynchronous Executions, Design Issues and Challenges, Model of Distributed Computations - Distributed Program, Model of Distributed Executions, Models of Communication Networks, Global State of Distributed System.

UNIT II: (9 Hrs)

LOGICAL TIME AND GLOBAL STATE: Logical Time - Physical Clock Synchronization - NTP, Framework for a System of Logical Clocks, Scalar Time, Vector Time, Message Ordering and Group Communication - Message Ordering Paradigms, Asynchronous Execution with Synchronous Communication, Synchronous Program Order on Asynchronous System, Group Communication, Causal Order, Total Order, Global State and Snapshot Recording Algorithms - Introduction, System Model and Definitions, Snapshot Algorithms for FIFO Channels.

UNIT III: (9 Hrs)

DISTRIBUTED MUTEX AND DEADLOCK: Distributed Mutual exclusion Algorithms - Introduction, Preliminaries, Lamport's algorithm, Ricart, Agrawala's Algorithm, Token-Based Algorithms, Suzuki-Kasami's Broadcast Algorithm, Deadlock Detection in Distributed Systems- Introduction, System Model, Preliminaries, Models of Deadlocks, Chandy - Misra - Haas Algorithm for the AND model and OR Model.

UNIT IV: (9 Hrs)

CONSENSUS AND RECOVERY: Consensus and Agreement Algorithms- Problem Definition, Overview of Results, Agreement in a Failure, Free System(Synchronous and Asynchronous), Agreement in Synchronous Systems with Failures, Checkpointing and Rollback Recovery- Introduction, Background and Definitions, Issues in Failure Recovery, Checkpoint - based Recovery, Coordinated Checkpointing Algorithm, Algorithm for Asynchronous Checkpointing and Recovery.

UNIT V: (9 Hrs)

CLOUD COMPUTING: Definition of Cloud Computing, characteristics of Cloud, Cloud Deployment Models, Cloud Service Models, Driving Factors and Challenges of Cloud, virtualization, Load Balancing, scalability and elasticity, replication, monitoring, cloud Services and platforms - Compute Services, storage Services, Application Services.

Text Books:

1. Rajiv Misra and Yashwant Singh Patel, "Cloud and Distributed Computing : Algorithms and Systems", Wiley Emerging Technology series, 2020.
2. Arshdeep Bagga and Vijay Madisetti, "Cloud Computing - A Hands on Approach", Universities Press, 2014.
3. Kshemkalyani Ajay D and Mukesh Singhal, "Distributed Computing - Principles, Algorithms and Systems", Cambridge Press, 2011.
4. Coulouris George, Dollimore Jean, et al, "Distributed Systems Concepts and Design", Pearson Education, 5^{th} Edition, 2017.

References:

1. Tanenbaum A S and Van Steen M, "Distributed Systems", 4^{th} Edition, 2023
2. Liu M L, "Distributed Computing - Principles and Applications", Pearson Education, 2004.

ONLINE/ NPTEL Courses:

1. Distributed Computing Systems- Basic Concepts: https://nptel.ac.in/courses/106106107
2. Cloud Computing and Distributed Systems: https://nptel.ac.in/courses/106104182
3. Cloud computing: https://nptel.ac.in/courses/106105167

CSPC604 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Basic Mathematics, Basic programming knowledge.

Course Objective:

- To understand various machine learning concepts, artificial intelligence and neural networks.

Course Outcomes:

- To use appropriate search algorithms for problem solving.
- To apply reasoning under uncertainty.
- To build supervised learning models.
- To build ensembling and unsupervised models.
- To build deep learning neural network models.

UNIT I: (12 Hrs)

INTRODUCTION TO AI: AI Applications- Problem solving, Problem solving agents, Search Algorithms, Uninformed Search Strategies, Heuristic search strategies, Local Search and Optimization Problems, Adversarial Search, Constraint Satisfaction Problems (CSP).

UNIT II: (12 Hrs)

KNOWLEDGE AND REASONING: Logical Agents, First Order Logic, Knowledge representation, planning, Acting under uncertainty, Bayesian inference, Na¨ıve Bayes models- Probabilistic reasoning, Bayesian networks, Exact inference in BN, Approximate inference in BN, Causal networks.

UNIT III: (12 Hrs)

SUPERVISED LEARNING: Introduction to Machine Learning, Linear Regression Models- Least Squares, Sin- gle & Multiple Variables, Bayesian linear regression, Gradient Descent, Linear Classification Models- Discriminant function, Probabilistic Discriminative Model, Logistic Regression, Probabilistic Generative model, Support Vector Machine, Decision Tree, Random Forest Algorithm.

UNIT IV: (12 Hrs)

ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING: Combining Multiple Learners- Model Combination Schemes, Voting - Ensemble Learning, Bagging, Boosting, stacking, Unsupervised learning- K-means, Instance Based Learning: KNN, Gaussian Mixture Models and Expectation Maximization.

UNIT V: (12 Hrs)

NEURAL NETWORKS: Perceptron, Multilayer Perceptron, Activation functions, Network Training, Gradient Descent Optimization, Stochastic Gradient Descent, Error Back Propagation, Shallow Networks to Deep Networks, Unit Saturation , ReLU, Hyperparameter Tuning, Batch Normalization, Regularization, Dropout.

Text Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education, 4th Edition, 2021.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 4th Edition, 2020.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

References:

1. Mariusz Flasin´ski, "Introduction to Artificial Intelligence", Springer, 2021.
2. Russell/Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 4th Edition, 2022.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016
4. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014
5. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013
6. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.

ONLINE/ NPTEL Courses:

1. An Introduction to Artificial Intelligence: https://nptel.ac.in/courses/106102220
2. Introduction to Machine Learning: https://nptel.ac.in/courses/106105152
3. Machine Learning for Engineering and Science Applications: https://nptel.ac.in/courses/106106198

CSPL601 WEB TECHNOLOGY LAB

L	T	P	C
0	0	4	2

Course Objectives:

- To practice HTML design and development of client side program in Javascript. To apply various server side scripting.

Course Outcomes:

- To understand HTML design and development of client side program in Javascript.
- To develop web applications using JavaScript, HTML and CSS.
- To apply Server side scripting using JSP.
- To validate the application using PHP.
- To develop an E-commerce applications using Scripting languages.

LIST OF EXPERIMENTS

1. Creation of college website using HTML.
2. Implementation of various types of CSS.
3. Implementation of Client Side Scripting using JavaScript.
4. Implementation of Server Side Scripting to Session and Application objects using Servlets.
5. Implement Database Connectivity using JSP.
6. Configuration of web servers: Apache and Internet Information Server(IIS).
7. Validate a form using PHP regular expression.
8. Developing E-commerce application.

(Total Periods:45)

CSPL602 COMPILER DESIGN LAB

L	T	P	C
0	0	4	2

Course Objective:

- To practice the test-cases in MMC and then inspect the generated code.
- To learn parser to parser program.

Course Outcomes:

- To understand the test-cases in MMC and then inspect the generated code.
- To understand lexer to recognize valid tokens.
- To understand parser to parser program.
- To understand type-checker for a syntactically correct input MMC program.

LIST OF EXPERIMENTS

1. Write a Lex Program to scan reserved word & Identifiers of C Language
2. Generate Yacc specification for a few syntactic categories.
   (a) Program to recognize a valid arithmetic expression that uses operator +,-, * and /.
   (b) Program to recognize a valid variable which starts with a letter followed by any number of letter or digits.
   (c) Implementation of calculator using lex and yacc.
3. Implement Predictive Parsing algorithm
4. Implement SLR(1) Parsing algorithm
5. Design LALR bottom up parser for the given language
6. Write a program for implementing the functionalities of predictive parser for a mini language
7. Write a program for constructing of LL (1) parsing.
8. Write a program for constructing recursive descent parsing.
9. Convert the bnf rules into yacc form and write code to generate abstract syntax tree.
10. Write a program to generate three address code.
11. Implementation of simple code optimization techniques.

(Total Periods:45)

CSPC701 CYBER SECURITY

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic Programming Language, Computer Networks

Course Objective:

- To learn the importance of cyber security and various attacks on digital systems.To explore various vulnerabilities in web applications, networks and Internet Infrastructure.

Course Outcomes:

- To understand the importance of cyber security.
- To understand the concepts of authentication, authorization and privileges of Cyber security.
- To acquire knowledge about security in application layer and its mitigation techniques.
- To understand perimeter protection and Intrusion detection system.
- To explore various malware and its analysis.

UNIT I (9 Hrs)

INTRODUCTION TO CYBER SECURITY: Introduction and basic Terminology Cyber Security and CIA Triad, Cyber Threats to CIA, Cyber-Attack surfaces, Recent Cyber- Security incidents and high-level analysis - Basic Cryptography - Role of Cryptography in ensuring confidentiality for data at rest, data in motion, and data in process - Symmetric and Asymmetric Cryptography, Needs, Symmetric and Asymmetric algorithm outlines (RSA, DH, DES, AES) - Role of cryptography in Data Integrity, non-repudiation Hashing and Digital Signature - hash function (MD5, SHA-256), Understanding digital signature and its role, Digital Certificate and PKI - Importance of the role of a proper Pseudo Random Number Generator.

UNIT II (5 Hrs)

AUTHENTICATION, AUTHORIZATION AND PRIVILEGE: Importance of strong Authentication – distinction between authorization and authorization - importance of authorization-access control – Mandatory and Discretionary Access control - role based authorization – privilege and privilege escalation.

UNIT III (13 Hrs)

APPLICATION SECURITY: Application Security- Basic application vulnerabilities (Buffer overflow, Integer Overflow, format string vulnerability) – Basic mitigations of buffer overflow – platform bases – compiler based, secure programming practice - Web Client Security, Same Origin Principle – DOM, Java Script Vulnerability – Cookies and Cookie Attributes Secure, http only–Concept of session and session ID– Session hijacking vulnerability–http vs. https and SSL/TLS and version issue - Web Server Security – XSS, CSRF, SQL Injection, Command Injection concepts.

UNIT IV (9 Hrs)

PERIMETER PROTECTION AND INTRUSION DETECTION: Vulnerabilities in DNS, Routing and IP protocols especially in IPv4 and suggested remedies with DNSSEC, S-BGP, and IPSec - Perimeter Protection And Intrusion Detection- Host Intrusion Detection techniques, To look for and how an SIEM tool can consolidate such indicators into a management console- Network Intrusion Detection – signature based vs. behavior based, Snort, Intrusion Detection System.

UNIT V (9 Hrs)

BASIC MALWARE ANALYSIS: Firewall vs. Intrusion detection tool – Firewall rules and customization techniques. Basic Malware Analysis- Various malware classes and their characteristics - Difference between static analysis and dynamic analysis - Signature vs. behavioral detection techniques.

Text Books:

1. Debtoru Chatterjee, "Cyber Crime and its Prevention in Easy Steps", Khanna Publishing House, 2022.
2. Debtoru Chatterjee, "Cyber Attacks and Counter-Measures Made Simple", Khanna Publishing House, 2022.
3. Ross J. Anderson, "Security Engineering", Wiley, 3rd Edition, 2020.
4. William Stallings, "Cryptography and Network Security", Pearson Education, 7th Edition, 2017.

References:

1. D Stuttard and M Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", Wiley publisher, 2011.
2. Peter Kim, "The Hacker Playbook: Practical Guide to Penetration Testing (vol. 1 and 2)", Createspace Independent Pub, 2015.
3. Jeeva Jose, "Introduction to Security of Cyber-Physical Systems", Khanna Publishing, 1st Edition, 2022.
4. Er.Harsh Bothra, "Mastering Hacking The Art of Information Gathering & Scanning", Khanna Book Publishing House, 1st Edition, 2019.

CSBS702 BIOLOGY

L	T	P	C
2	1	0	3

Course Objective:

- To discuss the concepts of molecular taxonmony, genetics laws, metabolism, BioMolecules, Microbiology with its importance and classifications are discussed.

Course Outcomes:

- To understand the underlying criteria, such as morphological, biochemical and ecological.
- To understand the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring.
- To explore all forms of life have the same building blocks and yet the manifestations are asdiverse as one can imagine.
- To understand the enzyme action and factors affecting their activity.
- To identify and classify microorganisms.

UNIT I (9 Hrs)

CLASSIFICATION: Classification outline based on (a) cellularity- Unicellular or multicellular (b) ultra structure prokaryotes or eukaryotes (c) Energy and Carbon utilisation - Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitats- acquatic or terrestrial.

UNIT II (9 Hrs)

GENETICS: Mendel's laws, Concept of segregation & independent assortment. Concept of allele. Recessiveness, and dominance. Single gene disorders in humans – Sickle cell disease, Phenylketonuria

UNIT III (9 Hrs)

BIOMOLECULES : Carbohydrates: Types, Structural & functional importance. Lipids: Classification - Simple, compound, & derived, Importance of lipid soluble vitamins. Amino acids – general structure, essential amino acids. Proteins - Levels of protein structure, structural & functional importance of proteins, Enzymes- Definition, Enzyme Activity & Units, Specific Activity, Specificity, Factors affecting enzyme activity. Nucleic acids: Types and importance.

UNIT IV (9 Hrs)

METABOLISM: Introduction: Food chain & energy flow. Definitions - Anabolism & Catabolism. Photosynthesis: Reaction and importance. Glycolysis & TCA cycle. ATP – the energy currency of cells.

UNIT V (9 Hrs)

MICROBIOLOGY: Concept of single celled organisms. Concept of species & strains. Identification & classification of microorganisms. Virus – Definition, types, examples.

References:

1. Campbell, N.A., Reece, J.B, Urry, Lisa, Cain, M,L, Wasserman, S.A, Minorsky, P.V, Jackson, R.B, "Biology: A global approach", Pearson Education, 12^{th} Edition, 2020.
2. E.E. Stumpf, P.K; Bruening, G; Doi, R.H, "Outlines of Biochemistry", Conn, John Wiley and Sons, 5^{th} Edition, 2016.
3. David L. Nelson, "Principles of Biochemistry", 7^{th} Edition, 2021.
4. Stent, G. S.,Satish Kumar Jain and Calender, "Molecular Genetics", Freeman and company, CBS Publisher, 2010
5. Amita Jain, Jyotsna Agarwal, et al., "Microbiology", 2018.

CSPL701 CYBER SECURITY LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Programming Language , Computer Networks

Course Objective:

- To practice the library functions to use RSA, AES, SHA- 256 and show the result of encryption, Hashing etc.

Course Outcomes:

- To understand the library functions to use RSA, AES, SHA- 256 and show the result of encryption, Hashing etc.
- To practice to use digital certificate and show the various components and their significance.
- To practice to install Wazuh, snort and monitor a host.
- To practice Basic malware functions and indicators of compromise.
- To understand and apply the security techniques in simulation environment and security tools.

LIST OF EXPERIMENTS

1. Using library functions to use RSA, AES, SHA- 256 and show the result of encryption, Hashing etc.
2. Taking apart a digital certificate and show the various components and their significance.
3. Exercise on 2 factor authentication
4. Exercise on privilege escalation example
5. Buffer overflow, integer overflow and format string vulnerability testing in vulnerable applications.
6. DVWA based command injection. SQL injection, XSS and CSRF.
7. To install Wazuh and monitor a host.
8. To install snort and monitor a network.
9. Use static analysis tools to find how an executable can be analyzed.

(Total: 45 Periods)

CSPROJ703 CAPSTONE PROJECT I

L	T	P	C
0	0	12	6

Course Pre-requisite:

- Mini project

Course Objective:

- To gain domain knowledge, technical skills to solve potential business/research problems and to prepare the project reports and presentation.

Course Outcomes:

- To understand Domain knowledge and technical skill set required for solving industry / research problems.
- To provide solution architecture, module level designs, algorithms.
- To implement, test and deploy the solution for the target platform.
- To prepare detailed technical report, demonstrate and present the work.
- To publish work in reputed indexing journal or patent.

Project Guidelines:

The students shall individually / or as group work(3 to 4 members) on business/research domains and related problems approved by the Department / Organization that offered the project.

The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology.

At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department.

The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

CSPROJ801 CAPSTONE Project II

L	T	P	C
0	0	12	6

Course Pre-requisite:

- Mini project
- CapStone Project I

Course Objective:

- To gain domain knowledge, technical skills to solve potential business/research problems.To publish work in indexed journal/patent and prepare reports and presentation.

Course Outcomes:

- To gain domain knowledge and technical skill set required for solving industry / research problems.
- To provide solution architecture, module level designs, algorithms.
- To implement, test and deploy the solution for the target platform.
- To prepare detailed technical report, demonstrate and present the work.
- To publish work in reputed indexing journal or patent.

Project Guidelines:

The students shall individually / or as group work(3 to 4 members) on business/research domains and related problems approved by the Department / organization that offered the project.

The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology.

At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

CSH01 PROGRAMMING WITH C++

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Basic programming language

Course Objective:

- To learn C++ programming concepts using constructors, inheritance, polymorphism, virtual functions, files, pointers and exception handling.

Course Outcomes:

- To understand the basic concepts of object-oriented programming.
- To explore the structure of classes, objects, memory and operators.
- To explore various types of inheritance and virtual functions.
- To understand the file stream classes, manipulators and pointers.
- To explore knowledge in templates and exception handling.

UNIT I (12 Hrs)

INTRODUCTION: : Introduction to object-oriented programming- Structure, Characteristics. C++ Declarations, Types, Datatypes, Operators, Typecasting- Functions – Operator Overloading, Function overloading, Inline functions.

UNIT II (12 Hrs)

CLASSES AND OBJECTS: : Structures and Classes, Classes and Constructors, Destructors, complex class, this pointer, Overloading Unary Operators- Objects and Memory Structure- Class Intricacies- Static and Dynamic Memory Allocation, Static members, Overloaded/Copy Constructors.

UNIT III (12 Hrs)

INHERITANCE & POLYMORPHISM: Inheritance – uses, Constructors in Inheritance- Types of inheritance – Polymorphism – Virtual functions, Abstract class, Function Binding, Virtual Base Class.

UNIT IV (12 Hrs)

FILES AND POINTERS: I/O stream classes, Manipulators – Files with I/O streams, File opening models, Error handling during I/O, Interaction with File System – Typecasting – Pointers to Members.

UNIT V (12 Hrs)

TEMPLATES AND EXCEPTION HANDLING: Templates- Function, Class Templates, Standard Template library, Applications – Exception handling – User Defined Exception.

Text Books:

1. Yashwant Kanetker, "Let Us C ++", BPB publishers, 2021.
2. Balagurusamy, E, "Object-Oriented Programming with C++", 8th Edition, 2020.

References:

1. Ashok N.Kamthane, "Object Oriented Programming with ANSI and Turbo C++", Pearson Edition, 2011.
2. Deitel & Deitel, C++ How to program, Prentice Hall, 8th Edition, 2011.

ONLINE/NPTEL Courses:

1. Data Structure: https://nptel.ac.in/courses/106105080
2. Object oriented: https://onlinecourses.swayam2.ac.in/aic20_sp01

CSH02 SYSTEM SOFTWARE

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Basic understanding of Computers.
- Computer Organization and Architecture.

Course Objectives:

- To understand the design principles of assemblers, linkers, loaders and system software tools.

Course Outcomes:

- To understand the system software concepts and its architectures.
- To understand the functions of assemblers and its features.
- To understand the design and implementation of linkers and loaders.
- To understand the concepts of macroprocessors.
- To understand the system software tools.

UNIT I (12 Hrs)

INTRODUCTION: System software and Machine Architecture – The Simplified Instructional Computer (SIC) - Machine architecture - Data and Instruction formats - Addressing modes - Instruction sets - I/O and Programming.

UNIT II (12 Hrs)

ASSEMBLERS: Basic assembler functions - A simple SIC assembler – Assembler algorithm and data structures - Machine dependent assembler features - Instruction formats and addressing modes – Program relocation - Machine independent assembler features - Literals – Symbol-defining statements – Expressions - One pass assemblers and Multi pass assemblers - Implementation example - MASM assembler.

UNIT III (12 Hrs)

LOADERS AND LINKERS: Basic loader functions - Design of an Absolute Loader – A Simple Bootstrap Loader - Machine dependent loader features - Relocation – Program Linking – Algorithm and Data Structures for Linking Loader - Machine-independent loader features - Automatic Library Search – Loader Options - Loader design options - Linkage Editors – Dynamic Linking – Bootstrap Loaders - Implementation example - MSDOS linker.

UNIT IV (12 Hrs)

MACRO PROCESSORS: Basic macro processor functions - Macro Definition and Expansion – Macro Processor Algorithm and data structures - Machine-independent macro processor features - Concatenation of Macro Parameters – Generation of Unique Labels – Conditional Macro Expansion – Keyword Macro Parameters-Macro within Macro-Implementation example - MASM Macro Processor – ANSI C Macro language.

UNIT V (12 Hrs)

SYSTEM SOFTWARE TOOLS: Text editors - Overview of the Editing Process - User Interface – Editor Structure. - Interactive debugging systems - Debugging functions and capabilities – Relationship with other parts of the system – User-Interface Criteria.

Text Books:

1. Leland L. Beck, "System Software – An Introduction to Systems Programming",Pearson Education Asia, 3rd Edition, 2000.

REFERENCES:

1. D. M. Dhamdhere, "Systems Programming and Operating Systems", Tata McGraw-Hill, 2nd Edition, 1999.
2. John J. Donovan "Systems Programming", Tata McGraw-Hill Edition, 1972.

ONLINE/NPTEL Courses:

1. System Software: https://nptel.ac.in/courses/106105080 https://nptel.ac.in/courses/106105214

CSH03 UNIX AND SHELL PROGRAMMING

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Basic programming language

Course Objectives:

- To learn unix and shell programming for handling files, filters and process.

Course Outcomes:

- To understand the basics of Unix commands and File directories.
- To demonstrate simple effective user interfaces using Shell commands.
- To explore knowledge in filters.
- To demonstrate the Shell script commands and debugging.
- To analyses the types processes and external commands.

UNIT I (12 Hrs)

INTRODUCTION TO UNIX: History - Unix Components - Using Unix - Commands in Unix - Some Basic Commands - Command Substitution - Giving Multiple Commands, File system – Basics of Files - File - Directories and File Names-Permissions - I Nodes- Directory Hierarchy, File Attributes and Permissions - File Command knowing the File Type - Chmod Command Changing File Permission.

UNIT II (12 Hrs)

USING THE SHELL: Command Line Structure - Met Characters - Creating New Commands - Command Arguments and Parameters - Program Output as Arguments - Shell Variables - More on I/O Redirection - Looping in Shell Programs.

UNIT III (12 Hrs)

FILTERS: Grep Family-Other Filters-Stream Editor Sed- AWK Pattern Scanning and processing Language-Good Files and Good Filters.

UNIT IV (12 Hrs)

SHELL PROGRAMMING: Shell Variables- Export Command- First Shell Script- Read Command-Positional parameters-Variable knowing the exit Status-More about the Set Command-The Exit Command-Branching Control Structures-Loop Control Structures- Continue and Break Statement- Expr Command: Performing Integer Arithmetic-Real Arithmetic in Shell Programs- Document-Sleep Command-Debugging Scripts- Script Command- Eval Command- Exec Command.

UNIT V (12 Hrs)

THE PROCESS: Meaning-Parent and Child Processes-Types of Processes-More about Foreground and Background Processes-Internal and External Commands-Process Creation-The Trap Command-The Stty Command-The Kill Command-Job Control.

Text Books:

1. M.G.Venkateshmurthy, “Introduction to Unix Shell Programming”, Pearson Education, 2009.
2. Brian W. Kernighan & Rob Pike, “The Unix Programming Environment”, Pearson Education, 1st Edition, 2015.

References:

1. Sumitabha Das, “Unix Concepts and Application”, McGraw Hill, 4th Edition, 2017.
2. B.M.Harwani, “Unix and Shell programming”, Oxford University press, 2013.

ONLINE/NPTEL Courses:

1. Unix & Shell: https://nptel.ac.in/courses/117106113

CSH04 COMPUTER GRAPHICS

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Basic Computer Knowledge

Course Objectives:

- To learn basic graphic functions to represent 2D,3D geometric transformations using OpenGL library functions.

Course Outcomes:

- To understand the basic graphic functions and graphic output primitives.
- To understand 2D geometric transformations and viewing functions
- To understand 3D geometric transformations and viewing functions
- To explore OpenGL library functions.
- To understand colour representations, lighting models.

UNIT I (12 Hrs)

GRAPHIC OUTPUT PRIMITIVES: Absolute and Relative coordinate Specifications Point Function, Line Function, Line Drawing Algorithms, DDA, Bresenham's Line drawing algorithms- curve functions, Circle-Generating Algorithms- Midpoint Circle Algorithms, Ellipse Generating Algorithms, Midpoint Ellipse Algorithm- Polygon fill Area functions, Vertex Array, Pixel Array, bitmap, pixmap, Character Function.

UNIT II (12 Hrs)

TWO DIMENSIONAL GEOMETRIC TRANSFORMATIONS: Matrix Representations and Homogeneous Coordinates, Composite Transformations; 2D Viewing – Viewing Pipeline, Viewing coordinate, Reference frame; Window- to-View port coordinate Transformation, Two Dimensional Viewing Functions; Clipping Operations – Point, line, and Polygon Clipping Algorithms.

UNIT III (12 Hrs)

THREE-DIMENSIONAL GRAPHICS: 3D object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; 3D viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

UNIT IV (12 Hrs)

OPENGL LIBRARIES: Graphics Programming Interfaces- Graphics pipeline- Shades – programming Shaders- data flow in the programmable pipeline, OpenGL and GLSL version, OpenGL Extensions, Functions of GLSL, Efficiency of different drawing methods.

UNIT V (12 Hrs)

COLOUR REPRESENTATION & LIGHTING MODELS: Greyscale representation and intensities, colour models and spaces, colour interpolation-Lightning Models- light sources of local illumination, reflection by Phong, shading, shadows,opacity and transparency- Texture process.

Text Books:

1. Donald Hearn, M.Pauline Baker, and Warren Carithers, "Computer Graphics with OpenGL", Pearson Education, 4th Edition, 2013.
2. Karsten Lehn , Merijam Gotzes , Frank Klawonn, "Introduction to Computer Graphics: Using OpenGL and Java", Springer, 3rd Edition, 2023.

References:

1. James D. Foley, "Computer Graphics: Principles and Practice", Pearson Education, 2nd Edition, 2021.
2. John F Hughes, Andries Van Dam, Morgan McGuire, David F Sklar, James D Foley, Steven K Feiner and Kurt Akeley, "Computer Graphics", 2018.

ONLINE/NPTEL Courses:

1. Computer Graphics: https://onlinecourses.nptel.ac.in/noc21_cs97

CSH05 DIGITAL IMAGE PROCESSING

L	T	P	C
3	1	0	4

Course Objectives:

- To understand the concepts of Image Processing and to design applications.

Course Outcomes:

- To understand the fundamentals of image processing.
- To understand the image processing operations and transformations.
- To understand the image enhancement and restoration techniques.
- To understand various image compression techniques.
- To understand the aspects of image segmentation.

UNIT I (12 Hrs)

DIGITAL IMAGE FUNDAMENTALS: Nature of Image Processing and Its Applications – Image Representations – Image Types – Image Processing Operations – Image Acquisition – Image Sampling and Quantization – Image Quality –Image Storage and File Formats

UNIT II (12 Hrs)

IMAGE PROCESSING OPERATIONS: Need for Image Transforms – Fourier Transforms and Its Properties – Haar, slant, Hadamard Transforms and Its Applications.

UNIT III (12 Hrs)

IMAGE ENHANCEMENT AND RESTORATION: Need for Enhancements – Point operations – Histogram Techniques – Spatial filtering concepts – Frequency Domain Filtering – Image Smoothening – Image Sharpening - Image degradation and Noise Models – Introduction to Restoration Techniques.

UNIT IV (12 Hrs)

IMAGE PROCESSING ACTIVITIES: Image Compression: Compression Models and Measures – Coding Types – Types of Redundancy –Lossless Compression Algorithms – Lossy Compression Algorithms – Introduction to Compression Standards.

UNIT V (12 Hrs)

IMAGE SEGMENTATION: Detection of Discontinuities – Edge Detection – Thresholding –Region Based Segmentation – Introduction to Color Image Processing – Introduction to Morphological Operations and Image Processing Framework.

Text Books:

1. S. Sridhar, "Digital Image Processing", Oxford Press, 1st Edition, 2011

References:

1. Anil Jain K, “Fundamentals of Digital Image Processing”, Prentice-Hall of India, 1989.
2. Sid Ahmed, “Image Processing”, McGraw-Hill, 1995.

ONLINE / NPTEL Courses:

1. Digital Image Processing of Remote Sensing Data:https://nptel.ac.in/courses/105107160
2. Computer Vision and Image Processing - Fundamentals and Applications: https://nptel.ac.in/courses/108103174

CSM01 DATA STRUCTURES

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Basic knowledge of programming

Course Objective:

- To familiarize with basic data structures and their use in fundamental algorithms.

Course Outcomes:

- To understand the different concepts of data structure.
- To apply data structure in searching and sorting techniques.
- To understand the advanced data structures.
- To understand the performance of the algorithms.
- To understand the suitability of techniques for the given problems.

UNIT I (12 Hrs)

INTRODUCTION: Algorithmic Notation - Big Oh - Analyzing Algorithms. Arrays: One Dimensional, Multidimensional Array, Pointer Arrays. Linked List: Singly, Doubly and Circular Linked Lists.

UNIT II (12 Hrs)

SEARCHING AND SORTING: Linear Search, Binary Search, and Fibonacci Search. Sorting: Insertion Sort, Selection Sort, Bubble Sort and Heap Sort. Radix Sort, Bucket Sort, Shell Sort.

UNIT III (12 Hrs)

STACKS, QUEUES AND LINKED DATA STRUCTURES: Stacks: Definition – Operations - Applications of Stack. Queues: Definition - Operations – Priority Queues - De Queues – Applications of Queue. Linked Stacks, Linked Queues, Applications of Linked List – Dynamic Storage Management.

UNIT IV (12 Hrs)

TREES AND GRAPHS: Binary Tree, Terminology, Representation, Traversals, Applications – Binary Search Tree –Graph: Terminology, Representation, Traversals – Applications - Spanning Trees, Shortest Path And Transitive Closure, Topological Sort.

UNIT V (12 Hrs)

DIVIDE AND CONQUER, GREEDY METHOD: Divide and Conquer: General Method – Binary Search – Maximum and Minimum – Merge Sort – Quick Sort. Greedy Method: General Method – Knapsack Problem – Minimum Spanning Tree Algorithms – Single Source Shortest Path Algorithm.

Text Books:

1. D.Samanta, “Classic Data Structures”, MaakZoo Publisher, 2nd Edition, 2023.
2. Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures”, Galgotia Book Source, Pvt. Ltd., 2004.

References:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, Galgotia Publications Pvt. Ltd., 2008.

ONLINE/NPTEL Courses:

1. Introduction to data Structures and Algorithms: https://archive.nptel.ac.in/courses/106/102/106102064
2. Introduction to Programming, Data Structures and Algorithms Using Python: https: //onlinecourses. nptel.ac.in/noc2 3 cs15
3. Programming, Data Structures and Algorithms using Python for beginners: https: //nptel.ac.in /courses/106106145

CSM02 PRINCIPLES OF OPERATING SYSTEM

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Basic computer knowledge

Course Objective:

- To learn the different functionalities of the operating systems.

Course Outcomes:

- To demonstrate and understand of computers and operating systems functions.
- To understand process management functions.
- To solve synchronization and deadlock problems.
- To compare various memory management schemes.
- To explain file systems concepts and i/o management.

UNIT I (12 Hrs)

INTRODUCTION TO COMPUTER AND OPERATING SYSTEM: Computer System Organization, Architecture – Operating System Structure, Operations – Process, Memory, Storage Management, Protection and Security – Computing Environments – Operating System Services – User Operating System Interface – System Calls – Types, System Programs, OS Structure, OS Generation, System Boot.

UNIT II (12 Hrs)

PROCESS, THREADS AND SCHEDULING: Process Concept – Scheduling, Operations on Processes – Cooperating Processes, Inter-Process Communication – Threads - Multithreading Models, Thread Libraries, Threading Issues, Scheduling Criteria, Scheduling Algorithms, Algorithm Evaluation.

UNIT III (12 Hrs)

PROCESS SYNCHRONIZATION AND DEADLOCKS: The Critical-Section Problem – Peterson's Solution – Synchronization Hardware – Mutex Locks - Semaphores – Classic Problems of Synchronization– Critical Regions – Monitors –Deadlocks – System Model – Deadlock Characterization – Methods for Handling Deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery from Deadlock.

UNIT IV (12 Hrs)

MEMORY MANAGEMENT: Introduction - Swapping – Contiguous Memory Allocation – Paging – Segmentation- Structure of the Page Table - Virtual Memory- Background – Demand Paging – Copy on Write – Page Replacement – Allocation of Frames – Thrashing.

UNIT V (12 Hrs)

INPUT/ OUTPUT AND FILES: Overview of Mass Storage Structure - Disk Structure - Disk Scheduling and Management-File System Interface – File Concept, Access Methods, Directory and Disk Structure- Directory Implementation - Allocation Methods- I/O Systems – I/O Hardware, Application I/O Interface, Kernel I/O Subsystem.

Text Books:

1. William Stallings, "Operating Systems: Internals and Design Principles", Prentice-Hall, 9th Edition, 2018.
2. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, "Operating Systems Concepts", Wiley, 9th Edition, 2012.

References:

1. Andrew Tanenbaum, "Modern Operating Systems", Prentice Hall, 3rd Edition, 2009.

ONLINE/NPTEL Courses:

1. Introduction to Operating Systems: https://nptel.ac.in/courses/106106144
2. Operating System Fundamentals: https://nptel.ac.in/courses/106105214
3. Operating Systems: https://nptel.ac.in/courses/106108101

CSM03 PRINCIPLES OF DATABASE SYSTEMS

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Basic Knowledge in programming

Course Objective:

- To learn the physical and logical database designs, database modeling, relational, hierarchical, and network models.

Course Outcomes:

- To understand the concepts and features of database systems and master in design principles
- To transform an information model into a relational database schema and effectively organize the data using normalization
- To formulate solutions to a broad range of query and data update problems using SQL
- To understand the basics of query processing, optimization and fast retrieval techniques with the familiarity of transaction processing
- To understand the issues in concurrency control and familiarizing in different database architectures

UNIT I (12 Hrs)

INTRODUCTION TO DATABASE CONCEPTS: Database System: Definition, Purpose, Application, Data Abstraction, Database Architecture, Database Users, Database Administrators, Instances & Schema, Data Models. Entity Relationship Model: Overview, Definitions, ER Diagram, Mapping Cardinalities, Reduction to Relational Schema, Extended ER Features.

UNIT II (12 Hrs)

RELATIONAL MODEL AND DESIGN: Relational Model- Structure of Relational Database, Keys (Primary, Foreign, Candidate, Super).Relational Algebra- Definition and Operations. Relational Database Design- Overview, Normalization, Normal Forms (First, Second, Third, Boyce Codd), Decomposition using Functional Dependencies and Multi-Valued Dependencies.

UNIT III (12 Hrs)

SQL: SQL- Definition, Basic Structure, Datatypes, Basic Operations (DDL, DML, DCL), Set Operations, Aggregate Functions, Nested Sub-queries, Join Expression, Views, Transactions, Integrity Constraints, Authorization. PL-SQL- Definition, Basic Structure, Procedures, Functions, Cursors, Triggers, Packages.

UNIT IV (12 Hrs)

QUERY PROCESSING AND TRANSACTION: Query Processing- Basic Steps, Measures of Query Cost, Query Optimization. Indexing-Definition, Purpose, Types of Indexing, B Tree and B+ Tree. Hashing- Basic Concepts, Hash Function, Static and Dynamic Hashing. Transaction - Overview, Transaction States, ACID properties, Implementation of ACID properties, Serializability.

UNIT V (12 Hrs)

CONCURRENCY CONTROL AND SYSTEM ARCHITECTURE: Overview, Lock Types, Lock based Protocols, Deadlock Conditions and Handling, Recovery Systems- Introduction to Parallel Databases, Distributed Databases, Data Mining and Data Warehouse.

Text Books:

1. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Addison-Wesley, 2022.
2. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "Database System Concepts", 7th Edition, McGraw Hill International Inc., 2019.

References:

1. Fred R McFadden, Jeffery A. Hoffer and Mary B. Prescott, "Modern Database Management", Addison Wesley, 2018.

ONLINE/NPTEL Courses:

1. Introduction to Database Systems: https://nptel.ac.in/courses/106106220
2. Database Systems: https://nptel.ac.in/courses/106106095
3. Basic Database Queries: https://nptel.ac.in/courses/106104021

CSM04 INTERNET PROGRAMMING

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Basic programming knowledge

Course Objectives:

- To understand the principles of Design, develop and demonstrate interactive client and server side executable applications.

Course Outcomes:

- To describe the basic concepts of internet and HTML tags
- To create a client-side programs using JavaScript
- To develop Server-side programs using Servlets and JSP
- To construct web pages in PHP and to represent data in XML format
- To design an interactive web application using AJAX and Web services

UNIT I (12 Hrs)

INTERNET PROTOCOLS, HTML 5.0: The Internet – Basic Internet protocols – HTTP, SMTP, POP3, MIME and IMAP. Domain Name Server - World Wide Web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers –Web Browser. HTML- Anatomy of HTML document, Text Basics, rules, Images and Multimedia, Document layout and webs, formatted lists, Cascading Style Sheets, forms, tables, frames, and Executable content.

UNIT II (12 Hrs)

CLIENT-SIDE PROGRAMMING: Client-Side Programming- Java Script: An introduction to JavaScript–JavaScript DOM Model-Date syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers and Regular Expression.

UNIT III (12 Hrs)

SERVER-SIDE PROGRAMMING: Servlets- Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling Understanding Cookies- Database Connectivity: JDBC perspectives, JDBC program example. JSP-Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

UNIT IV (12 Hrs)

PHP AND XML: PHP- An introduction to PHP- Variables- Program control- Built-in functions-Connecting to Database – JSON (basics) - XML- Basic XML- Document Type Definition- XML Schema, DOM.

UNIT V (12 Hrs)

INTRODUCTION TO AJAX AND WEB SERVICES: AJAX: Ajax Client Server Architecture; Web Services-Introduction to Web Services, UDDI, SOAP, WSDL, Web Service Architecture, Developing and deploying web services.

Text Books:

1. Anuradha A. Puntambekar, "Internet Programming: A Complete Beginner's Guide", Technical Publication, 2020.
2. Uttam K.Roy, "Web Technologies", Oxford University Press, 1st Edition, 2012.
3. Deitel and Goldberg, "Internet and World Wide Web – How to Program", Pearson Education Asia, 5th Edition, 2011.

References:

1. Eric Newcomer, "Understanding Web Services: XML, WSDL, SOAP, and UDDI", Addison Wesley, Platinum Edition, 2002.

ONLINE/NPTEL Courses:

1. HTML: https://nptel.ac.in/courses/106104072

CSM05 NETWORK TECHNOLOGY

L	T	P	C
3	1	0	4

Course Objective:

- To learn the concepts of layered architecture of computer networks, ISO/OSI model, TCP/IP protocol suite, other network protocols and Network Security standards.

Course Outcomes:

- To identify the need for networking and understand the layered concept computer networks.
- To understand the basics concepts of data communication and physical medium.
- To understand about wired and wireless data link layer.
- To understand the devices needed for networking and discover the addressing techniques.
- To learn various standard protocols at different layers of the network.

UNIT I (12 Hrs)

NETWORKING FUNDAMENTALS: Need for networking – Types of Network – Internetworking – Network models – Layered architecture – OSI Protocol Stack – TCP/IP Protocol Suite – Addressing – Physical vs Logical – Port Addressing.

UNIT II (12 Hrs)

DATA COMMUNICATION AND PHYSICAL MEDIUM: Analog Vs Digital data – Transmission impairment – Data rate limits and performance – Transmission media – Guided Vs Unguided media – Characteristics – Virtual Circuit networks – Structure of a Switch.

UNIT III (12 Hrs)

DATA LINK LAYER: WIRED AND WIRELESS: Error detection and correction – Block coding - CRC - Flow and error control –Stop and Wait protocol – Go Back N ARQ protocol – Multiple Access – ALOHA – CSMA – CSMA/CD – CSMA/CA – FDMA – TDMA – CDMA –Ethernet Standard, Fast and Gigabit– IEEE standards - WLAN – IEEE 802.11 –Bluetooth.

UNIT IV (12 Hrs)

NETWORK AND TRANSPORT LAYER PROTOCOLS: Connecting Devices- Hubs – Repeaters – Bridges – Routers – 2/3 Layer Switches – Gateway –Network Layers- Logical Addressing – IPv4 Vs IPv6 – Internet Protocol –ARP – ICMP – IGMP – Unicast Vs Multicast – Transport Layer: UDP - TCP.

UNIT V (12 Hrs)

APPLICATION LAYER AND NETWORK SECURITY: Domain Name System – DNS records – Telnet – Email – FTP – WWW - Client Server – HTTP – SNMP – Network Security Services - IPSec – SSL – HTTPS – Firewalls – PGP.

Text Books:

1. Behrouz A. Forouzan, "Data Communications and Networking with TCP/IP protocol", McGraw Hill, 6th Edition, 2021.
2. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition, 2020.
3. James F. Kurose, Keith W. Ross, "Computer Networks–Top-down Approach", Pearson Education, 3rd Edition, 2013.

References:

1. Andres S. Tanenbaum, David J. Wetherall, Computer Networks, Prentice Hall, 6th Edition, 2020.

ONLINE/NPTEL Courses:

1. Computer Networks: https://nptel.ac.in/courses/106105080
2. Emergence of Networks & Reference Models: https://nptel.ac.in/courses/106105081
3. Introduction on Computer Networks: https://nptel.ac.in/courses/106106091

CSPE101 SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Computer Programming

Course Objective:

- To learn the SDLC model and the process involved in project estimation, scheduling, design and testing to develop quality software.

Course Outcomes:

- To compare various software life cycle models.
- To understand requirement analysis and modelling.
- To develop good software design for effective software development.
- To practice good coding and design test cases to test software systems.
- To understand software maintenance and emerging trends.

UNIT I (9 Hrs)

INTRODUCTION TO SOFTWARE ENGINEERING: Software Engineering - Software engineering practice - Software process-A Generic process model, Prescriptive Process Models - The Waterfall Model, Incremental Process models, Evolutionary Process models, Concurrent models, Evolutionary model, Evolutionary models, Specialized Process Models -Component - Based Development, Formal methods model, Unified process, Agile Development - Agile process, Extreme Programming, Agile process models.

UNIT II (9 Hrs)

REQUIREMENTS ANALYSIS & REQUIREMENTS MODELLING: Requirements Engineering, Eliciting requirements – Collaborative requirements gathering ,Quality function deployment, Building the Requirements model, Requirement Analysis, Scenario - Based Modelling, UML models, Data Modelling Concepts, Class-Based Modelling, Requirement modelling strategies - Flow-Oriented modelling, Creating a Behavioral model, Patterns for requirements modelling, Requirements modeling for Web Apps.

UNIT III (9 Hrs)

SOFTWARE DESIGN AND QUALITY: Design Process, Design Concepts, Design Model, Architectural Design, Component Based Design - Designing class- Based components, Cohesion, Coupling, Conducting component level design ,Component level design for Web Apps ,User Interface design, P attern based design, Web app design ,Software Quality - Cost of quality, Quality and security, Achieving software Quality, Elements of software Quality Assurance, Software reliability.

UNIT IV (9 Hrs)

SOFTWARE TESTING AND MANAGEMENT: Approach to Software Testing - Verification and validation ,Testing ,Unit testing ,Integration Testing ,Testing Strategies for Object Oriented Software, Validation testing, System testing, White box testing, Control structure testing, Black-Box Testing, Model-Based Testing .Software Configuration Management - SCM repository, SCM process, Managing software Projects, Process and Project Metrics, Estimation for software projects - Risk Management.

UNIT V (9 Hrs)

SOFTWARE MAINTENANCE AND TRENDS: Project Scheduling, Risk management, Software maintenance, Software Supportability, Characteristics of Software Maintenance, Reverse Engineering, Restructuring, Forward Engi - neering, Software Process Improvement - Approaches to SPI, Trends in Software Engineering-Identifying Soft trends, Technology Directions,Tools - Related trends

List of Experiments:

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Test the software system for all the scenarios identified as per the use case diagram.
5. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
6. Implement the modified system and test it for various scenarios.

Text Books:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw-Hill, 8th Edition, 2019.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning Pvt. Ltd., 5th Edition, 2018.

References:

1. Ian Sommerville, "Software Engineering", Pearson Publishers, 10th Edition, 2016.

ONLINE/ NPTEL Courses:

1. Software Engineering : https://onlinecourses.nptel.ac.in/noc22 cs106
2. Software Engineering : https://nptel.ac.in/courses/106105182

CSPE102 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Software Engineering

Course Objective:

- To learn the software project planning, evaluation, estimation techniques,to learn about the activity planning and risk management principles.

Course Outcomes:

- To understand Project Management principles while developing software.
- To explore extensive knowledge about the basic project management concepts, framework and the process models.
- To obtain adequate knowledge about software process models and software estimation techniques.
- To describe and estimate the risk involved in various project activities.
- To determine the checkpoints,project reporting structure, project progress and tracking mechanisms using project management principles.

UNIT I (9 Hrs)

PROJECT EVALUATION AND PROJECT PLANNING: Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects, Setting objectives, Management Principles, Management Control, Project portfolio Management, Cost-benefit evaluation technology, Risk evaluation, Strategic program Management, Stepwise Project Planning.

UNIT II (9 Hrs)

PROJECT LIFE CYCLE AND EFFORT ESTIMATION: Software process and Process Models, Choice of Process models, Rapid Application development, Agile methods, Dynamic System Development Method, Extreme Programming– Managing interactive processes, Basics of Software estimation, Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - A Parametric Productivity Model.

UNIT III (9 Hrs)

ACTIVITY PLANNING AND RISK MANAGEMENT: Objectives of Activity planning, Project schedules – Activities – Sequencing and scheduling, Network Planning models, Formulating Network Model, Forward Pass & Backward Pass techniques, Critical path (CRM) method, Risk identification, Assessment, Risk Planning, Risk Management, PERT technique, Monte Carlo simulation, Resource Allocation, Creation of critical paths, Cost schedules.

UNIT IV (9 Hrs)

PROJECT MANAGEMENT AND CONTROL: Framework for Management and control, Collection of data, Visualizing progress, Cost monitoring, Earned Value Analysis, Prioritizing Monitoring, Project tracking, Change control, Software Configuration Management, Managing contracts, Contract Management.

UNIT V (9 Hrs)

STAFFING IN SOFTWARE PROJECTS: Managing people, Organizational behavior, Best methods of staff selection, Motivation, Oldham, Hackman job characteristic model, Stress – Health and Safety – Ethical and Professional concerns – Working in teams, Decision making, Organizational structures, Dispersed and Virtual teams, Communications genres, Communication plans, Leadership.

List of Experiments:

1. Develop a PERT chart for Library Management System.
2. Project estimation using CRM method.
3. Project Cost estimation using COCOMO model.
4. Identify risk assessment for Student Registry system using Monte Carlo simulation.
5. Identify risk assessment for any simple project using Monte Carlo simulation.
6. Develop a PERT chart for Credit card processing system.
7. Identify risk management for any simple organization.

Text Books:

1. Bob Hughes, Mike Cotterell and Rajib Mall "Software Project Management" 5^{th} Edition, Tata McGraw Hill, New Delhi, 2012.

References:

1. Gopalaswamy Ramesh,"Managing Global Software Projects ", McGraw Hill Education (India), 14^{th} Reprint 2013.
2. Robert K. Wysocki,"Effective Software Project Management", Wiley Publication, 1^{st} Edition, 2011.
3. Walker Royce,"Software Project Management",Addison-Wesley, 13^{th} Edition 2004.

ONLINE/ NPTEL Courses:

1. Software Project Management:https://nptel.ac.in/courses/106105218
2. Software Engineering:https://nptel.ac.in/courses/106105182

CSPE103 OPEN SOURCE SOFTWARE

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Operating System
- Basics of Programming

Course Objective:

- Be exposed to the context in operation of free and open source software (FOSS) communities, associated software projects and learn scripting languages like Python,Perl and Ruby.

Course Outcomes:

- To install and run open-source operating systems.
- To understand information about Free and Open Source Software projects from software releases and from sites on the internet.
- To build and modify one or more Free and Open Source Software packages.
- To explore various programming techniques.
- To explore software to interact with Free and Open Source Software development projects.

UNIT I (9 Hrs)

PHILOSOPHY: Notion of Community, Guidelines for effectively working with FOSS community, Benefits of Community based Software Development –Requirements for being open, free software, Open source software, Four degrees of freedom, FOSS Licensing Models, FOSS Licenses, GPL, AGPL, LGPL, FDL, Implications, FOSS examples.

UNIT II (9 Hrs)

LINUX: Linux Installation and Hardware Configuration, Boot Process, Linux Loader (LILO), The Grand Unified Boot loader (GRUB), Dual-Booting Linux and other Operating System, Boot-Time Kernel Options, X Windows System Configuration, System Administration, Backup and Restore Procedures, Strategies for keeping a Secure Server.

UNIT III (9 Hrs)

FOSS PROGRAMMING PRACTICES: GNU debugging tools, Using source code versioning and managing tools, Review of common programming practices and guidelines for GNU/Linux and FOSS, Documentation.

UNIT IV (9 Hrs)

PROGRAMMING TECHNIQUES: Application programming, Basics of X Windows server architecture, QT programming, GTK + Programming, Python programming, Open source equivalent of existing Commercial software.

UNIT V (9 Hrs)

PROJECTS AND CASE STUDIES: Linux for portable Devices, Creation of Bootable CD and USB from command line, Case Studies – Samba, Libre office, Assistive technology.

List of Experiments:

1. Installation of UNIX Operating System.
2. Write a python program to simulate the following unix commands: a)mv b)cp (Use system calls).
3. Write a python program that simulates ls Command (Use system calls / directory API).
4. Write an awk program to print sum, avg of students marks.
5. Develop an interactive grep script that asks for a word and a file name and then tells how many lines contain that word. c) Repeat d) Part using awk.
6. Write a shell script that accepts a file name starting and ending line numbers as arguments and displays all the lines between the given line numbers.
7. Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.
8. Write a shell script that determines the period for which a specified user is working on the system.
9. Write an interactive file-handling shell program. Let it offer the user the choice of copying, removing, renaming, or linking files. Once the user has made a choice, have the program ask the user for the necessary information, such as the file name, new name and so on.

Text Books:

1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, "Linux in a Nutshell", OReilly Media, 6^{th} Edition, 2009.

References:

1. Philosophy of GNU URL: http://www.gnu.org/philosophy/
2. Linux Administration URL: http://www.tldp.org/LDP/lame/LAME/ linux-admin-made-easy/
3. The Python Tutorial available at http://docs.python.org/2/tutorial/
4. Perl Programming book at http://www.perl.org/books/beginning-perl/
5. Ruby programming book at http://ruby-doc.com/docs/ProgrammingRuby/
6. Version control system URL: http://git-scm.com/
7. Samba: URL : http://www.samba.org/
8. Libre office: http://www.libreoffice.org/

ONLINE/ NPTEL Courses:

1. The Joy of Computing Using Python : https://onlinecourses.nptel.ac.in/noc23 cs20
2. The Joy of Computing Using Python : https://nptel.ac.in/courses/106106182
3. Introduction To Operating Systems : https://onlinecourses.nptel.ac.in/noc22 cs78
4. Introduction To Operating Systems :https://nptel.ac.in/courses/106106144

CSPE104 SOFTWARE TESTING AND QUALITY ASSURANCE

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Software Engineering

Course Objective:

- Explore different software testing processes, types, testing software quality and its standards.

Course Outcomes:

- To understand how to detect, classify, prevent and remove defects with software testing fundamentals.
- To understand the effective strategies of testing, the methods and technologies of software testing.
- To analyze appropriate testing strategies and develop test cases.
- To understand object oriented software testing.
- To explore various software quality standards & techniques.

UNIT I (9 Hrs)

SOFTWARE TESTING FUNDAMENTALS: Need for Testing, SDLC and Testing, Functional and Non-Functional Testing, Verification and Validation, Testing levels, Unit, Integration, System and Acceptance Testing, Testing and Debugging, Test Case Design, Test Management (Planning, Monitoring and Reporting): Weyuker's Adequacy Axioms, Metrics and SDLC.

UNIT II (9 Hrs)

TESTING TYPES: White Box, Black Box and Grey Box, White box testing techniques, Statement coverage, Branch Coverage, Condition coverage, Decision/Condition coverage, Multiple condition coverage, Dataflow coverage, Mutation testing, Black box testing techniques, Boundary value analysis, Equivalence partitioning, Syntax testing, Finite state testing.

UNIT III (9 Hrs)

TESTING OBJECT ORIENTED (OO) SOFTWARE: Challenges, Differences from Testing non-OO Software, Testing and SDLC, Testing Strategies, Test Case Design, Testing Methods, Class testing strategies, Class Modality, State based Testing, Message Sequence Specification.

UNIT IV (9 Hrs)

SOFTWARE QUALITY: Introduction, Quality and SDLC, Software Quality Assurance (SQA), SQA Plan, Team, Characteristics, Documentation, Review and Audits, Software Quality Models (McCall, FURBS and GQM), Software Quality Measurement Metrics, Product quality, Process quality and Maintenance metrics, Quality Cost, Quality Control.

UNIT V (9 Hrs)

SOFTWARE QUALITY STANDARD: CMM Model, ISO 9000 Series, Introduction to PCMM, CMMI and Six Sigma concept. Testing Specialized Environment, Testing Client-Server applications, Testing GUI, Testing compilers and language processors, Testing Realtime Systems. Testing Tools, Automated Tools for Testing, WinRunner, Load Runner, Static code analyzers, Test case generators, GUI Capture/Playback.

List of Experiments:

1. A program written in C language for matrix multiplication fails.Introspect the causes for its failure and write down the possible reasons for its failure.
2. Take any system(e.g ATM system) and study its system specifications and report the various bugs.
3. Write the test cases for Banking application.
4. Create a test plan document for Library Management System.
5. Study of any testing tool(e.g Win runner).
6. Study of any web testing tool(e.g Selenium).
7. Study of any bug tracking tool(e.g Bugzilla, bugbit).
8. Study of any test management tool(e.g Test Director).
9. Study of any open soource-testing tool(e.g Test Link).

Text Books:

1. Roger S. Pressman, "Software Engineering. A Practitioners Approach", McGraw- Hill International Edition, 9th Edition, 2019.
2. Glenford J. Myers, Tom Badgett, Corey Sandler, and Todd M. Thomas, "The Art of Software Testing", John Wiley & Sons, 3rd Edition, 2011.

References:

1. William E. Perry, "Effective Methods for Software Testing", John Wiley & Sons, 3rd Edition, 2006.
2. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", Pearson Education (Singapore)Pt Ltd 3rd Edition, 2002.
3. Robert V.Binder, "Testing Object-Oriented Systems: Models Patterns and Tools", Addison Wesley,3rd Edition, 2000.

ONLINE/ NPTEL Courses:

1. Software Testing: https://nptel.ac.in/courses/106105150
2. Software Testing: https://nptel.ac.in/courses/106101163

CSPE105 OBJECT ORIENTED ANALYSIS AND DESIGN

L	T	P	C
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Course Pre-requisite:

- Software Engineering
- Java Programming

Course Objective:

- To learn the concept of Object oriented software development process to get acquainted with UML diagrams , Object Oriented Analysis Processess

Course Outcomes:

- To understand object oriented software development process.
- To understand object oriented methodologies & UML diagrams.
- To apply object oriented analysis processes for projects.
- To understand object oriented Design.
- To apply design patterns to develop software.

UNIT I (9 Hrs)

OBJECT ORIENTED METHODOLOGIES: Software development Life Cycle - Traditional cycle models , Object Oriented approach - Rambaugh Object Modeling Technique , Booch Methodology, Jacobson methodology , Rational Unified Process (RUP) - Unified Modeling Language (UML) – UML Models.

UNIT II (9 Hrs)

UML DIAGRAMS: Use case diagram - UML class diagram -interaction diagram - state diagram - activity diagram - Requirements for ATM banking system , case study.

UNIT III (9 Hrs)

OBJECT ORIENTED ANALYSIS: Use case driven Object analysis – approaches for identifying classes – identifying objects, relationships attributes, methods for ATM banking system ,Object oriented design process – Design axioms.

UNIT IV (9 Hrs)

OBJECT ORIENTED DESIGN: Designing Classes, Methods , Access layer object storage and object interoperability – Access layer for the ATM banking system -View layer ,Designing interface objects , Prototyping User interface, View layer for the ATM. banking system

UNIT V (9 Hrs)

DESIGN PATTERNS: Design Patterns – Describing design patterns, Catalog of design patterns, Organizing the catalog, Creational pattern, Abstract factory , structural pattern - Adapter , behavioral pattern - chain of responsibility

List of Experiments:

UML Programs

1. Use Case diagram
2. Class Diagram
3. Sequence Diagram
4. Collaboration Diagram
5. State Diagram
6. Activity Diagram
7. Component Diagram
8. Deployment Diagram
9. Test Design.

List of Case Studies and problems that may be considered are:

10. College Information System.
11. Hostel Management.
12. ATM System
13. Credit card processing system
14. Library Management system

Text Books:

1. Ali Bahrami,"Object Oriented systems development", Paperback-Bigbook, 2017
2. Carol Britton and Jill Doake, "A student Gide to Object Oriented Development", Elsevier, Butterworth – Heinemann, 8th Edition, 2007.

References:

1. Craig Larman,"Applying UML and Patterns: An Introduction to object-oriented Analysis and Design and iterative development", 3rd Edition, Pearson Education, 2005.
2. Mike O'Docherty "Object-Oriented Analysis & design – understanding system development with UML 2.0", John Wiley, 2005.
3. Grady Booch, James Rumbagh, Ivar Jacobson,"The UML user Guide", Pearson Education, 2005
4. Timothy C. Lethbridge, Robert Laganiere,"Object-Oriented Software Engineering – A practical software development using UML and Java", Tata McGraw-Hill, New Delhi, March 2003.

ONLINE/NPTEL Courses:

1. Object Oriented System Development using UML, Java and Patterns: https://nptel.ac.in / courses/106105224

CSPE201 HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic Knowledge about Interacting with the Computers

Course Objective:

- Understanding various components of Human Computer Interaction domain and learning the process of building effective interaction.

Course Outcomes:

- To understand the terminologies associated with HCI.
- To acquire skills in designing usable interfaces.
- To understand personalization in the interaction process.
- To get insights about the importance of accessible interfaces.

UNIT I (9 Hrs)

INTRODUCTION TO HCI: Definition and scope of HCI - Historical Perspective - Theories and methods in HCI- Importance of HCI in software development.

UNIT II (9 Hrs)

HCI DESIGN PRINCIPLES AND FRAMEWORK: : : Introduction to design principles- Models of Interaction- HCI frameworks- Basics of Ergonomics - Interaction styles- Interactivity- User experience- Fundamentals of Interaction design- User Interaction design principles.

UNIT III (9 Hrs)

USER-CENTERED DESIGN AND INTERACTION DESIGN: Introduction to user-Centric design – Case studies, Historical evolution, Issues and challenges and current trend. Computational user models (classical) – GOMS, KLM, Fitts' law, Hick-Hymans law - Computational user models (contemporary) – 2D and 3D pointing, Constrained navigation, Mobile typing, Touch interaction.

UNIT IV (9 Hrs)

USABILITY EVALUATION: User centric design evaluation – Overview of evaluation techniques, Expert evaluation, User evaluation, Model-based evaluation with case studies-Accessibility in HCI.

UNIT V (9 Hrs)

FUTURE TRENDS IN HCI: Emerging technologies- Artificial intelligence- AR/VR- Multimodal interaction- Interaction in Wearable devices- Accessibility and Inclusive design- Ethical consideration in HCI.

List of Experiments:

1. Take a Product of Your choice and Perfrom Schneiderman's Golden Rules Analysis
2. Perform Content Navigation without using Mouse and Make a Report
3. Perform a Comparative analysis of Accessibility with a case study of your choice
4. Evaluate an existing interface using Nielsen's usability heuristics.
5. Create an interactive prototype using a tool like Sketch or Figma.

Text Books:

1. Samit Bhattacharya, Human-Computer Interaction: User-Centric Computing for Design, 2019, 935316804X, McGraw-Hill.
2. Alan Dix, Janet E. Finlay, Gregory D. Abowd and Russel Beale. (2003). Human-Computer Interaction (3rd Edition), Pearson.

References:

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen and Steven Jacobs. (2009). Designing the User Interfaces: Strategies for Effective Human-Computer Interaction, 5th Edition, Pearson.

ONLINE /NPTEL Courses:

1. Human Computer Interaction-https://onlinecourses.nptel.ac.in/noc20_cs45/

CSPE202 MULTIMEDIA AND ANIMATION

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge of computer System
- Basic Programming Knowledge

Course Objective:

- Introduce the fundamental elements of multimedia to learn representations, perceptions ,applications and emphasize hands-on in digital media.

Course Outcomes:

- To understand the basics of Multimedia platform.
- To understand different types of file formats in Multimedia.
- To use different standard animation techniques for 2D and 3D applications.
- To deploy multimedia tools on various platforms.
- To understand about various Multimedia Applications.

UNIT I (9 Hrs)

INTRODUCTION TO MULTIMEDIA: Definitions- Elements, Multimedia Hardware and Software, Distributed multimedia systems-challenges- Security,sharing / distribution,Storage, Retrieval, processing, Computing- Multimedia metadata- Multimedia databases, Hypermedia, Multimedia Learning.

UNIT II (9 Hrs)

MULTIMEDIA FILE FORMATS AND STANDARDS: File formats – Text-,Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT III (9 Hrs)

MULTIMEDIA AUTHORING: Authoring metaphors,Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, Simulations.

UNIT IV (9 Hrs)

ANIMATION: Principles of animation- Staging-squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques- Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, Vector animation, Stop motion, Motion graphics, Fluid Simulation, Skeletal animation, Skinning Virtual Reality, Augmented Reality.

UNIT V (9 Hrs)

MULTIMEDIA APPLICATIONS: Multimedia Big data computing- social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, Media on demand, Security and forensics, Online social networking, Multimedia ontology, Content based retrieval from digital libraries.

List of Experiments:

Working with Image Editing tools:

1. Install tools like GIMP/ InkScape / Krita / Pencil and perform editing operations:
    - Use different selection and transform tools to modify or improve an image
    - Create logos and banners for home pages of websites.

    Working with Audio Editing tools:
    - Install tools like, Audacity / Ardour for audio editing, sound mixing and special effects like fade-in or fade-out etc.,
    - Perform audio compression by choosing a proper codec.

    Working with Video Editing and conversion tools:

2. Install tools like OpenShot / Cinelerra / HandBrake for editing video content.
    - Edit and mix video content, remove noise, create special effects, add captions.
    - Compress and convert video file format to other popular formats.

    Working with Video Editing and conversion tools:

3. Install tools like OpenShot / Cinelerra / HandBrake for editing video content.
    - Edit and mix video content, remove noise, create special effects, add captions.
    - Compress and convert video file format to other popular formats.

    Working with web/mobile authoring tools:

4. Adapt / KompoZer/ BlueGriffon / BlueFish / Aptana Studio/ NetBeans / WordPress /Expression Web:
    - Design simple Home page with banners, logos, tables quick links etc
    - Provide a search interface and simple navigation from the home page to the inside pages of thewebsite.
    - Design Responsive web pages for use on both web and mobile interfaces

    Working with Animation tools:

5. Install tools like, Krita, Wick Editor, Blender:
    - Perform a simple 2D animation with sprites
    - Perform simple 3D animation with keyframes, kinematics:Working with Mobile UI animation tools: Origami studio / Lottie / Framer etc.,

    Working with E-Learning authoring tools:

6. Install tools like EdApp / Moovly / CourseLab/ IsEazy and CamStudio/Ampache, VideoLAN:
    - Demonstrate screen recording and further editing for e-learning content.
    - Create a simple E-Learning module for a topic of your choice.

    Creating VR and AR applications:
    - Any affordable VR viewer like Google Cardboard and any development platform like Openspace 3D / ARCore etc.

Text Books:

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, “Fundamentals of Multimedia”, Springer Texts in Computer Science, 3rd Edition, 2021. (UNIT-I, II, III).

References:

1. Emilio Rodriguez Martinez, Mireia Alegre Ruiz, "UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native", Packt Publishing, 2022.
2. Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature,1st Edition, 2021.
3. Gerald Friedland, Ramesh Jain,"Multimedia Computing", Cambridge University Press, 2018.
4. John M Blain, "The Complete Guide to Blender Graphics: Computer Modeling & Animation", CRC press, 3rd Edition, 2016.
5. Prabhat K.Andleigh, Kiran Thakrar, "Multimedia System Design", Pearson Education, 1st Edition, 2015.
6. Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rd Edition, 2012.
7. Rogers David, "Animation: Master – A Complete Guide (Graphics Series)", Charles River Media, 2006.

ONLINE /NPTEL Courses

1. Multimedia and Animation- https://nptel.ac.in/courses/106102065
2. Multimedia Design- https://archive.nptel.ac.in/courses/107/101/107101001

CSPE203 UI AND UX DESIGN

L	T	P	C
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Course Pre-requisite:

- Software Engineering
- Basics of Programming

Course Objective:

- To Learn the process of user experience designer research and analysis skills and design an effective and compelling digital experiences across different platforms.

Course Outcomes:

- To gain the basic knowledge of basic designing.
- To understand the concepts of UI design.
- To understand the concepts of UX design.
- To implement Wireframe, prototype and testing.
- To adopt research methodologies on UI and UX design.

UNIT I (9 Hrs)

FOUNDATIONS OF DESIGN: UI vs. UX Design - Core Stages of Design Thinking , Divergent and Convergent Thinking ,Brainstorming and Game storming , Observational Empathy .

UNIT II (9 Hrs)

FOUNDATIONS OF UI DESIGN: Visual and UI Principles - UI Elements and Patterns, Interaction Behaviors and Principles, Branding, Style Guides.

UNIT III (9 Hrs)

FOUNDATIONS OF UX DESIGN: Introduction to User Experience - Why You Should Care about User Experience, Understanding User Experience, Defining the UX Design Process and its Methodology, Research in User Experience Design, Tools and Method used for Research, User Needs and its Goals, Know about Business Goals.

UNIT IV (9 Hrs)

WIREFRAMING, PROTOTYPING AND TESTING: Sketching Principles - Sketching Red Routes , Responsive Design, Wireframing, Creating Wireflows, Building a Prototype, Building High-Fidelity Mockups, Designing Efficiently with Tools, Interaction Patterns, Conducting Usability Tests, Other Evaluative User Research Methods, Synthesizing Test Findings, Prototype Iteration.

UNIT V (9 Hrs)

RESEARCH, DESIGNING, IDEATING & INFORMATION ARCHITECTURE: Identifying and Writing Problem Statements, Identifying Appropriate Research Methods, Creating Personas, Solution Ideation, Creating User Stories, Creating Scenarios, Flow Diagrams, Flow Mapping, Information Architecture.

List of Experiments:

1. Designing a Responsive layout for an societal application
2. Exploring various UI Interaction Patterns
3. Developing an interface with proper UI Style Guides
4. Developing Wireflows diagram for application using open source software
5. Exploring various open source collaborative interface Platform
6. Hands on Design Thinking Process for a new product
7. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)
8. Identify a customer problem to solve
9. Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping
10. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements

Text Books:

1. Joel Marsh, "UX for Beginners", O'Reilly,Grey scale publishers, 2022.
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" ,O'Reilly, 2021.

References:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" ,3rd Edition, O'Reilly, 2020.
2. Steve Schoger, Adam Wathan, "Refactoring UI", 2018.
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", 3rd Edition, 2015.
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature.

ONLINE /NPTEL Courses:

1. UI & UX Design- https://onlinecourses.nptel.ac.in/noc21 ar05
2. User Inteface Designhttps://archive.nptel.ac.in/courses/124/107/124107008/

CSPE204 AUGMENTED REALITY/VIRTUAL REALITY

L	T	P	C
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Course Pre-requisite:

- Java Programming
- Multimedia and Animation

Course Objective:

- Learn the basic principles of virtual reality applications, different gaming toolkits and to develop AR/VR applications.

Course Outcomes:

- To understand the basic concepts of AR and VR.
- To understand the tools and technologies related to AR/VR.
- To gain knowledge on VR programming.
- To develop AR/VR applications in different domains.
- To gain knowledge about AR/VR.

UNIT I (9 Hrs)

INTRODUCTION: Introduction to Virtual Reality and Augmented Reality – Definition, Introduction to Trajectories and Hybrid Space, Three I's of Virtual Reality , Virtual Reality Vs 3D Computer Graphics, Benefits of Virtual Reality, Components of VR System, Introduction to AR- AR Technologies-Input Devices, 3D Position Trackers, Types of Trackers, Navigation and Manipulation Interfaces, Gesture Interfaces, Types of Gesture Input Devices, Output Devices, Graphics Display, Human Visual System, Personal Graphics Displays, Large Volume Displays,Sound Displays, Human Auditory System.

UNIT II (9 Hrs)

VR MODELING: Modeling – Geometric Modeling, Virtual Object Shape, Object Visual Appearance, Kinematics Modeling – Transformation Matrices, Object Position, Transformation Invariants, Object Hierarchies, Viewing the 3D World, Physical Modeling, Collision Detection, Surface Deformation – Force Computation, Force Smoothing and Mapping, Behavior Modeling, Model Management.

UNIT III (9 Hrs)

VR PROGRAMMING: VR Programming – Toolkits and Scene Graphs, World ToolKit, Java 3D, Comparison of World ToolKit and Java 3D

UNIT IV (9 Hrs)

APPLICATIONS: Human Factors in VR – Methodology and Terminology, VR Health and Safety Issues, VR and Society-Medical Applications of VR, Education, Arts and Entertainment, Military VR Applications, Emerging Applications of VR – VR Applications in Manufacturing, Applications of VR in Robotics, Information Visualization, VR in Business,VR in Entertainment, VR in Education.

UNIT V (9 Hrs)

AUGMENTED REALITY: Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation- Navigation-Wearable devices

List of Experiments:

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection types by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
9. Develop simple MR enabled gaming applications.

Text Books:

1. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018.
2. William R. Sherman, Alan B.Craig, "Understanding Virtual Reality – Interface, Application,Design ", Morgan Kaufmann, 2nd Edition, 2018.
3. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016.

References:

1. Ali A. Ghorbani, Wei Lu, "Network Intrusion Detection and Prevention: Concepts and Techniques", Springer, 2010.
2. Paul E. Proctor, "The Practical Intrusion Detection Handbook", Prentice Hall , 2001.
3. Ankit Fadia and Mnu Zacharia, "Intrusiion Alert", Vikas Publishing house Pvt., Ltd, 2007.
4. Earl Carter, Jonathan Hogue, "Intrusion Prevention Fundamentals", Pearson Education, 2006.

Online/ NPTEL courses:

1. Augmented and Virtual Reality courses- https://elearn.nptel.ac.in/shop/iit-workshops/completed/foundation-course-on-virtual-reality-and-augmented-reality/
2. Virtual Reality- https://archive.nptel.ac.in/courses/121/106/121106013/

CSPE205 GRAPHICS AND IMAGE PROCESSING

L	T	P	C
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Course Pre-requisite:

- Basic knowledge in Computer Design.

Course Objective:

- To learn two dimensional graphical structures, the components of Graphics and Image Processing applications. To design innovative applications.

Course Outcomes:

- To describe acquainted Graphics and Image Processing domains.
- To understand the major intricacies of Graphics and Image Processing.
- To understand verbal descriptions to images and vice versa.

UNIT I (9 Hrs)

GRAPHICS SYSTEMS AND GRAPHICAL USER INTERFACE: Pixel Resolution types of video display devices- Graphical input devices, Output devices, Hard copy devices, Direct screen interaction, Logical input function, GKS User dialogue, Interactive picture construction techniques.

UNIT II (9 Hrs)

GEOMETRIC DISPLAY PRIMITIVES AND ATTRIBUTES: Geometric Display Primitives and Attributes- Geometric display primitives,Points Lines and Polygons,Point display method, Line drawing methods. 2D Transformations and Viewing- Transformations types matrix representation, Concatenation,Scaling Rotation, Translation, Shearing, Mirroring, Homogeneous coordinates. Window to view port transformations- Windowing And Clipping, Point Lines Polygons, boundary intersection methods.

UNIT III (9 Hrs)

DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS: Digital Image Fundamentals and Transforms- Nature of Image processing, related fields, Image representations,Image types,Image processing operations, Applications of Image processing, Imaging system, Image Acquisition, Image Sampling and Quantization, Image quality, Image storage and file formats, Image processing operations, Image Transforms, need for Transforms, Fourier Transforms and its properties- Introduction to Walsh, Hadamard, Discrete Cosine, Haar, Slant, SVD, KL and Hotelling Transforms.

UNIT IV (9 Hrs)

IMAGE ENHANCEMENT AND RESTORATION: Image Enhancement and Restoration- Image Quality and need for Enhancements, Point operations, Histogram Techniques, Spatial filtering concepts, Frequency Domain Filtering, Image Smoothening, Image Sharpening, Image degradation and Noise Models Introduction to Restoration Techniques.

UNIT V (9 Hrs)

IMAGE COMPRESSION: Image Compression- Compression Models and measures, coding types, Types of Redundancy, Lossless compression algorithms, Lossy compression algorithms, Introduction to compression standards. Image Segmentation- Detection of Discontinuities, Edge Detection, Thresholding, Region Based Segmentation-Introduction to Color Image Processing- Introduction to Morphological operations.

List of Experiments:

1. Implement Bresenham's line drawing algorithm for all types of slope.
2. Clip a line using Cohen-Sutherland algorithm
3. Analysis of spatial and intensity resolution of images.
4. Intensity transformation of images.
5. Transforms (Walsh, Hadamard, DCT, Haar)
6. Image Enhancement-Spatial filtering
7. Image Enhancement- Filtering in frequency domain
8. Image segmentation Edge detection, line detection and point detection

Text Books :

1. S. Sridhar, "Digital Image Processing", Oxford Press, 1st Edition, 2011.
2. Donald D. Hearn, M. Pauline Baker and Warren Carithers, "Computer Graphics with OpenGL", Pearson Education, 4th Edition, 2010.

References :

1. Gonzalez R. C and Woods R.E., "Digital Image Processing", Pearson Education, 2nd Edition, 2002.
2. Newmann W.M. and Sproull R.F., "Principles of Interactive Computer Graphics", Tata McGraw-Hill, 2nd Edition, 2000.
3. Foley J.D., Van Dam A, Fiener S.K. and Hughes J.F., "Computer Graphics", Addison-Wesley, 2nd Edition, 1993.
4. Anil Jain K, "Fundamentals of Digital Image Processing", Prentice-Hall of India, 1989.

ONLINE /NPTEL Courses:

1. https://onlinecourses.nptel.ac.in/noc21 _ee23

CSPE301 CLOUD COMPUTING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Database Management System

Course Objective:

- To learn the concepts of Cloud System Architecture, Application, Abstraction and Virtualization.

Course Outcomes:

- To learn the cloud computing architecture.
- To understand the architecture, services and applications of cloud computing.
- To understand the abstraction and virtualization of various applications.
- To understand the cloud management and cloud security.
- To write case studies using Web services and Amazon web services.

UNIT I (9 Hrs)

INTRODUCTION TO CLOUD COMPUTING: Overview - Roots of Cloud Computing, Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks, Assessing the role of Open Standards.

UNIT II (9 Hrs)

CLOUD ARCHITECTURE, SERVICES AND APPLICATIONS: Exploring the Cloud Computing Stack - Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, Using PaaS Application Frameworks, Software as a Service, Identity as a Service, Compliance as a Service.

UNIT III (9 Hrs)

ABSTRACTION AND VIRTUALIZATION: Introduction to Virtualization Technologies - Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.

UNIT IV (9 Hrs)

MANAGING & SECURING THE CLOUD: Administrating the Clouds - Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, Establishing Identity, Presence.

UNIT V (9 Hrs)

CASE-STUDIES: Using Google Web Services, Using Amazon Web Services, Using Microsoft Cloud Services.

List of Experiments:

1. Install Virtualbox/VMware/ Equivalent open source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Use the GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Install Hadoop single node cluster and run simple applications like wordcount.
8. Creating and Executing Your First Container Using Docker.
9. Run a Container from Docker Hub

Text Books:

1. Buyya R, Broberg J, Goscinski A, "Cloud Computing: Principles and Paradigm", John Wiley & Sons, 1st Edition, 2011.
2. Sosinsky B, "Cloud Computing Bible", Wiley Edition, 1st Edition, 2011.

References:

1. Naresh Kumar Sehgal, Pramod Chandra P. Bhatt, John M. Acken "Cloud Computing with Security and Scalability Concepts and Practices", Springer, 3rd Edition, 2023.
2. Smooth S., Tan N., "Private Cloud Computing", Morgan Kauffman , 1st Edition, 2011.
3. Miller Michael, "Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online", Pearson Education India.
4. Linthicium D,"Cloud Computing and SOA Convergence in Enterprise", Pearson Education India.

ONLINE/NPTEL Courses:

1. https://freevideolectures.com/course/4639/nptel-cloud-computing/23
2. https://www.digimat.in/nptel/courses/video/106105167/L01.html

CSPE302 BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basis of Programming
- Database Management System

Course Objectives:

- To learn the concepts of data analytics, data management and practice in various applications like HDFS, MapReduce, Hadoop, YARN etc.,

Course Outcomes:

- To describe big data and use cases from selected business domains
- To explore NoSQL big data management
- To install, configure, and run Hadoop and HDFS
- To perform map-reduce analytics using Hadoop
- To use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

UNIT I (9 Hrs)

UNDERSTANDING BIG DATA: Introduction to Big Data - Convergence of key trends, Unstructured Data, Industry Examples of Big Data, Web Analytics, Big Data Applications, Big Data Technologies. Introduction to Hadoop – Open Source Technologies, Cloud and Big Data, Mobile Business Intelligence, Crowd Sourcing Analytics, Inter and Trans Firewall Analytics.

UNIT II (9 Hrs)

NoSQL DATA MANAGEMENT: Introduction to NoSQL - Aggregate Data Models, Key-Value and Document Data Models, Relationships, Graph databases, Schemaless Databases, Materialized Views. Distribution Models - Master-Slave Replication, Consistency. Cassandra - Cassandra Data Model, Cassandra Examples, Cassandra Clients

UNIT III (9 Hrs)

MAPREDUCE APPLICATIONS: MapReduce Workflows - Unit Tests with MRUnit, Test Data and Local Tests, Anatomy of MapReduce Job Run, classic Map-reduce, YARN, Failures in Classic Map-Reduce and YARN, Job Scheduling, Shuffle and Sort, Task Execution, MapReduce Types, Input Formats, Output Formats.

UNIT IV (9 Hrs)

BASICS OF HADOOP: Data Format – Analyzing Data with Hadoop, Scaling out, Hadoop Streaming, Hadoop Pipes, Design of Hadoop Distributed File system (HDFS),HDFS Concepts, Java Interface, Data Flow, Hadoop I/O, Data Integrity, Compression, Serialization, Avro – File-Based Data Structures, Cassandra, Hadoop Integration. Introducing Apache Spark - Spark Shell, Spark Context.

UNIT V (9 Hrs)

HADOOP RELATED TOOLS: Hbase – Data Model and Implementations, HBase clients, HBase Examples, Praxis.Pig – Grunt, Pig Data Model, Pig Latin, Developing and Testing Pig Latin scripts.Hive, Data types and File Formats, HiveQL Data Definition, HiveQL Data Manipulation, HiveQL Queries.

List of Experiments:

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.
2. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files
3. Implement of Matrix Multiplication with Hadoop Map Reduce
4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. Installation of Hive along with practice examples.
6. Installation of HBase, thrift Practice examples
7. Practice importing and exporting data from various databases.
8. Distributed Cache and Map Side Join, Reduce side Join and Running a Spark Application Word count in Hadoop and Spark Manipulating RDD
9. Inverted Indexing in Spark Sequence alignment problem in Spark Implementation of Matrix algorithms in Spark SQL programming, Building Spark Streaming application.

Text Books:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Tom White, "Hadoop: The Definitive Guide", O'Reilley, 3rd Edition, 2012.
4. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

References:

1. Seema Acharya, Subashini Chellappan " Big Data and Analytics", Wiley India Pvt. Ltd, 2nd Edition 2019.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.

ONLINE/NPTEL Courses:

1. Big Data Concepts: https://onlinecourses.nptel.ac.in/noc20cs92

CSPE303 BUILDING CLOUD AND BIG DATA APPLICATIONS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Big Data, Distributed Computing

Course Objective:

- The course presents the principles of cloud architecture models & Infrastructure. Provide Bigdata and use cases from selected business domains.

Course Outcomes:

- To describe the basic concept and characteristics of cloud computing
- To understand the concept of virtualization and data center automation
- To analyze the different cloud software utility architecture
- To describe big data and use cases from selected business domains.
- To explain NoSQL big data management

UNIT I (9 Hrs)

CLOUD COMPUTING ARCHITECTURE AND MODEL: Technologies for Network Based System - System Models for Distributed and Cloud Computing, NIST Cloud Computing Reference Architecture. Cloud Models - Characteristics, Cloud Services, Cloud models (IaaS, PaaS, SaaS), Public Vs Private Cloud, Cloud Solutions, Cloud Ecosystem, Service Management, Computing on Demand.

UNIT II (9 Hrs)

VIRTUAL MACHINE: Basics of Virtualization - Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data-center Automation.

UNIT III (9 Hrs)

SOFTWARE UTILITY APPLICATION: Software Utility Application Architecture - Characteristics of SaaS, Software Utility Application, Cost Versus Value. Software Application Framework – Common Enablers, Conceptual view to Reality, Business Profits, Implementing Database System for Multitenant Architecture.

UNIT IV (9 Hrs)

UNDERSTANDING BIG DATA: Introduction to Big Data - Convergence of key trends, Unstructured Data, Industry Examples of Big Data, Web Analytics, Big Data Applications, Big Data Technologies. Introduction to Hadoop - Open Source Technologies, Cloud and Big Data, Mobile Business Intelligence, Crowd Sourcing Analytics, Inter and Trans Firewall Analytics.

UNIT V (9 Hrs)

NOSQL DATA MANAGEMENT: Introduction to NoSQL - Aggregate Data Models, Key-Value and Document Data Models, Relationships, Graph Databases, Schemaless Databases, Materialized Views, Distribution Models, Master-slave Replication, Consistency. Cassandra - Cassandra Data Model, Cassandra Examples, Cassandra Clients.

List of Experiments:

1. Cisco simulator – VLAN design, Routing, Sub netting, Gateway configuration.
2. Virtual box based Webserver creation, access webpage from 2nd VM on another subnet work.
3. EC2 AWS – S3 bucket based static webpages.
4. EC2 AWS – Instance Creation, Migration.
5. EC2 AWS – Web application using Beanstalk.
6. AWS – Local balancing and auto scaling.
7. IBM Blue Mix - Mobile Application development
8. DaaS – Deployment of a basic web app and add additional functionality(Java scripts based)
9. PaaS – IOT – Mobile sensor based IOT application hosted via PaaS environment
10. SaaS – Deployment of any SaaS application for a online collaborative tool
11. Deployment of Open stack or Virtual box from the scratch
12. Automating Open stack deployment using Chef/Puppet configuration for 4 node/ 5 node/ HA clusters
13. Hadoop as a Service

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing Principles and Paradigms", Wiley Publications, 2017.
2. Alfredo Mendoza, "Utility Computing Technologies, Standard, and Strategies", Artech House INC, 2017.
3. Kai Hwang, Geoffrey C Fox and Jack G Dongarra, "Distributed and Cloud Computing,From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2016.
4. Arshdeep Bahga, Vijay Madisetti, "Cloud Computing", University Press, 2016.
5. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.

References:

1. Seema Acharya, Subashini Chellappan " Big Data and Analytics", Wiley India Pvt. Ltd, 2nd Edition, 2019.
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.
4. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.
5. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier / Morgan Kaufmann, 2005.

ONLINE/NPTEL Courses:

1. Big Data: http://www.nitttrc.edu.in/nptel/courses/video/106106156/L23.html

CSPE304 PARALLEL COMPUTING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Data Structures and Algorithms, Database Management System, Computer Networks

Course Objectives:

- To learn the challenges of efficient execution of large-scale parallel applications and to apply various algorithms for application development.

Course Outcomes:

- To understand the principles of parallel programming platform.
- To understand the principles of various parallel algorithms.
- To analyze the parallel modelling programming techniques.
- To implement parallel programming using message passing paradigm.
- To apply various algorithm and develop an application.

UNIT I (9 Hrs)

INTRODUCTION: Introduction - Motivation, Scope, Parallel Programming Platforms, Implicit Parallelism, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Communication Cost in Parallel Machines, Routing Mechanism for Interconnection Networks.

UNIT II (9 Hrs)

PRINCIPLES OF PARALLEL ALGORITHM: Decomposition Techniques - Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for containing Interaction overheads. Parallel Algorithm Models – Basic communication Operations, One-to-All Broadcast and All-to-One Reduction, Scatter and Gather, Improving the speed of some communication Operations.

UNIT III (9 Hrs)

ANALYTICAL MODELLING OF PARALLEL PROGRAMS: Sources of Overhead in Parallel Programs - Performance metrics for parallel systems, Effect of Granularity and Data Mapping on Performance, Scalability of Parallel Systems, Minimum analysis of Parallel Programs, Other Scalability Metrics.

UNIT IV (9 Hrs)

PROGRAMMING USING MESSAGE PASSING PARADIGM: Principles of Message Passing Programming – The Building Blocks, Send and Receive Operations. MPI - The Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators.

UNIT V (9 Hrs)

PARALLEL ALGORITHMS AND APPLICATIONS: Dense Matrix Algorithms - Matrix Vector Multiplication, Matrix-Matrix Multiplication, Solving a System of Linear Equations. Sorting - Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quick sort, Bucket and Sample Sort, Other Sorting Algorithms.

List of Experiments:

1. Open MP - Basic Programs such as Vector addition, Dot product.
2. Open MP - Loop-work sharing and section work-sharing.
3. Open MP - Combined parallel loop reduction and orphaned parallel loop reduction.
4. Open MP - Matric multiply.
5. MPI - Basics of MPI
6. MPI - Communication between MPI process.
7. MPI - Advanced Communication between MPI process.
8. MPI - Collective operation with synchronization.
9. MPI - Collective operation with data movement.
10. MPI - Collective operation with collective computation.
11. MPI - Non blocking operation.

Text Books:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, "Introduction to Parallel Computing", Pearson, 2^{nd} Edition, 2004.

References:

1. Peter S. Pacheco, "An introduction to Parallel Programmin", Morgan Kaufmann, 1^{st} Edition, 2011.
2. Fayez Gebali, "Algorithms and Parallel Computing", Wiley series, 2011.

ONLINE/NPTEL Courses:

1. Parallel Computing: https://onlinecourses.nptel.ac.in/noc22cs21

CSPE305 OPEN MULTI PROCESSING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic programming knowledge

Course Objective:

- • To learn openMP programming concepts, features, performance, troubleshooting and its future.

Course Outcomes:

- To understand the basic concepts of OpenMP program.
- To explore the features in OpenMP languages.
- To analyze the performance using OpenMP.
- To understand the troubleshooting process in OpenMP.
- To understand the real working of OpenMP and its future.

UNIT I (9 Hrs)

INTRODUCTION: Shared Memory Parallel Computers, Cache memory is not shared, Implications of Private Cache Memory characteristics. Origin of OpenMP, Creating an OpenMP program-Overview of OpenMP –First OpenMP program- Matrix Multiplication, keeping sequential and Parallel Programs as a single source code.

UNIT II (9 Hrs)

OPENMP LANGUAGE FEATURES: Parallel Construct -Sharing the work among Threads in an OpenMP program, Loop, Sections, Single , Workshare ,Combined Parallel work-sharing constructs-Clauses to control Parallel and work-sharing Constructs- OpenMP synchronization Constructs- More OpenMP clauses-Advanced OpenMP constructs.

UNIT III (9 Hrs)

PERFORMANCE USING OPENMP: Performance Considerations for Sequential Programs –Measuring OpenMP performance-Best Practices-Additional Performace Considerations-Case study.

UNIT IV (9 Hrs)

TROUBLESHOOTING: Introduction-Common Misunderstandings and frequent errors-Deeper Trouble ,Memory Consistency problems, Incorrect use of flush–Debbugging OpenMP codes.

UNIT V (9 Hrs)

OPENMP REAL WORKING AND FUTURE: The Basics of Compilation-OpenMP translation-OpenMP runtime systems- Future of OpenMP ,Architectural challenges-OpenMP in distributed memory systems-Increasing the expressivity of OpenMP.

List of Experiments:

1. Develop openMp program to control number of threads on multiple nesting levels.
2. Develop OpenMP program to implement different Clauses (nowait,collapse,map,default map).
3. Develop OpenMP program to implement different constructs (parallel Sections,single,workshare.master).
4. Implement Task and task wait constructs using OpenMP program.
5. Implement Target construct problems using OpenMP program.
6. Implement lock routine check up program using OpenMP.

Text Books:

1. Barbara Chapman,Gabriele Jost,and Ruud Van Der Pas, "Using Open MP" , The MIT Press, 2021.

References:

1. Michael Klemm and Jim Cownie ,"High Performance Parallel Runtimes" De Gruyter Oldenbourg , 2021.
2. Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2006.
3. Michael Jay Quinn, "Parallel Programming in C with MPI and OpenMP", McGraw-Hill, 2003.
4. M.J. Quinn, "Parallel Computing – Theory and Practice", McGraw-Hill, 1994.
5. OpenMP Programmer's Manual.
6. MPI Programmer's Manual

ONLINE/NPTEL Course:

1. High Performance Computing: https://archive.nptel.ac.in/courses/106/108/106108055

CSPE401 MOBILE COMPUTING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer Networks

Course Objective:

- To learn about mobile computing trends and wireless application protocol and study about various application languages and mobile application development platforms

Course Outcomes:

- To understand various mobile computing techniques
- To explore the knowledge about the mobile Internet
- To familiarize with various mobile computing trends and wireless protocols.
- To understand various application languages and mobile application development platforms.
- To explore knowledge in Wireless LAN, Mobile Internet Connectivity and Personal Area Network.

UNIT I (9 Hrs)

AN OVERVIEW: Mobile communication-Mobile computing Mobile Computing Architecture-Mobile devices-Mobile System Networks – Data dissemination – Mobile management- security. MOBILE DEVICES AND SYSTEM Mobile phones – Digital Music players – Handheld Pocket computers – Handheld devices –Smart systems – Limitations of mobile devices – Automotive systems.

UNIT II (9 Hrs)

GSM AND SIMILAR ARCHITECTURES: GSM – services and architectures – Radio interfaces –Protocols – Localization – Calling – Handover – Security – New data services – General packet radio service- High speed circuit switched data – DECT. WIRELESS MEDIUM ACCESS CONTROL BASED COMMUNICATION-Medium Access Control – Introduction to CDMA –based Systems – Spread spectrum in CDMA Systems – Coding methods in CDMA – IS-95 cdmOne System – IMT – 2000 – i-mode – OFDM

UNIT III (9 Hrs)

MOBILE IP NETWORK LAYER AND MOBILE TRANSPORT LAYER: IP and mobile Network layers –Packet Delivery and Handover Management – Location management – Registration –Tunneling and Encapsulation - Route Optimization - Dynamic Host Configuration Protocol. Conventional TCP/IP Transport Layer Protocols – Indirect TCP – Snooping TCP – Mobile TCP – Other methods of mobile TCP – layer transmission – TCP over 2.5G/3G Mobile networks

UNIT IV (9 Hrs)

MOBILE DEVICES: SERVER AND MANAGEMENT: Mobile agent – Application server – Gateways –Portals -Service Discovery – Device management – Mobile file systems-Security.MOBILE AD HOC AND WIRELESS SENSOR NETWORKS-Introduction to mobile Ad hoc network – MANET –Wireless Sensor Networks –Applications.

UNIT V (9 Hrs)

WIRELESS LAN, MOBILE INTERNET CONNECTIVITY AND PERSONAL AREA NETWORK: WirelessLAN(Wi-Fi) Architecture and Protocol layers- WAP 1.1 and WAP 2.0 Architecture – XHTML MP (Extensible Hypertext Markup Language Mobile Profile) - Bluetooth enabled devices network – layers in Bluetooth protocol- Security in Bluetooth protocol- IrDA – ZigBees -Mobile application languages and mobile application development platforms

List of Experiments:

1. Develop mobile applications using GUI and Layouts
2. Develop mobile applications using Event Listener
3. Develop mobile applications using Databases
4. Develop mobile applications using RSS Feed, Internal/External Storage, SMS, Multi-threading and GPS.
5. Analyze and discover own mobile app for simple needs

Text Books:

1. Raj Kamal,"Mobile Computing", Oxford Higher education, 2011.
2. William Stallings,"Wireless Communication and Networks", Pearson Education, 2009.
3. J.Schiller, "Mobile Communication", Pearson Education, 2014.

References:

1. LotherMerk, Martin.S.Nicklaus and Thomas Stober, "Principle of Mobile Computing", Springer, 2nd Edition, 2003.

ONLINE/ NPTEL Courses:

1. Mobile Computing: https://nptel.ac.in/courses/106106147
2. Advanced 3G and 4G Wireless Mobile Communications: https://nptel.ac.in/courses/117104099

CSPE402 MOBILE APPLICATION DEVELOPMENT

L	T	P	C
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Course Pre-requisite:

- Computer Networks, Digital Electronics

Course Objective:

- To understand the mobile application features and deploy applications to the android phone features.

Course Outcomes:

- To gain the knowledge about various types of Wireless Data Networks and Voice Networks.
- To understand the architectures, the challenges and the Solutions of Wireless Network.
- To communication Realize the role of Wireless Protocols in shaping the future Internet.
- To develop simple Mobile Application using Android.
- To develop Mobile Platforms Application using various platforms.

UNIT I (9 Hrs)

INTRODUCTION: Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA.

UNIT II (9 Hrs)

MOBILE TELECOMMUNICATION AND NETWORK LAYER: Introduction to Cellular Systems - GSM – Services & Architecture – GPRS -UMTS – Architecture – Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR- AODV - Hybrid routing –ZRP- Multicast Routing- ODMRP-MOBILE TRANSPORT AND APPLICATION LAYER :Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML.

UNIT III (9 Hrs)

MOBILE DATABASES: Issues in Transaction Processing-Transaction Processing Environment-Centralized Environment-Client-server Environment-Distributed Environment-Mobile Environment -Data Dissemination-Transaction Processing in Mobile Environment-Atomicity Relaxation-Consistency Relaxation-Isolation Relaxation-Durability Relaxation.

UNIT IV (9 Hrs)

MOBILE APPLICATION DEVELOPMENT USING ANDROID: Mobile Applications Development - Understanding the Android Software Stack – Android Application Architecture –The Android Application Life Cycle – The Activity Life Cycle Creating Android Activity -Views- Layout -Creating User Interfaces with basic views- linking activities with Intents.

UNIT V (9 Hrs)

MOBILE PLATFORMS AND APPLICATIONS: Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

List of Experiments:

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager
6. Develop a real time Mobile application. (Mini Project)
7. Develop a simple Graphic application.

Text Books:

1. Prasant Kumar Pattink, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt.Ltd, 2nd Edition, 2016.
2. J. Schiller, "Mobile Communication" , Pearson Education, 2nd Edition, 2014.

References:

1. Iti Saha Misra, "Wireless Communication and Networks:3G and Beyond",McGraw Hill Education (India) Private Ltd, New Delhi,2nd Edition,2017.
2. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to wireless and Mobile System", Thomas Asia Pvt Ltd, 2005.
3. William .C.Y.Lee, "Mobile Cellular Telecommunication –Analog and Digital System" TataMcGtaw Hill Edition, 2nd,2006.
4. Golden Richard, Frank Adelstein, Sandeep KS Gupta, Golden Richard and Loren Schwiebert, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional Publishing, 2005.

ONLINE/ NPTEL Courses:

1. Mobile Computing: https://nptel.ac.in/courses/106106147
2. Advanced 3G and 4G Wireless Mobile Communications: https://nptel.ac.in/courses/117104099

CSPE403 WIRELESS SENSOR NETWORKS

L	T	P	C
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Course Pre-requisite:

- Computer Networks

Course Objective:

- To learn various protocols for wireless communication networks.

Course Outcomes:

- To understand the functioning of wireless communication system.
- To understand recent wireless technologies.
- To demonstrate multiple access techniques for Wireless Communication.
- To understand wireless personal area networks.
- To evaluate design challenges, constraints and security issues associated with Ad-hoc wireless networks.

UNIT I (9 Hrs)

OVERVIEW OF WIRELESS COMMUNICATION: Cellular communication- Different generations and standards in cellular communication system- Satellite communication including GPS-wireless local loop- Cordless phone-paging systems- RFID.

UNIT II (9 Hrs)

RECENT WIRELESS TECHNOLOGIES: Multicarrier modulation- OFDM- MIMO system- Diversity multiplexing trade-off, MIMO-OFDM system, Smart antenna- Beam forming and MIMO-cognitive radio-Software defined radio-Communication relays, Spectrum sharing.

UNIT III (9 Hrs)

MULTIPLE ACCESS TECHNIQUES IN WIRELESS COMMUNICATION: Contention-multiple access schemes -FDMA -TDMA-CDMA- SDMA and Hybrid- Contention based multiple access schemes (ALOHA and CSMA).

UNIT IV (9 Hrs)

WIRELESS PERSONAL AREA NETWORKS: Bluetooth, UWB and ZigBee- Wireless local area networks (IEEE 802.11,Network architecture,Medium access methods,WLAN standards), Wireless metropolitan area networks (WiMAX).

UNIT V (9 Hrs)

AD-HOC WIRELESS NETWORKS: Design Challenges in Ad-hoc wireless networks- Concept of cross layer design-Security in wireless networks-Energy constrained networks- MANET and WSN. Wireless system protocols : Mobile network layer protocol (mobile IP,IPv6,dynamic host configuration protocol)- Mobile transport layer protocol (traditional TCP,Classical TCP improvements)- Support for mobility (wireless application protocol).

List of Experiments:

Use any Simulation tool to demonstrate the following Experiments:

1. Create a sample wireless topology.
2. Create a mobile Ad-hoc networks.
3. Implement an Ad-hoc On-demand Distance Vector protocol.
4. Implement a Transmission Control Protocol.
5. Implement an User Datagram Protocol.
6. Implement a Low Energy Adaptive Hierarchy protocol.
7. Implement a Power Efficient Gathering in Sensor Information System.
8. Implement a Sensor Protocol for Information via Negotiation (SPIN).

Text Books:

1. Iti Saha Misra, "Wireless Communication and Networks:3G and Beyond",McGraw Hill Education (India) Private Ltd, New Delhi, 2nd Edition,2017.
2. Sanjay Kumar, "Wireless Communication the Fundamental and Advanced Concepts", River Publishers, Denmark, 2015.
3. Waltenegus Dargie , Christian Poellabauer, "Fundamentals of Wireless Sensor Networks - Theory and Practice", John Wiley & Sons Publications, 2011.

References:

1. J. Schiller, "Mobile Communication" , Pearson Education, 2nd Edition,2014.
2. Vijay K Garg, "Wireless Communications and Networks", Morgan Kaufmann Publishers, USA 2013.
3. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2nd Edition, 2010.

ONLINE/ NPTEL Courses:

1. Wireless Ad Hoc and Sensor Networks: https://nptel.ac.in/courses/106105160
2. Introduction to Wireless and Cellular Communications: https://nptel.ac.in/courses/106106167

CSPE404 NEXT GENERATION NETWORKS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer Networks
- Wireless Sensor Networks

Course Objective:

- The objective of this course is to learn the advantages and disadvantages of existing networks and future generation networks.

Course Outcomes:

- To understand the design of routing mechanism to meet out the desired QoS in NGN.
- To analyse IMS architecture, services, convergent management issues in NGN.
- To analyse various methods of providing connection-oriented services over a NGN with reference to MPLS.
- To analyse various multicasting services with reference to VPNs, VLANs, pseudo wires, VPLS and typical applications.
- To understand the various NGN management modules.

UNIT I (9 Hrs)

WIRELESS IP: Evolution of public mobile services - Motivations for IP based services, Wireless IP network Architecture 3GPP packet data network architecture. Introduction to next generation networks – Opportunities and challenges. Technologies-Networks and services-Future trends.

UNIT II (9 Hrs)

IMS AND CONVERGENT MANAGEMENT: IMS Architecture - IMS services-QoS Control and Authentication-Network and Service management for NGN-IMS advantages-Next Generation OSS Architecture - Standards important to OSS architecture-Information framework- OSS interaction with IMS-NGN OSS function/ information view reference model-DMTF CIM.

UNIT III (9 Hrs)

MPLS and VPN: Technology overview –MPLS & QoS- MPLS services and components –layer 2 VPN-layer 2 internetworking-VPN services, Signaling-layer 3 VPN –Technology overview-Remote Access and IPsec integration with MPLS VPN – GMPLS

UNIT IV (9 Hrs)

MULTICAST: MPLS Multicast VPN overview – Applications- Examples-IPv6 and MPLS- Technology overview-Future of MPLS –Integrating IP and optical networks- Future layer 3 services-future layer 2 services-edge computing-Fog-5G-SDN.

UNIT V (9 Hrs)

NGN MANAGEMENT: MPLS Multicast VPN overview – Applications, Examples, IPv6 and MPLS- Technology overview, Future of MPLS –Integrating IP and optical networks, Future layer 3 services, future layer 2 services.

List of Experiments:

1. To practise the system configuration.
2. To practise network configuration.
3. To practise connecting a PC in a network using physical medium to get connectivity.
4. Demonstrate to connect two computer without connecting devices.
5. Demonstrate to connect two computer with connecting devices.
6. Demonstrate to establish client-server connection with using of windows server 2008.
7. Use of policies in Windows Server 2008 7. Overview of Router.
8. Demonstrate the use of router to make a connection.
9. Overview of router.
10. Implement IP Subnetting in IPV4.
11. Implement IP routing using RIP.
12. Implement IP routing using IGRP.

Text Books:

1. Monique J. Morrow, "Next Generation Networks", CISCO Press, 2007.
2. Robert Wood, "MPLS and Next Generation Networks: Foundations for NGN and Enterprise Virtualization", CISCO Press, 2006.

References:

1. Thomas Plavyk, "Next generation Telecommunication Networks, Services and Management", Wiley & IEEE Publications, 2010.
2. Neill Wilkinson, "Next Generation Network Services", John Wiley Publications, 2002.

ONLINE/ NPTEL Courses:

1. Networks and Systems: https://nptel.ac.in/courses/108106075

CSPE405 INTERNET OF THINGS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer Networks
- Python Programming

Course Objective:

- To learn IoT concepts, architecture and protocols.

Course Outcomes:

- To understand the architectural overview of IoT.
- To apply basic knowledge and understanding of Architecture and protocols.
- To gain knowledge in network IEEE standards.
- To understand the various IoT Protocols like Datalink, Network, Transport, Session, Service layers.
- To understand the IoT Reference Architecture and Real World Design Constraints.

UNIT I (9 Hrs)

OVERVIEW OF IOT: An Architectural Overview– Building an architecture- Main design principles-needed capabilities- An IoT architecture outline- Standards considerations. M2M and IoT Technology.Fundamentals- Devices and gateways- Local and wide area networking- Data management-Business processes in IoT- Everything as a Service(XaaS)- M2M and IoT Analytics-Knowledge Management.

UNIT II (9 Hrs)

REFERENCE MODEL: IoT Architecture-State of the Art – Introduction, State of the art- Reference Model and architecture- IoT reference Model - IoT Reference Architecture- Introduction-Functional View-Information View-Deployment and Operational View- Other Relevant architectural views.Real-World Design Constraints- Introduction-Technical Design constraints-Hardware is popular again-Data representation and visualization, Interaction and remote control.

UNIT III (9 Hrs)

IoT DATA LINK LAYER & NETWORK LAYER PROTOCOLS: PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15)-WirelessHART- ZWave- Bluetooth Low Energy- Zigbee Smart Energy,DASH7 - Network Layer-IPv4-IPv6- 6LoWPAN- 6TiSCH-ND- DHCP- ICMP- RPL- CORPL- CARP.

UNIT IV (9 Hrs)

TRANSPORT & SESSION LAYER PROTOCOLS: Transport Layer (TCP- MPTCP- UDP-DCCP-SCTP)-(TLS-DTLS) – Session Layer HTTP-CoAP- XMPP-AMQP-MQTT.

UNIT V (9 Hrs)

SERVICE LAYER PROTOCOLS & SECURITY: Service Layer -OneM2M-ETSI M2M-OMA-BBF – Security in IoT Protocols – MAC 802.15.4 - 6LoWPAN- RPL- Application Layer.

List of Experiments:

1. Introduction to Arduino platform and programming
2. Interfacing Arduino to Zigbee module
3. Interfacing Arduino to GSM module
4. Interfacing Arduino to Bluetooth Module
5. Introduction to Raspberry PI platform and python programming
6. Interfacing sensors to Raspberry PI
7. Communicate between Arduino and Raspberry PI using any wireless medium
8. Setup a cloud platform to log the data
9. Log Data using Raspberry PI and upload to the cloud platform.
10. Design an IoT based system

Text Books:

1. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri, "Internet of Things: Architectures, Protocols and Standards", 1st Edition, 2018.
2. BK Tripathy and J.Anuradha, "Internet Of Things (IoT) Technologies Applications Challenges And Solutions", Taylor & Francis, 1st Edition, 2017.

References:

1. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM, MUMBAI, 1st Edition, 2015.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Academic Press, 1st Edition,2014.
3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", Springer, 1st Edition, 2011.

ONLINE/ NPTEL Courses:

1. Introduction to internet of things : Data Analysis And Applications: https://nptel.ac.in/courses/106105166
2. Introduction to Industry 4.0 and Industrial Internet of Things: https : //nptel.ac.in/courses/106105195

CSPE501 OPTIMIZATION TECHNIQUES

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Course Pre-requisite:

- Artificial Intelligence and Machine Learning

Course Objective:

- To introduce the basic concepts of linear,non-programming a interior point and dynamic programming.

Course Outcomes:

- To understand the linear programming model and acquire management skills.
- To apply the theory of optimization methods and algorithms.
- To understand non linear programming.
- To analyze karmarkar's algorithm and applying optimization techniques in problems of Engineering and Technology.
- To understand dynamic programming and appreciate variety of performance measures for various optimization problems.

UNIT I (9 Hrs)

LINEAR PROGRAMMING: Introduction- Formulation of linear programming model- Graphical solution- Solving LPP using simplex algorithm-Revised Simplex Method.

UNIT II (9 Hrs)

ADVANCES IN LPP: Dual theory- Dual simplex method- Sensitivity analysis- Transportation problems- Assignment problems- Traveling sales man problem- Data Envelopment Analysis.

UNIT III (9 Hrs)

NON LINEAR PROGRAMMING: Classification of Non Linear programming-Lagrange multiplier method- Karush, Kuhn Tucker conditions- Reduced gradient algorithms-Quadratic programming method-Penalty and Barrier method.

UNIT IV (9 Hrs)

INTERIOR POINT METHODS: Karmarkar's algorithm- Projection Scaling method-Dual affine algorithm-Primal affine algorithm Barrier algorithm.

UNIT V (9 Hrs)

DYNAMIC PROGRAMMING: Formulation of Multi stage decision problem- Characteristics- Concept of sub- Optimization and the principle of optimality-Formulation of Dynamic programming- Backward and Forward recursion-Computational procedure-Conversion of final value problem in to Initial value problem.

List of Experiments:

1. Formulate engineering system design problem as an optimization problem.
2. Problem formulated in Experiment No. 1 should be solved graphically and identify the nature of problem.
3. By using excel solver solve unconstrained and constrained optimization problems by creating excel worksheets.
4. Solve LPP by two-phase simplex method numerically and verify the results by using simulation software
5. Solve quadratic programming problem numerically and verify results by using simulation software.
6. Verify the descent conditions for a given search direction for unconstrained optimization problem and calculate step size along search direction using Equal Interval Search method numerically and verify results by using simulation software
7. Solve nonlinear optimization problems by using numerical optimization methods (indirect) Newtons methods verify the results by using simulation software.

Text Books:

1. Sultan Chand and Sons, "Operations Research", Sultan Chand and Sons, 2019.
2. L. R. Foulds,"Optimization Techniques",Softcover reprint of the original, 1^{st} Edition, 2011.
3. Chander Mohan and Kusum Deep,"Optimization Techniques", New Age Science Ltd, 2009.

References:

1. Philips, Ravindran and Solberg, "Operations Research", John Wiley, 2019.
2. Ronald L.Rardin, "Optimization in Operation Research", Pearson Education Pvt.Ltd., 2018.

ONLINE/ NPTEL Courses:

1. Linear Programming Problems : https://nptel.ac.in/courses/111102012
2. Nonlinear programming: https://nptel.ac.in/courses/111107104

CSPE502 DEEP LEARNING

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Course Pre-requisite:

- Artificial Neural networks
- Machine Learning

Course Objective:

- To enable design and deployment of deep learning models for machine learning problems.

Course Outcomes:

- To understand basics of deep learning.
- To implement various deep learning models.
- To realign high dimensional data using reduction techniques.
- To analyze optimization and generalization in deep learning.
- To explore the deep learning applications.

UNIT I (9 Hrs)

INTRODUCTION TO MACHINE LEARNING: Linear models (SVMs and logistic regression)- Intro to Neural Nets: Shallow network - Connect and Train a network: loss functions, Back propagation and stochastic gradient descent- Neural networks as universal function approximates.

UNIT II (9 Hrs)

HISTORY OF DEEP LEARNING : A Probabilistic Theory of Deep Learning- Back propagation and regularization- Batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN)- Semi supervised Learning.

UNIT III (9 Hrs)

LINEAR AND MANIFOLDS: Auto encoders and CNN - Introduction to Convent - Architectures – AlexNet, VGG, Inception, ResNet -Training a Convent: Weights initialization, Batch normalization, Hyper parameter optimization.

UNIT IV (9 Hrs)

OPTIMIZATION IN DEEP LEARNING: Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks-LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning.

UNIT V (9 Hrs)

APPLICATIONS OF DEEP LEARNING: Images segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative adversarial networks – Video to Text with LSTM models –Attention models for Computer Vision – Case Study: Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks –Sentence Classification using Convolutional Neural Networks – Dialogue Generation with LSTMs.

List of Experiments:

1. Write a program to implement Support Vector Machine algorithm to classify the iris data set. Print both correct and wrong predictions.
2. Build a simple neural network model for regression.
3. Write a program to implement deep learning Techniques for image segmentation.
4. Build a feed forward neural network for prediction of logic gates.
5. Write a program for Time-Series Forecasting with the LSTM Model.
6. Write a program to predict a caption for a sample image using LSTM.

Text Books:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.
3. CosmaRohillaShalizi, "Advanced Data Analysis from an Elementary Point of View", 2015.

References:

1. Jon Krohn, Beyleveld Grant and Bassens Aglae´, "Deep Learning Illustrated: A Visual, Interactive, Guide to Artificial Intelligence", Addison-wesley, 2019.
2. Hyatt Saleh, "Applied Deep Learning with PyTorch", Packt Publishing, 2019.
3. Pradeep Pujari, Md. and Rezaul Karim, Mohit Sewak, "Practical Convolutional Neural Networks",Packt Publishing, February 2018.
4. Ragav Venkatesan and Baoxin Li, "Convolutional Neural Networks in Visual Computing (Data Enabled Engineering)", CRC Press, September 2017.

ONLINE/ NPTEL Courses:

1. Deep Learning : https://nptel.ac.in/courses/106105215
2. Deep Learning : https://nptel.ac.in/courses/106106201

CSPE503 KNOWLEDGE ENGINEERING

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Course Pre-requisite:

- Basics of Artificial Intelligence

Course Objective:

- To deal with knowledge acquisition, representation, validation, inference, explanation and maintenance.

Course Outcomes:

- To understand the basics of Knowledge Engineering.
- To apply methodologies and modelling for agent design and development.
- To design and develop ontologies.
- To apply reasoning with ontologies and rules.
- To understand learning and rule learning.

UNIT I (9 Hrs)

REASONING UNDER UNCERTAINTY: Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

UNIT II (9 Hrs)

METHODOLOGY AND MODELING : Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT III (9 Hrs)

ONTOLOGIES DESIGN AND DEVELOPMENT: Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching.Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNIT IV (9 Hrs)

REASONIING WITH ONTOLOGIES AND RULES: Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

UNIT V (9 Hrs)

LEARNING AND RULE LEARNING: Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

List of Experiments:

1. Implementation of Missionaries and Cannibals Problem using rule-based approach.
2. Implementation of First Order Logic
3. Implementation of Bayesian networks.
4. Implementation of Semantic Networks.
5. Developing a Fuzzy Inference system
6. Construction of Ontology for a given domain.
7. Implementation of Frames.
8. Develop an expert system for classification of Animals with Property Inheritance
9. Mini Project using Fuzzy Rules and Machine Learning

Text Books:

1. Ela Kumar, "Knowledge Engineering", IK International Publisher House, 2018.
2. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, "Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning", Cambridge University Press, 1st Edition, 2016.

References:

1. Michael K. Bergman,"Knowledge Representation and Reasoning", 2018.
2. King , "Knowledge Management and Organizational Learning", Springer, 2009.
3. Ronald J. Brachman, Hector J. Levesque,"Knowledge Representation and Reasoning", Morgan Kaufmann, 2004.

ONLINE/ NPTEL Courses:

1. Knowledge Management: https://nptel.ac.in/courses/110105076
2. Knowledge Representation and Reasoning: https://nptel.ac.in/courses/106106140

CSPE504 NATURAL LANGUAGE PROCESSING

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Course Pre-requisite:

- Artificial Intelligence and Neural Networks

Course Objective:

- To read, understand and decode human words in a valuable manner.

Course Outcomes:

- To understand given text with basic Language features.
- To design an innovative application using NLP components.
- To implement a rule based system to tackle morphology/syntax of a language.
- To design a tag set to be used for statistical processing for real-time applications.
- To compare and contrast the use of different statistical approaches for different types of NLP applications.

UNIT I (9 Hrs)

INTRODUCTION: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology- Transducers for lexicon and rules- Tokenization, Detecting and Correcting Spelling Errors-Minimum Edit Distanceg.

UNIT II (9 Hrs)

WORD LEVEL ANALYSIS: Unsmoothed N-grams- Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging- Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III (9 Hrs)

SYNTACTIC ANALYSIS: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for gram- mar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG- Probabilistic CYK-Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT IV (9 Hrs)

SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis-Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V (9 Hrs)

DISCOURSE ANALYSIS AND LEXICAL RESOURCES: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer- Lemmatizer- Penn Treebank, Brill's Tagger-WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

List of Experiments:

1. Word Analysis
2. Word Generation
3. Morphology
4. N-Grams Smoothing
5. POS Tagging: Hidden Markov Model
6. POS Tagging: Viterbi Decoding

Text Books:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: "An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014.
2. Steven Bird, Evan Klein and Edward Loper, "Natural Language Processing with Python", O'Reilly Media, 1st Edition, 2009.
3. S.N.Sivanandham and M Paulraj, "Introduction to Artificial Neural Networks", Vikas Pubishing, 2023.

References:

1. Breck Baldwin, "Language Processing with Java and LingPipe Cookbook", Atlantic Publisher, 2015.
2. Richard M Reese, "Natural Language Processing with Java‖", O'Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing", Chapman and Hall/CRC Press,2nd Edition, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

ONLINE/ NPTEL Courses:

1. Applied Natural Language Processing : https://nptel.ac.in/courses/106106211
2. Natural Language Processing : https://nptel.ac.in/courses/106105158

CSPE505 ARTIFICIAL NEURAL NETWORKS

L	T	P	C
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Course Pre-requisite:

- Computer Networks

Course Objective:

- To introduce models of ANN for solving simple pattern recognition problems.

Course Outcomes:

- To understand the building blocks of Neural networks.
- To provide the application areas of neural networks.
- To develop neural network models.
- To provide knowledge of learning networks.
- To design and develop applications using neural networks.

UNIT I (9 Hrs)

INTRODUCTION: Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem- XOR Problem, Multilayer Networks. Learning: Learning Algorithms- Error correction and Gradient Descent Rules- Learning objective of TLNs, Perceptron Learning Algorithm- Perceptron Convergence Theorem.

UNIT II (9 Hrs)

SUPERVISED LEARNING: Perceptron learning and Non Separable sets, alpha -Least Mean Square Learning, MSE Error surface-Steepest Descent Search- μ-LMS approximate to gradient descent- Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Back propagation Learning Algorithm-Practical consideration of BP algorithm.

UNIT III (9 Hrs)

SUPPORT VECTOR MACHINES AND RADIAL BASIS FUNCTION: Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks- Learning in RBFNs- RBF application to face recognition.

UNIT IV (9 Hrs)

ATTRACTOR NEURAL NETWORKS: Associative Learning, Attractor Associative Memory, Linear Associative memory, Hopfield Network- Application of Hopfield Network- Box neural Network, Simulated Annealing, Boltzmann Machine - Bidirectional Associative Memory.

UNIT V (9 Hrs)

SELF-ORGANIZATION FEATURE MAP: Maximal Eigenvector Filtering, Extracting Principal Components Generalized Learning Laws, Vector Quantization, Self organization, Feature Maps, Application of SOM, Growing Neural Gas.

List of Experiments:

1. Write a MATLAB program to plot a few activation functions that are being used in neural networks
2. Generate AND NOT function using McCulloch-Pitts neural net by a MATLAB program
3. Generate XOR function using McCulloch-Pitts neuron.
4. Write a MATLAB program for perceptron net for an AND function with bipolar inputs and targets.
5. Write a MATLAB program to illustrate ART neural network.

Text Books:

1. Satish Kumar,"Neural Networks", McGraw Hill Education,2nd Edition, 2017.

References:

1. B. Yegnanarayana, "Artificial Neural Networks", PHI, 2012.
2. J.M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publications, 2010.

ONLINE/ NPTEL Courses:

1. Neural Networks and Applications : https://nptel.ac.in/courses/117105084
2. Fuzzy Logic and Neural Networks : https://nptel.ac.in/courses/127105006
3. Neural Networks for Signal Processing :https://nptel.ac.in/courses/108108148

CSPE601 INFORMATION SECURITY

L	T	P	C
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Pre-requisite:

- Computer Networks

Course Objective:

- To learn principle concepts of Information security, investigation techniques, security analysis and design with applications.

Course Outcomes:

- To master information security governance, and related legal and regulatory issues.
- To be familiar with how threats to an organization are discovered, analyzed.
- To be familiar with network security threats and counter measures.
- To be familiar with network security designs using available secure solutions (such as PGP, SSL, IPSec, etc).
- To be familiar with advanced security issues and technologies (such as DDoS attack detection and containment, and anonymous communications).

UNIT I (9 Hrs)

FUNDAMENTALS: Introduction to Information Security - Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components , Balancing Security and Access, SDLC, Security SDLC

UNIT II (9 Hrs)

SECURITY INVESTIGATION: Need for Security - Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues.

UNIT III (9 Hrs)

SECURITY ANALYSIS: Risk Management- Identifying and Assessing Risk, Assessing and Controlling Risk, Trends in Information Risk Management, Managing Risk in an Intranet Environment.

UNIT IV (9 Hrs)

LOGICAL DESIGN: Blueprint for Security - Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity.

UNIT V (9 Hrs)

PHYSICAL DESIGN: Security Technology - IDS, Scanning and Analysis Tools, Cryptography - Access Control Devices, Physical Security, Security and Personnel issues.

List of Experiments:

1. Installation of Wire shark, tcpdump and observe data transferred in client-server communication using UDP/TCP and identify the UDP/TCP datagram.
2. Experiment Eavesdropping, Dictionary attacks, MITM attacks
3. Experiment with Sniff Traffic using ARP Poisoning
4. Demonstrate intrusion detection system using any tool.
5. Explore network monitoring tools
6. Study to configure Firewall, VPN

Text Books:

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, 2022.

References:

1. Matt Bishop, Elisabeth Sullivan, Michelle Ruppel, "Computer Security Art and Science", Addison-Wesley/Pearson Education, 2019.
2. Stuart Collier, Mark;Endler, David, "Hacking Exposed", Open University publications, 2nd Edition, 2013.
3. Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 2004.

Online / NPTEL Courses:

1. Cryptography and Network Security- https://archive.nptel.ac.in/courses/106/105/106105162
2. Introduction to Information Security- https://archive.nptel.ac.in/noc/courses/noc15/SEM1/noc15-cs03

CSPE602 MODERN CRYPTOGRAPHY

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Course Pre-requisite:

- Computer security
- Algorithms and Data structures

Course Objective:

- To provide instruction about the concepts of cryptography, Notions of attacks, random oracles, pseudo random permutation, block ciphers and message authentication codes.

Course Outcomes:

- To interpret the basic principles of cryptography and general cryptanalysis.
- To determine the concepts of symmetric encryption and authentication.
- To identify the use of public key encryption, digital signatures, and key establishment.
- To articulate the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
- To express the use of Message Authentication Codes.

UNIT I (9 Hrs)

INTRODUCTION: Basics of Symmetric Key Cryptography- Basics of Asymmetric Key Cryptography, Hardness of Functions- Notions of Semantic Security (SS) and Message Indistinguishability (MI)- Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption- Goldreich-Levin Theorem- Relation between Hardcore Predicates and Trap-door permutations.

UNIT II (9 Hrs)

FORMAL NOTIONS OF ATTACKS: Attacks under Message Indistinguishability- Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability- NM-CPA and NM- CCA2, Inter-relations among the attack model.

UNIT III (9 Hrs)

RANDOM ORACLES: Provable Security and asymmetric cryptography- Hash functions-One-way functions: Weak and Strong one-way functions, Pseudo-random Generators (PRG), Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo random Functions (PRF).

UNIT IV (9 Hrs)

BUILDING A PSEUDO RANDOM PERMUTATION: LubyRackoff Construction- Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.

UNIT V (9 Hrs)

MESSAGE AUTHENTICATION CODES: Left or Right Security (LOR)- Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC- Public Key Signature Schemes- Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes- One-way functions Imply Secure One-time Signatures, Shamir's Secret Sharing Scheme, Formally Analyzing Cryptographic Protocols, Zero Knowledge Proofs and Protocols.

List of Experiments:

1. Implement Feige-Fiat-Shamir identification protocol.
2. Implement GQ identification protocol.
3. Implement Schnorr identification protocol
4. Implement Rabin one-time signature scheme.
5. Implement Merkle one-time signature scheme.
6. Implement Authentication trees and one-time signatures.
7. Implement GMR one-time signature scheme.

Text Books:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", PHI, 8th Edition, 2019.
2. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag, 2015.
3. Wenbo Mao, "Modern Cryptography, Theory and Practice", Pearson Education, 2013.

References:

1. OdedGoldreich, "Foundations of Cryptography", CRC Press, Volume 1 and Volume 2, 2014.

Online / NPTEL Courses :

1. Modern Cryptography- https://onlinecourses.nptel.ac.in/noc22_cs03
2. Cryptography and Network Security- https://nptel.ac.in/courses/106105031

CSPE603 CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES

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Course Pre-requisite:

- Distributed systems
- Cryptography

Course Objective:

- To understand the basics of Blockchain, Bitcoin cryptocurrency, consensus, hyperledger fabric/Ethereum and apply it in various blockchain applications.

Course Outcomes:

- To understand emerging abstract models for Blockchain Technology.
- To identify major research challenges and technical gaps in crypto currency domain.
- To understand the function of Blockchain as a method of securing distributed ledgers.
- To apply hyperledger Fabric and Ethereum platform to implement the Block chain application.
- To explore various applications of Blockchain.

UNIT I (9 Hrs)

INTRODUCTION TO BLOCK CHAIN: Block chain- Public Ledgers, Block chain as Public Ledgers - Block in a Block chain, Transactions- The Chain and the Longest Chain - Permissioned Model of Block chain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT II (9 Hrs)

BITCOIN AND CRYPTOCURRENCY: A basic crypto currency, Creation of coins, Payments and double spending, FORTH – The precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT III (9 Hrs)

BITCOIN CONSENSUS: Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW, Bitcoin PoW, Attacks on PoW, Monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool- Permissioned model and use cases.

UNIT IV (9 Hrs)

HYPERLEDGER FABRIC & ETHEREUM: Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT V (9 Hrs)

BLOCK CHAIN APPLICATIONS: Smart contracts, Truffle Design and issue- DApps- NFT. Block chain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

List of Experiments:

1. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.
2. Create and deploy a block chain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your block chain network.
3. Interact with a block chain network. Execute transactions and requests against a block chain network by creating an app to test the network and its rules.
4. Deploy an asset-transfer app using block chain. Learn app development within a Hyperledger Fabric network.
5. Use block chain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.

Text Books:

1. Bashir and Imran, "Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks",Packet Publishing, 2017.
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media, 2014.

References:

1. Daniel Drescher, "Blockchain Basics", 1st Edition, Apress, 2017
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. "Bitcoin and cryptocurrency technologies: a comprehensive introduction", Princeton University Press, 2016.
3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly Media, 2015.
4. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing, 2018.

Online /NPTEL Courses:

1. Cryptocurrency and Blockchain Technologies- https://onlinecourses.nptel.ac.in/noc22_cs44
2. Blockchain Technologies- https://nptel.ac.in/courses/106104220

CSPE604 DIGITAL AND MOBILE FORENSICS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Cyber Security
- Basics of Knowledge Programming

Course Objective:

- To understand the basics of digital forensics, techniques, crime investigation, forensic readiness, iOS forensics and android forensics.

Course Outcomes:

- To obtain knowledge on digital forensics.
- To know about digital crime and investigations.
- To understand the Origins of forensics Science.
- To investigate, identify and extract digital evidence from iOS devices.
- To investigate, identify and extract digital evidence from Android devices.

UNIT I (9 Hrs)

INTRODUCTION TO DIGITAL FORENSICS: Forensic Science – Digital Forensics, Digital Evidence, Digital Forensics Process, Introduction, Identification Phase, Collection Phase, Examination Phase, Analysis Phase – Presentation Phase

UNIT II (9 Hrs)

DIGITAL CRIME AND INVESTIGATION: Digital Crime – Substantive Criminal Law, General Conditions, Offenses, Investigation Methods for Collecting Digital Evidence, International Cooperation to Collect Digital Evidence.

UNIT III (9 Hrs)

DIGITAL FORENSIC READINESS: Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness, Rationale for Digital Forensic Readiness, Frameworks, Standards and Methodologies, Enterprise Digital Forensic Readiness, Challenges in Digital Forensics

UNIT IV (9 Hrs)

iOS FORENSICS: Mobile Hardware and Operating Systems - IOS Fundamentals, Jail breaking, File System, Hardware, IPhone Security, IOS Forensics, Procedures and Processes,Tools, Oxygen Forensics, MobilEdit, iCloud.

UNIT V (9 Hrs)

ANDROID FORENSICS: Android basics – Key CodesADB, Rooting Android, Boot Process, File Systems, Security, Tools, Android Forensics, Forensic Procedures, ADB, Android Only Tools, Dual Use Tools, Oxygen Forensics MobilEdit, Android App Decompiling.

List of Experiments:

1. Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.
2. Data extraction from call logs using Sleuth Kit.
3. Data extraction from SMS and contacts using Sleuth Kit.
4. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups.
5. Study of Computer Forensics and different tools used for forensic investigation
6. How to Recover Deleted Files using Forensics Tools
7. Find Last Connected USB on your system (USB Forensics)
8. Live Forensics Case Investigation using Autopsy
9. How to Collect Email Evidence in Victim PC
10. Study the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt.
11. Extract installed applications from Android devices.

Text Books:

1. Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", 1st Edition, CRC Press, 2022
2. Andre Arnes, "Digital Forensics", Wiley, 2018.

References:

1. Vacca, J, "Computer Forensics, Computer Crime Scene Investigation", Charles River Media, 2nd Edition, 2005.

Online/ NPTEL Courses:

1. ACM Summer School in Information Security and Forensics-https://nptel.ac.in/courses/128106006

CSPE605 ETHICAL HACKING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer networking
- Information Security

Course Objective:

- To learn the basics of computer based vulnerabilities and to practice tools to perform ethical hacking to expose the vulnerabilities.

Course Outcomes:

- To express knowledge on basics of computer based vulnerabilities.
- To gain understanding on different foot printing, reconnaissance and scanning methods.
- To demonstrate the enumeration and vulnerability analysis methods.
- To gain knowledge on hacking options available in Web and wireless applications.
- To acquire knowledge on the options for network protection.

UNIT I (9 Hrs)

INTRODUCTION: Ethical Hacking Overview - Role of Security and Penetration Testers, Penetration-Testing Methodologies, Laws of the Land - Overview of TCP/IP, The Application Layer, The Transport Layer, The Internet Layer, IP Addressing , Network and Computer Attacks, Malware, Protecting Against Malware Attacks, Intruder Attacks, Addressing Physical Security.

UNIT II (9 Hrs)

FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS: Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering, Footprinting Tools, Network Scanning Concepts, Port-Scanning Tools, Scanning Techniques, Scanning Beyond IDS and Firewall.

UNIT III (9 Hrs)

ENUMERATION AND VULNERABILITY ANALYSIS: Enumeration Concepts - NetBIOS Enumeration, SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts,Desktop and Server OS Vulnerabilities, Windows OS Vulnerabilities, Tools for Identifying Vulnerabilities in Windows, Linux OS Vulnerabilities, Vulnerabilities of Embedded Oss.

UNIT IV (9 Hrs)

SYSTEM HACKING: Hacking Web Servers - Web Application Components, Vulnerabilities, Tools for Web Attackers and Security Testers Hacking Wireless Networks, Components of a Wireless Network, Wardriving, Wireless Hacking, Tools of the Trade .

UNIT V (9 Hrs)

NETWORK PROTECTION SYSTEMS: Access Control Lists - Cisco Adaptive Security Appliance Firewall, Configuration and Risk Analysis Tools for Firewalls and Routers, Intrusion Detection and Prevention Systems, Network-Based and Host-Based IDSs and IPSs, Web Filtering, Security Incident Response Teams, Honeypots.

List of Experiments:

1. Install Backtrack Linux / Metasploitable/ Windows XP.
2. Practice the basics of Foot printing and Reconnaissance.
3. Developing and implementing malwares.
4. Aggregates information from public databases using online free tools like Paterva's Maltego.
5. Information gathering using tools like Robtex.
6. Scan the target using tools like Nessus.
7. View and capture network traffic using Wireshark.
8. Study Sql injection and Session hijacking

Text Books:

1. Patrick Engebretson, "The Basics of Hacking and Penetration Testing" SYNGRESS, Elsevier, 2013.
2. Dafydd Stuttard and Marcus Pinto"The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", Wiley,2011.
3. Michael T. Simpson, Kent Backman, and James E. Corley, "Hands-On Ethical Hacking and Network Defense, Course Technology", Delmar Cengage Learning, 2010.

References:

1. Justin Seitz, "Black Hat Python: Python Programming for Hackers and Pentesters", No Starch Press, 2014.

Online/ NPTEL Courses:

1. Ethical Hacking- https://nptel.ac.in/courses/106105217
2. Computer Networks and internet protocol- https://archive.nptel.ac.in/courses/106 105/106105183/

CSOE001 DATA STRUCTURES

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic programming language

Course Objective:

- To learn data structures concepts, sorting and searching applications, lists, arrays, stacks, queues, trees, graphs, hashing techniques.

Course Outcomes:

- To understand the basics of data structure concepts.
- To understand the concepts of sorting algorithms.
- To understand the concepts of queues and its applications.
- To underdstand the concept of tree and graph
- To develop the applications of data structures with hashing techniques.

UNIT I (9 Hrs)

BASICS: Abstract Data Type(ADT)- Introduction to data structures, representation, implementation. Stack and list- Representing stack- implementation, application, balancing symbols, conversion of infix to postfix expression, evaluating a postfix expression, recursive function call. Linked list ADT- implementation using arrays, limitations, linked list using dynamic variables, linked implementation of stacks, circular list, doubly linked lists.

UNIT II (9 Hrs)

SORTING: Efficiency of sorting- Bubble sort, Quick sort, Selection sort, Heap sort, Insertion sort, Shell sort, Merge sort, Radix sort.

UNIT III (9 Hrs)

QUEUES: Queue abstract data type- Array implementation, Circular queue, linked list implementation of queues, Priority queues, Double ended queues, Multiple stacks and queues, application.

UNIT IV (9 Hrs)

TREES: General trees, Binary tree, traversal methods, Expression trees, Game trees. Binary search trees, AVL trees, Splay trees, B Trees, B+ Trees, Tries, application.

UNIT V (9 Hrs)

HASHING: Introduction, Hash function, methods, Hash table implementation, Rehashing. Graph- Directed and undirected graph, Representation of graphs, Graph traversals: Depth first search, Breadth first search, Transitive closure, Spanning trees, application, Topological sorting.

List of Experiments:

1. Array implementation of Stack, Queue and Circular Queue ADTs
2. Implementation of Singly Linked List
3. Linked list implementation of Stack and Linear Queue ADTs
4. Implementation of Polynomial Manipulation using Linked list
5. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues
9. Implementation of Dijkstra's Algorithm
10. Implementation of Prim's Algorithm
11. Implementation of Linear Search and Binary Search
12. Implementation of Insertion Sort and Selection Sort
13. Implementation of Merge Sort
14. Implementation of Open Addressing (Linear Probing and Quadratic Probing)

Text Books:

1. Mark Allen Weiss, "Data structures and algorithm analysis in C++", Pearson Education, 6th Edition, 2011.
2. YedidyahLangsam, Moshe J Augenstein and Aaron M Tanenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2009.

References:

1. G.A.V.Pai, "Data Structures and Algorithms – Concepts, Techniques and Applications", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Ellis Horowitz and SartajSahni, "Fundamentals of Data structures", Galgotia Publications, New Delhi, 2nd Edition, 2008.
3. Alfred V. Aho, Jeffrey D. Ullman and John E. Hopcroft. "Data Structures and Algorithms", Addison Wesley, 1983

Online/NPTEL Courses:

- Introduction to Data Structures and Algorithms: https://nptel.ac.in/courses/106102064
- Data Structures: https://onlinecourses.swayam2.ac.in/cec19_cs04

CSOE002 FUNDAMENTALS OF DATABASE

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic programming language

Course Objective:

- To learn the fundamental concepts of Database Management System, ER Model for real time projects, Query with constraints, Nested queries and Transactions concepts.

Course Outcomes:

- To understand the Concepts of Database Management System.
- To design ER Model for Real Time projects.
- To understand Query with Constraints.
- To use Nested Queries.
- To understand the Transactions Concepts.

UNIT I (9 Hrs)

INTRODUCTION TO DATABASES AND TRANSACTIONS: Introduction to Database Systems- Overview, Data Models, Database System Architecture, Storage Management, Transaction Management, History of Database Systems, Introduction to Relational Model.

UNIT II (9 Hrs)

ENTITY-RELATIONSHIP MODEL: Basic Concepts, Constraints, Keys, Design Issues, Entity Relationship Diagram, Entity Sets, Design of E-R Database Schema, Case study- ER Modelling.

UNIT III (9 Hrs)

RELATIONAL MODEL: Structure of Relational Databases, Fundamental Relational-Algebra Operations, Additional Relational–Algebra Operations, Extended Relational-Algebra Operations, Null Values, Modification of the Databases.

UNIT IV (9 Hrs)

SQL: Introduction to SQL, SQL Data-Definition language- Basic Query Structure, Create Table Command, Integrity Constraints, Set Operations. Aggregate Functions, Null Values, Nested Sub-Queries, Views, Modification of Database, Joined Relations, Data-Definition Language-Normalization - 1NF, 2NF, 3NF and BCNF.

UNIT V (9 Hrs)

TRANSACTION MANAGEMENT AND CONCURRENCY: Transaction Management, ACID Properties, Serializability and Concurrency Control- Lock-Based Protocols, Recovery System- Failure Classification, Storage Structure, Recovery and Atomicity.

Text Books:

1. Avi Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", McGraw Hill Education, 7th Edition, 2019.
2. C.J. Date, "An Introduction to Database Systems", Pearson Education, 8th Edition, 2019.

Reference:

1. Hugh Darwen, "Introduction to Relational Database Theory", Addison Wesley, 3rd Edition, 2012.
2. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGrawHill, 2003.

Online/NPTEL Courses:

1. Data Base Management System: https://onlinecourses.nptel.ac.in/noc22 cs91
2. Data Base Management System: https://nptel.ac.in/courses/106105175

CSOE003 ESSENTIALS OF OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Course Objective:

- To learn the fundamentals of operating systems, process management, memory management, File, I/O Management, Storage management and Security.

Course Outcomes:

- To understand the fundamentals of operating system, processes.
- To understand the concept of process scheduling, synchronization and system deadlock handling.
- To understand the concepts of memory management and Virtual memory mangement.
- To understand basic file and I/O management techniques.
- To understand mass storage management and system security issues.

UNIT I (9 Hrs)

INTRODUCTION: Introduction to operating systems- Review of computer organization, Operating system structures, System calls, System programs, System structure, Virtual machines. Processes- Process concept, Process scheduling, Operations on processes, Cooperating processes, Inter-process communication, Communication in client-server systems, Concept of threads.

UNIT II (9 Hrs)

PROCESSOR MANAGEMENT: CPU Scheduling- Scheduling criteria, Scheduling algorithms. Process Synchronization- The critical-section problem, Synchronization hardware, Semaphores, Classic problems of synchronization. Deadlock- System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III (9 Hrs)

MEMORY MANAGEMENT: Memory Management- Background, Swapping, Contiguous memory allocation, Paging, Segmentation, Segmentation with paging. Virtual Memory- Background, Demand paging, Page replacement, Allocation of frames, Thrashing.

UNIT IV (9 Hrs)

FILE AND I/O MANAGEMENT: File-System Interface- File concept, Access methods, Directory structure, File system mounting, Protection. File-System Implementation- Directory implementation, Allocation methods, Free-space management, Efficiency and performance, Recovery Log, structured file systems, I/O Systems, I/O Hardware, Application I/O interface, kernel I/O subsystem, streams–performance.

UNIT V (9 Hrs)

STORAGE MANAGEMENT AND SECURITY: Mass Storage Structure- Disk scheduling, Disk management, Swap-space management, RAID, Disk attachment, Stable storage, Tertiary storage, System Protection and Security.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley & Sons(ASIA) Pvt. Ltd, 9th Edition, 2017.
2. D. M. Dhamdhere, "Operating Systems: A concepts based approach", Tata McGraw-Hill Publishing Company Ltd., 2nd Edition, 2006.

References:

1. Harvey M. Deital, "Operating Systems", 3rd3rd Edition, Pearson Education, 2004
2. Andrew S. Tannenbaum and Herbert Bos, "Modern Operating Systems", 4th Edition, Prentice Hall, 2014.

Online/NPTEL Courses:

1. Introduction to Operating System: https://nptel.ac.in/courses/106108101
2. Operating System Fundamentals: https://nptel.ac.in/courses/106105214

CSOE004 FUNDAMENTALS OF CLOUD COMPUTING

L	T	P	C
3	0	0	3

Course Objectives:

- To familiarize the core concepts of cloud computing, characteristics,service and deployment models.
- To design, deploy and manage virtualized resources in cloud environments, virtual machines, storage, and networking components.

Course Outcomes:

- To impart the principles and paradigm of Cloud Computing and understand the Service Model with reference to Cloud Computing.
- To understand the Cloud Computing architecture and implementation.
- To realize the role of Virtualization Technologies and acquire knowledge of how hypervisors are used in Virtual Machines.
- To comprehend Secure and perform identity management in the Cloud and to access and use the services in the Cloud.
- To understand the popular Cloud Service Providers.

UNIT I: (9 Hrs)

INTRODUCTION TO CLOUD COMPUTING: Overview- Roots of Cloud Computing, Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks, Assessing the role of Open Standards.

UNIT II: (9 Hrs)

CLOUD ARCHITECTURE, SERVICES AND APPLICATIONS: Exploring the Cloud Computing Stack, Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, Software as a Service, Identity as a Service, Compliance as a Service, Introduction to Virtualization Technologies, Cloud Management Products.

UNIT III: (9 Hrs)

AWS: Independently manage a Cloud Architecture through AWS Services, create a computing Infrastructure using Scalable Virtual Service, AWS technology into projects, the Amazon S3 Service, Features and Benefits by AWS.

UNIT IV: (9 Hrs)

MICROSOFT AZURE: Getting started with Azure, Websites and Cloud Services, Virtual Machines, Storage, Virtual Networks, Database.

UNIT V: (9 Hrs)

OPEN SOURCE TOOLS: OpenNebula , Eucalyptus, Apache CloudStack, Nimbus, GoGrid Cloud, PaaSmaker, Red Hat OpenShift Origin, Xen Cloud platform, Cloudify, Apache VCL, Google Drive, Google Docs-Dropbox.

Text Books:

1. Buyya R, Broberg J and Goscinski A, "Cloud Computing: Principles and Paradigm", 1st Edition, John Wiley & Sons, 2013.
2. Sosinsky B, "Cloud Computing Bible", 1st Edition, Wiley Edition, 2011.
3. Theo H.King, "AWS - The Ultimate Guide From Beginners To Advanced for the Amazon Web services", 2021.

References:

1. Miller Michael, "Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online", Pearson Education India
2. Smooth S and Tan N., "Private Cloud Computing", Morgan Kauffman , 1st Edition, 2011.
3. Linthicium D, "Cloud Computing and SOA Convergence in Enterprise", Pearson Education India
4. N.Raghavendra Rao,"Enterprise management strategies in the Era of Cloud Computing", Business Science.

ONLINE/NPTEL Courses:

1. Cloud Computing: https://onlinecourses.nptel.ac.in/noc21 cs14
2. Google Cloud Computing Foundation Course: https://nptel.ac.in/courses/106105223

CSOE005 LINUX PROGRAMMING

L	T	P	C
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Course Pre-requisite:

- Opreating Systems

Course Objective:

- To familiarize fundamentals of the Bourne again shell (bash), shell programming, pipes, input and output redirection Control structures, arithmetic in shell interrupt processing, functions, debugging shell scripts and to impart fundamentals of file concepts kernel support for file, File structure related system calls (file API's).

Course Outcomes:

- To use various Linux commands that are used to manipulate system operations at admin level and a prerequisite to pursue job as a Network administrator.
- To apply Shell Programming using Linux commands.
- To design and write application to manipulate internal kernel level Linux File System.
- To develop IPC-API's that can be used to control various processes for synchronization.
- To develop Network Programming that allows applications to make efficient use of resources available on different machines in a network.

UNIT I (9 Hrs)

INTRODUCTION TO LINUX AND LINUX UTILITIES: A brief history of LINUX, Architecture of LINUX, Features of LINUX, Introduction to vi editor. Linux commands- PATH, Man, Echo, Printf, Script, Passwd, Uname, Who, Date, Stty, Pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin.Text Processing utilities and backup utilities , Tail, head , sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio

UNIT II (9 Hrs)

INTRODUCTION TO SHELLS: Linux Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell Environment Customization. Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.

UNIT III (9 Hrs)

GREP: Operation, grep Family, Searching for File Content. Sed- Scripts, Operation, Addresses, commands, Applications, grep and sed - UNIX FILE STRUCTURE- Introduction to UNIX file system, inode (Index Node), File descriptors, System calls and device drivers. File Management - File Structures, System Calls for File Management – create, open, close, read, write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown, Directory API – opendir, readdir, closedir, mkdir, rmdir, umask.

UNIT IV (9 Hrs)

PROCESS AND SIGNALS: Process, Process Identifiers, Process structure- Process table, viewing processes, System processes, Process scheduling, Starting new processes - Waiting for a process, Zombie processes, Orphan process, fork, vfork, exit, wait, waitpid, exec, Signals functions, Unreliable signals, Interrupted system calls, kill, raise, Alarm, Pause, Abort, System, Sleep functions, Signal sets. File locking: Creating lock files, locking regions, Use of read and write with locking, Competing locks, Other lock commands, Deadlocks.

UNIT V (9 Hrs)

INTER PROCESS COMMUNICATION: Pipe, process pipes, The pipe call, Parent and child processes and named pipes - Fifos, Semaphores - Semget, Semop, Semctl, Message queues - Msgget, msgsnd, msgrcv, msgctl, Shared Memory - Shmget, shmat, shmdt, shmctl, ipc status commands. Socket- Socket Connections - Socket Attributes, Socket Addresses, Socket, Connect, Bind, Listen, Accept, Socket Communications.

Text Books:

1. W. Richard. Stevens , "Advanced Programming in the UNIX Environment", Pearson Education, 3rd Edition, 2013.
2. Behrouz A. Forouzan, Richard F. Gilberg.Thomson "Unix and shell Programming", 1st Edition, 2003.

References:

1. Robert Love, "Linux System Programming" O'Reilly Media, 2nd Edition, 2013.
2. W.R.Stevens, "Advanced Programming in the UNIX environment", Pearson Education, 2nd Edition, 2005.
3. W.R. Stevens, "UNIX Network Programming", PHI, 2003.
4. Graham Glass, King Ables,"UNIX for Programmers and Users", Pearson Education, 3rd Edition, 2021.

ONLINE/NPTEL Courses:

1. Linux- https://nptel.ac.in/courses/117106113