Eligibility for Admission

Candidates who have secured 55% of marks or above in B.Tech./ B.E. in Computer Science and Engineering/ Information Technology or M.Sc. in Computer Science/Information Technology/ Software Engineering or equivalent or MCA with Bachelor’s in Computer Science/ Computer Applications/ Information Technology /Mathematics /Statistics/ Physics/ Electronics/ Applied Sciences are eligible for admission.

Duration of the Course

The course shall be of two years’ duration spread over four consecutive semesters. The maximum duration to acquire prescribed number of credits in order to complete the Programme of Study shall be four years.

Medium

The medium of instruction shall be English.

Passing & Classification

Passing & Classification for the award of the M. Tech (Computer Science & Engineering) Degree shall be as per the norms of CBCS System of Pondicherry University.
<table>
<thead>
<tr>
<th>Category</th>
<th>Course Nomenclature</th>
<th>Number of courses</th>
<th>Credits per course</th>
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<th>Remarks</th>
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PONDICHERRY UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE

Master of Technology
(Computer Science and Engineering)

CURRICULUM
(Effective from the academic year 2018-2019)

Note: All Course Codes are to be preceded with ‘CSCE’.
H – Hard Core subject
SH – Supportive Hard Core subject
RS- Restricted Soft core subject
SS- Specialisation Soft core subject
OS-Open Soft core subject

FIRST SEMESTER

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<tr>
<th>S.No</th>
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8. CSCE 628 Pervasive computing lab | H | 0 | 0 | 4 | 0 | 2

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* In case of failure due to lack of attendance or minimum internal marks, the course has to be repeated in the subsequent semester and only after successful completion, CSCE 721 and CSCE 722 could be credited. If failure is due to external marks only, the course can be credited along with CSCE 721 and CSCE 722.
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<td>CSCE 842</td>
<td>Principles of interaction design</td>
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<td>CSCE 843</td>
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<td>22</td>
<td>CSCE 844</td>
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<td>CSCE 871</td>
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<td>Digital Image Processing</td>
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<td>Pattern Recognition</td>
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<td>CSCE 874</td>
<td>Steganography and Digital Watermarking</td>
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<tr>
<td>39</td>
<td>CSCE 876</td>
<td>Content Based Information Retrieval</td>
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CSCE 611 DISCRETE MATHEMATICS

L T P C
3 2 0 3

Pre-requisite:
- Knowledge of functions and basic algebra

Objectives:
- Introduce the mathematical concepts fundamental to computer science.
- To illustrate the applications of mathematical concepts to computer science

Module-I: Basic Structures: Sets, Functions, Sequences, Sums, and Matrices  6 hrs
Sets – Set Operations – Functions – Sequences and summation – cardinality – Matrices

Module-II: Number theory  8 hrs
Divisibility and modular arithmetic – Integer representations and algorithms – Prime and GCD – Congruences and applications – cryptography.

Module-III: Induction and Recursion  8 hrs
Mathematical induction – strong induction and well ordering – recursive definition and structural induction – recursive algorithms – program correctness

Module-IV: Counting  8 hrs
Basics – Pigeon hole principle – Permutations and combinations – binomial coefficients - Generalized Permutations and combinations

Module-V: Advanced Counting Techniques  10 hrs
Recurrence relations – solving – applications – Divide and conquer – generating functions – inclusion – exclusion – applications

Text Book:

Reference Books:

Web resources:
2. NPTEL Course on Discrete Mathematics : https://nptel.ac.in/courses/111107058/#
CSCE 612 PROBABILITY AND STATISTICS

Pre-requisite:
- Set Theory and Calculus

Objectives:
- To learn and understand random variables that describe randomness or an uncertainty in certain realistic situations.
- To understand the types of sampling distributions and transformations.
- To understand the framing and testing of hypothesis.

Module-I: 10 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.
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-II: 8 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-III: 6 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.

Module-IV: 8 hrs
Estimation: Concepts of Unbiasedness, consistency and sufficiency, Methods of estimation - maximum likelihood estimation, Interval estimation, confidence intervals for mean and variance - problems.

Module-V: 8 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.
Reference Books:

CSCE 613 NETWORK CONFIGURATION AND MANAGEMENT

Pre-requisite:

- Complete knowledge about Operating System and Computer Network

Objectives:

- Students learn how to implement and administer common operating systems environments. They gain experience in systems administration functions and issues as well as network services. Students develop a conceptual understanding of each operating system function and network service and learn how to plan, implement, and administer each. Topics include user access and privileges, DHCP, DNS, remote access, file and print, update and patch management, security and network management services

Module-I: Introduction 8 Hrs

Module-II: Network Configuration 10 Hrs
IPv4 and 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: Web, Proxy, Mail Server Configuration and Management 10 Hrs
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: Remote Administration and Management 5 Hrs

Module-V: Techniques for Network Management 9 Hrs
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, Second Edition

Reference Book(s):
Pre-requisite:
Basic Knowledge in
• Algorithm design and analysis techniques
• Data Structures
• Mathematical techniques

Objectives:
Understanding of
• Randomized algorithms
• Graph algorithms
• Parallel algorithms

Module-I: Introduction 8 hrs

Module II: Divide and Conquer, Randomized Algorithms 8 hrs

Module III: Advanced Design and Analysis Techniques 8 hrs

Module IV: Probabilistic and parallel Algorithms 8 hrs

Module V: String matching and approximation algorithms 8 hrs
Text Book(s):

Reference Book(s):
CSCE 615 INTERNET AND WEB TECHNOLOGIES

Pre-requisites:
- Basic Understanding of Computer Programming.

Course Objectives:
- Getting familiar with Full Stack of Web development.
- Understanding the components of Web Design and Development.
- Acquiring skills on developing effective web applications.

Module I:

Module II:
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:

Module IV:
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: Web Application Security

Ref Books:

Web Resources:
1. https://github.com/MilanAryal/web-development-resources
4. https://www.w3schools.com/ MOOC NPTEL Course on Internet Technology : http://nptel.ac.in/courses/106105084/
Skills to be acquired:
  • Administration of web server, proxy server, e-mail server, remote monitoring of server, etc.

Lab Software Requirements:
  • Open source network management tools

List of Exercises:
  1. Server/Client Installation over VMware Environment
  2. Packet Analysis by using TCPDUMP and WIRESHARK
  3. Network Practice with Packet Tracer
  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
Skills to be acquired:

- Designing and developing web pages / applications.

Lab Software Requirements:

- Open Source Web Development tools.

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.
Pre-requisite:

- Nil

Objectives:

- To introduce graphs as a powerful modelling tool that can be used to solve practical problems in various fields

Module-I:

8 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:

8 hrs


Module-III:

8 hrs

Planar Graphs and Colouring: Planar Graphs – Dual Graphs - Euler’s Formula – Kurotowski’s Theorem - Applications. Edge Colouring- Chromatic Number, Vizing’s Theorem- Timetabling Problem – Vertex Colouring – Chromatic Number- Brook’s Theorem

Module-IV:

8 hrs

Directed graphs: Concepts-Directed walks-paths-cycles-orientation of graph-Job Sequencing problem-tournaments- Applications

Module-V:

8 hrs


Textbooks:


Reference Books:

CSCE 622 RESEARCH METHODOLOGY

Pre-requisite:
- Nil

Objectives:
- Learn to focus on a research problem using scientific methods
- Learn research design methods
- Learn the art of report and thesis writing

Module-I: Objectives and types of research
Motivation and objectives – Research methods vs Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical

Module-II: Research Formulation
Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs-patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis.

Module-III: Research design and methods
Research design – Basic Principles- Need of research design — Features of good design – Important concepts relating to research design – Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models. Developing a research plan - Exploration, Description, Diagnosis, and Experimentation. Determining experimental and sample designs.

Module-IV: Reporting and thesis writing

Module-V: Application of results and ethics
Environmental impacts - Ethical issues - ethical committees - Commercialisation – Copy right – royalty - Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights – Reproduction of published material – Plagiarism - Citation and acknowledgement - Reproducibility and accountability.
Text Book(s):

Reference Book(s):
5. Fink, A., Conducting Research Literature Reviews: From the Internet to Paper. 2009, Sage Publications
CSCE123 DATA MINING AND BIG DATA

L T P C
3 1 2

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 analyze and interpret streaming data

Module-I: Introduction to data mining

8 hrs

Why Data mining-KDD versus data mining, Stages of the Data Mining Process—Issues- Getting to know your data- Data Preprocessing - Data Warehousing and OLAP.

Module-II: Mining Associations, Classification and Clustering

8 hrs

Apriori algorithm- 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 divisive clustering, Density-Based Methods - Grid Based Methods - Model-Based Clustering Methods- Clustering high dimensional data– Outlier Analysis.

Module-III: Data mining and large scale files

8 hrs

Introduction to Statistical modeling – Machine Learning – Computational approaches to modeling – Summarization – Feature Extraction – Statistical Limits on Data Mining - Distributed File Systems – Map-reduce – Algorithms using Map Reduce

Module-IV: Mining Data Streams

8 hrs

Stream Data Model – Sampling Data in the Stream – Filtering Streams – Counting Distance Elements in a Stream – Estimating Moments – Counting Ones in Window – Decaying Windows

Module-V: Applications

8 hrs

Mining complex data objects – Spatial databases – Temporal databases – Multimedia databases — Case study Recommendation systems – Mining social networks

Laboratory Components:

Skills to be acquired:

- Implementation of data mining algorithms
- Implementation of big data mining concepts

List of S/W requirements
- Weka, R language, Python
- Hadoop, spark

**Text Book(s):**

Pre-requisite:
• Knowledge of Computer Networks

Objectives:
• Learn the underlying engineering principles that make pervasive computing work.
• To get an in-depth understanding about the most dynamic technologies like mobile computing, service discovery, context aware computing and security issues in mobile & pervasive computing.

Module-I: Introduction to Mobile Computing             7 hrs

Module-II: Context Aware Computing                    10 hrs

Module-III: Adhoc & Sensor networks            6 hrs

Module-IV: Protocols                               8 hrs

Module-V: Wireless Security                       8 hrs

Text Book(s):

Reference Book(s):
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

List of exercise
  • Implementing classification and clustering algorithms
  • Analysis of the algorithms
  • Implementing mining algorithms on data streams
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 devices.

Lab Software Requirements:
- Open Source Development tools.
- J2ME
- NS3

List of Exercises:
- Study of mobile application development platform and tools.
- Design and develop pervasive applications.
Prerequisite:
- Nil

Objectives:
- This course provides practical foundation level training that enables immediate and effective participation in big data projects. The course provides grounding in basic and advanced methods to big data technology and tools, including MapReduce and Hadoop and its ecosystem.

Module I: Introduction to Big Data (8 hours)
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 Introduction to Hadoop (8 hours)
Big Data – Apache Hadoop&HadoopEcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

Module III Hadoop Architecture (8 hours)
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 Hadoop Ecosystem and Yarn (8 hours)
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 HIVE AND HIVEQL, HBASE (8 hours)
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 - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.

References:
CSCE 812 STATISTICS FOR DATA ANALYTICS

Objectives:

- This course teaches fundamental concepts and tools needed to understand the emerging role of business analytics in organizations.

MODULE I  Data Analytics Life Cycle (9 Hours)

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  Statistics (9 Hours)

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  Probability and Hypothesis Testing (9 hours)


MODULE IV  Predictive Analytics (9 hours)

Predictive modeling and Analysis - Regression Analysis, Multicollinearity , Correlation analysis, Rank Correlation coefficient, Multiple correlation, Least square, Curve fitting and good ness of fit.

MODULE V  Time Series Forecasting and Design Of Experiments (9 Hours)

Forecasting Models for Time series : MA, SES, TS with trend, season - Design of Experiments, one way Classification, two way classification, ANOVA, Latin square, Factorial Design.

Reference books:

Prerequisite:
- Nil

Objectives:
- The purpose of this course is to introduce the students into the field of Multivariate Techniques for analyzing large volumes of data and to take decisions based on inference drawn.

MODULE I: Introduction to Multivariate Analysis (9 Hours)
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: Factor Analysis (9 hours)
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: Cluster Analysis (9 hours)
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: Discriminant Analysis (9 hours)
Discriminant Analysis- concept, objective and applications. Procedure for conducting discriminant analysis. Stepwise discriminate analysis and Mahalanobis procedure. Logit model.

MODULE V: Linear Programming (9 hours)

References:
Prerequisite:
- Basic knowledge in statistics

Objectives:
- To learn data analysis techniques.
- To understand Data mining techniques and algorithms.
- Comprehend the data mining environments and application.

**MODULE I** INTRODUCTION TO DATA MINING 7 hrs
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** CLASSIFICATION AND CLUSTERING 7 hrs
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 divisive clustering - Density-Based Methods – Expectation maximization -Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis.

**MODULE III** DATA MINING SOFTWARE AND APPLICATIONS 7 hrs
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** PREDICTION OF QUANTITATIVE VARIABLES 7 hrs

**MODULE V** METHODS OF INTERNAL ANALYSIS 8 hrs

**Reference Book(s):**


Prerequisite:
- Basic knowledge in AI

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
- To apply reinforcement learning techniques

MODULE I


MODULE II


MODULE III


MODULE IV


MODULE V


Reference Book(s):

Prerequisite:
- Basic knowledge in machine learning

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
- To apply reinforcement learning techniques

MODULE I
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


MODULE III
Convolutional Neural Networks - Neurons in Human Vision - The Shortcomings of Feature Selection - Vanilla Deep Neural Networks Don’t Scale - Filters and Feature Maps - Convolutional Layer- Max Pooling - Architectural Description - MNIST with Convolutional Networks - Image Preprocessing Pipelines - Building a Convolutional Network for CIFAR-10 - Visualizing Learning - Leveraging and learning Convolutional Filters


MODULE IV

Memory Augmented Neural Networks - Neural Turing Machines - Attention-Based Memory Access - NTM Memory Addressing Mechanisms - Differentiable Neural Computers - Interference-Free Writing in DNCs - DNC Memory Reuse - Temporal Linking of DNC Writes - Understanding the DNC Read Head - The DNC Controller Network - Visualizing - Implementing, Teaching DNC

MODULE V


Reference Book(s):

1. Nikhil Buduma, Fundamentals of Deep Learning, Designing Next Generation Machine Intelligence Algorithms, O'Reilly publications, June 2017

Web Resources

1. https://github.com/joanbruna/stat212b
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.

Module-I: Testing Environment And Test Processes 9 hours


Module-II: Testing Techniques And Levels Of testing 9 hours


Module-III: Incorporating Specialized Testing Responsibilities 9 hours


Module-IV: Test Automation 9 hours


Module-V: Software Testing And Quality Metrics 9 hours

- 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):**

**Reference Book(s):**
CSCE 822 AGILE SOFTWARE PROCESS

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

Module-I: INTRODUCTION 8 hours

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: AGILE AND ITS SIGNIFICANCE 8 hours


Motivation: The facts of change on software projects – Key motivations for iterative development – Meeting the requirements challenge iteratively – Problems with the waterfall.


Module-III: AGILE METHODOLOGY 8 hours


Module-IV: CASE STUDY 8 hours

Module-V: AGILE PRACTICING AND TESTING 8 hours

Practice: Project management – Environment – Requirements – Test – The agile alliances – The manifesto – Supporting the values

Agile testing: Nine principles and six concrete practices for testing on agile teams.

Text Book(s):

Reference Book(s):

Web Resources:
1. www.agileintro.wordpress.com/2008: Agile Introduction For Dummies
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.

Module-I: 9 hours


Module-II: 9 hours


Module-III: 9 hours


Module-IV: 9 hours


Module-V: 9 hours

Text Book(s):

Reference Book(s):
Pre-requisite:
• Knowledge in Software Engineering

Objectives:
• This course is intended to provide the students with an overall view over Software Engineering Discipline and with insight into the processes of software development.
• To understand the various methods of Cost Estimation.
• To Study about Software Quality Management.
• To Study about Software Metrics

Module-I: 9 hours


Module-II: 9 hours


Module-III: 12 hours


Module-IV: 12 hours


Module-V: 12 hours

Text Book(s):
   Tenth Reprint, 2011.

Reference Book(s):
Pre-requisite:

- Knowledge in Software Engineering.

Objectives:

- Understand software architectural requirements and drivers.
- Be exposed to architectural styles and views.
- Be familiar with architectures for emerging technologies

Module-I: 9 hours


Module-II: 9 hours

**Quality Attribute Workshop:** Quality Attribute Workshop – Documenting Quality Attributes – Six part scenarios – Case studies.

Module-III: 9 hours


Module-IV: 9 hours

**Architectural Styles:** Introduction – Data flow styles – Call-return styles – Shared Information styles – Event styles – Case studies for each style.

Module-V: 9 hours

**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):**


**Reference Book(s):**
CSCE 826 SOFTWARE QUALITY ASSURANCE

Pre-requisite:
- Knowledge in Software Engineering

Objectives:
- To understand the basic tenets of software quality and quality factors.
- Be exposed to the Software Quality Assurance (SQA) architecture and the details of SQA components
- Understand of how the SQA components can be integrated into the project life cycle.
- Be familiar with the software quality infrastructure.
- Be exposed to the management components of software quality.

Module-I: 9 hours


Module-II: 9 hours


Module-III: 9 hours

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 hours


Module-V: 9 hours

Text Book(s):

Reference Book(s):
Pre-requisite:
• Exposure to AI

Objectives:
• To learn the basics of Cognitive Science with focus on acquisition, 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 neuroscience in the cognitive field

Module-I: Introduction to Cognitive Science 8hrs

Module-II: Cognitive Psychology 8hrs

Module-III: Language Acquisition, Semantics and Processing Model 8hrs

Module-IV: Integration Challenge 10hrs

Module-V: Tools 6hrs
Working with Concept Maps – Scribe Note making tools

Text Book(s):
Pre-requisite:
- Exposure to AI, formal languages, logic and programming

Objectives:
- Explore various representation formalisms and algorithms for reasoning

Module-I: Logic and Inferences 8hrs


Module-II: Concepts and Language 8hrs


Module-III: Structured Knowledge Representation 8hrs


Module-IV: Reasoning 8hrs

Knowledge Based Reasoning - Case Based reasoning – Default reasoning – Qualitative reasoning – Probabilistic reasoning – Stochastic Actions – Combining Evidences to form Beliefs

Module-V: Languages and Tools 8hrs

Working with LISP ,Prolog – RDF Tools – Ontology tools – SPARQL Implementation

Text Book:
Pre-requisite:
- Nil

Objectives:
The subject aims to introduce students to
- Fundamentals of key intelligent systems technologies including knowledge-based systems, neural networks, fuzzy systems, and evolutionary computation, and
- Practice in integration of intelligent systems technologies for engineering applications.

Module-I: Introduction 5 hrs

Module-II: Artificial Neural Networks 10 hrs

Module-III: Evolutionary computation 10 hrs
Representation: Chromosomes-fitness functions- selection mechanisms -Genetic algorithms: crossover and mutation - Genetic programming - Evolution strategies

Module-IV: Hybrid Intelligent Systems 10 hrs
Neural expert systems -Neuro-fuzzy systems -Evolutionary neural networks

Module-V: Applications and case studies 5 hrs
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, 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:

Reference Books:
Pre-requisites:
- Knowledge about data structures and algorithms

Objective:
- Understanding the various problem solving approaches
- Understanding the knowledge representation and reasoning techniques
- Understanding the handling of uncertain knowledge

Module-I: INTRODUCTION TO PROBLEM SOLVING 8 hrs


Module-II: Beyond Classical Search 8 hrs

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: Knowledge Representation 8 hrs

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: Uncertain knowledge and reasoning 8 hrs


Module-V: Probabilistic Reasoning over Time 8 hrs

Time and Uncertainty, Inference in Temporal Models, Hidden Markov Models, Kalman Filters, Dynamic Bayesian Networks, Keeping Track of Many Objects, Combining Beliefs and Desires

**Text Book(s):**

**Reference Book(s):**
Pre-requisite:

- Mathematical Methods for Computer Science,
- Logic and Proof,
- Knowledge of Programming
- Machine Learning

Objectives:

At the end of the course, students should be

- able to tag a given word with basic language processing features
- be able to discuss the current and likely future performance of several NLP applications;
- be able to describe briefly a fundamental technique for processing language for several subtasks, such as morphological processing, parsing, word sense disambiguation etc.;
- Understand how these techniques draw on and relate to other areas of computer science.

Module-I: Introduction to NLP


Module-II: Speech Tagging and Transducers


Module-III: 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: Semantic Analysis


Module-V: Case Studies and Applications

**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):**


**Reference Book(s):**


**Web Resources:**

Pre-requisites:
- Mathematical Foundation of Computer Science
- Basics of Machine Learning

Objectives:
- To understand agents, principles and applications
- Design, build and program simple autonomous robots.

Module-I: Agents, Paradigms, Sensors (9 hrs)
Intelligent agents-Search overview-Adversarial search-Constraint satisfaction-Paradigms: Hierarchical, Reactive-Types of Sensors-Vision

Module-II: Knowledge representation, reasoning and planning (9 hrs)
Predicate logic-Fuzzy logic-Classical planning-Planning and acting in real world-Navigation

Module-III: Learning (9 hrs)
Decision making-Learning from examples-Knowledge in learning-Learning probabilistic models-Reinforcement learning-Deep learning

Module-IV: Robot Programming (9 hrs)
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: Industrial Applications and Case Studies (9 hrs)

Text Books:

Reference Books:
Pre-requisites:
• Basic Understanding of Graphical User Interface.

Course Objectives:
• Understanding the components of Human Computer Interaction
• Understanding the basics of interaction design
• Understanding the fundamentals of Universal design

Module I: The Components

Module II: The Interaction

Module III:

Module IV:

Module V: 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:

Reference Book:

MOOC
1. NPTEL Course on Human Computer Interaction (HCI) :
   http://nptel.ac.in/courses/106103115/
Pre-requisites:
- Basic Understanding of Human-Computer Interaction methodology and GUI styles

Course Objectives:
- Focuses on creating interfaces, systems, and devices revolving around user behavior.
- Explores the interaction design process, explains how interaction designers work and the tools they use, and details the essential principles of interaction design

Module - I

Module - II

Module - III

Module - IV

Module-V

Text book:
Reference books:
CSCE 843 WEB ACCESSIBILITY

Pre-requisites:
- Basic Understanding of Web Technologies.

Course Objectives:
- Understanding the components of web accessibility
- Understanding Accessibility standards and Evaluation Processes.
- Acquiring skills to evaluate and make the web contents accessible.

Module I: Introduction


Module II: Web Content Accessibility Guidelines


Module III: Universal Design of Components


Module IV: WAI–ARIA and Other Standards


Module V:


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:

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
Pre-requisites:

- Basic Knowledge of mobile computing and distributed systems

Course Objectives:

- Getting familiar with the components of Context aware computing
- Acquiring skills to build context aware applications

Module I


Module II


Module III

Context aware mobile software agents – Context-aware addressing and communication for people, things and Software agents.

Module IV

Context aware sensor networks – Context awareness and mirror-world models – Constructing context aware pervasive systems: Declarative approaches and design patterns.

Module V


References:

CSCE 845 DATA VISUALIZATION

Pre-requisites:
- Basic Understanding of Interaction design.
- Basic Understanding of Programming

Course Objectives:
- Understanding the Objectives of Data Visualization
- Acquiring skills in professional data visualization techniques
- Understanding the fundamentals of Universal design

Module I: 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:

Module III:

Module IV:

Module V: Universal Design

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 visualization mechanisms such as Dendrogram, Node-link tree etc.

Text Book:
2. Mico Yuk. Data Visualization For Dummies

Web Resources:

(Interactive Data Visualization for the web – Open Book)
CSCE 846 SOCIAL COMPUTING SYSTEMS

Pre-requisites:

- Basic Understanding of HCI Concepts

Course Objectives:

- Understanding the components of Social computing systems.
- Acquiring skills to analyse the social network data.

Module I:

Module II:

Module III:

Module IV:
Opinion Formation Models – Cultural and language dynamics – crowd behavior patterns – Hierarchies formation – Propagation models in social networks; Advertisements and social network systems.

Module V:
Statistical tools to analyze social network data – Sentiment analysis – Recommendation systems – Link prediction in social networks.

Ref Books:

2. Robert Hanneman and Mark Riddle. Introduction to social network methods. Online Open Book.
**MOOC:**

https://www.coursera.org/learn/social-computing
CSCE 851 AUTOMATA, COMPUTABILITY AND COMPLEXITY

Pre-requisite:

- Knowledge of discrete mathematics, proofs, data structures and algorithms

Objectives:

- Introduce concepts in automata theory, design recognizers for different formal languages, and determine decidability and complexity of computational problems.

Module-I: Introduction to theory of computation and Finite Automata 10 hrs


Module-II: Regular Language (RL), Regular Grammar, Properties of RL 8 hrs


Module-III: Simplification of Context Free Grammars & Normal Forms 8 hrs

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: Properties of CFL and Turing Machines 6 hrs

Pumping lemma – closure properties

Turing machines (TM) – the standard TM – Turings’ thesis – Linear Bounded Automata

Module-V: Algorithmic computation 8 hrs

Problems that cannot be solved by TM – Undecidable problems for recursively enumerable and context-free languages- Post correspondence problem

Computational complexity

Efficiency of computation – TM and complexity – language families and complexity classes – complexity classes P and NP.

Text Book:

Reference Books


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 2 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

Module-I: Introduction 8 hrs

Objective – History – Terminology – Propositions, Beliefs and declarative sentences – Contradictions - Formalization – Formalizing the language – Extending the language

Module-II: Propositional Logic 8 hrs

Formulas, Models, Tableaux – Deductive systems – Resolution – Binary Decision Diagrams -

Module-III: First order Logic 8 hrs

Formulas, Models, Tableaux – Deductive systems - Gentzen system – Hilbert system – C-Rule - Formulas to Logic, Horn clauses in SLD resolution – Search Rules

Module-IV: Temporal Logic 8 hrs

Introduction – Syntax and semantics – Models of Time – Linear Temporal Logic – Binary temporal operators and its Axioms

Module-V: Tools 8 hrs

Working with Prolog programs – Standard ML programs

Text Books:

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:
At the end of the course the student will be able to
- Understand the fundamental concepts of Complexity theory
- Provide the concepts of complexity classes and reduction problems
- Enumerate NP-complete and NP-equivalent problems
- Discuss complexity of approximation problems and black box problems
- Describe communication complexity

Module-I : INTRODUCTION (8 hours)

Module-II : COMPLEXITY CLASSES & REDUCTIONS (8 hours)

Module-III : NP-COMPLETE AND NP-EQUIVALENT PROBLEMS (8 hours)

Module-IV : COMPLEXITY OF APPROXIMATION PROBLEMS (8 hours)
Complexity of Approximation Problems: Complexity Classes – Approximation Algorithms – Approximation-Preserving Reductions. Complexity of Black Box Problems: Black Box Optimization

Module-V : COMMUNICATION COMPLEXITY (8 hours)
The Communication Game – Nondeterministic Communication Protocols – Communication Complexity and VLSI Circuits – Communication Complexity and Computation Time

Text Book(s):


Reference Book(s):

CSCE 854 COMPUTABILITY THEORY

Pre-requisite:

- Exposure to Automata Theory and basic logic

Objectives:

- To learn the basics of mathematical logic and computability
- To apply those concepts in various computer science domain

Module-I: Computability Theory 8 hrs

Enumerability – Diagonalization – Turing Computability – Uncomputability – Abacus Computability – Recursive functions – Recursive sets and relations – Equivalent definitions of computability

Module-II: Logic 8 hrs

First order Logic – Syntax and Semantics – Undecidability of First Order Logic – Monadic and Dyadic Logic – Second order Logic- Modal Logic and Provability

Module-III: Logic Proofs 8 hrs

Models - The Existence of models – Proofs and completeness – Indefinitability, undecidability, Incompleteness – Unprovability of consistencey

Module-IV: Logic Theorems 8 hrs

Normal Forms – Disjunctive and Prenex Normal forms – Skolem Normal Form - Herbrand’s Theorem - Craig Interpolation Theorem – Ramsey’s Theorem

Module-V: Tools 8 hrs

Working with Prolog – IDP – FLORID - MOLTAP

Text Book:


Reference Book:

CSCE 855-ADVANCED COMPILER DESIGN

Pre-requisite:
- Knowledge of data structures, algorithms, compilers, architecture, assembly language programming

Objectives:
- Discuss advanced issues in the design and implementation of compilers

Module-I:
Compilers and Scanner - 10hrs
Overview of compilation – compiler structure – Translation - Introduction to Scanners – Regular expressions – Scanner – Implementing scanners

Module-II: Parser and Context sensitive analysis 10 hrs
Expressing syntax – top down parsing – Bottom Up Parsing – Practical issues
Type systems – attribute grammar framework – Adhoc SDT

Module-III: Intermediate Representation and Optimization 10 hrs
Graphical IR – Linear IR – Mapping values to names – Symbol Table
Scope of optimization – Local – Regional – global – Interprocedural optimization

Module-IV: Data flow analysis and Scalar optimization 8 hrs
Iterative data flow analysis – Single static assignment - Interprocedural analysis
Useless code elimination - code motion – specialization – redundancy elimination – other transformations

Module-V: Instruction selection, scheduling and register allocation 10 hrs
Code generation – tree pattern matching – peephole optimization
Instruction scheduling – local list – Regional scheduling
Register allocation – issues – local allocation – global allocation

Text Book:

Reference Book:

CSCE 861 DESIGN OF MODERN HEURISTICS

L  S  P  C
3  2  0  3

- **Pre-requisite:** Knowledge of fundamental concepts of Designing Strategies, Complexity analysis of Algorithms, followed by problems on Graph Theory and Sorting methods.

- **Objectives:** To enable the students to understand and appreciate and to design application and to learn and practise the optimization techniques.

**Module-I:** Optimization Problems 9 hours


**Module-II:** Optimization Methods 10 hours


**Module-III:** Design elements and Principles 9 hours


**Module-IV:** Search Strategies 9 hours

Local Search Methods - Recombination-Based Search - Genetic Algorithms, Estimation of Distribution Algorithms, Genetic Programming

**Module-V:** Case Study 8 hours

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):**


**Reference Books:**

Pre-requisite:
- Programming competence.
- An Algorithms course should suffice.
- A general course in artificial intelligence is desirable, but not necessary

Objectives:
- To master the basics of EA
- To learn the techniques for solving optimization problems through EA

Module-I: Introduction to EA 5 hours
EA Basics: Introduction to Evolutionary Computation: Biological evolution and genetics-artificial evolution, Basics of optimization and search space, evolutionary computation and AI, - The Historical Development of EC Classes 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: Genetic Algorithm 10 hours
The Schema Theorem in GA - Building Block Hypothesis - Applications of GA in Engineering problems, job shop scheduling and routing problems

Module-III: Advanced operators and techniques in Genetic Algorithm 8 hours
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: Genetic Programming 8 hours
Genetic programming and how it differs from GA., The creation and regeneration of populations: crossover, mating, and reproduction Classic GP problems and their solutions: Santa Fe Trail, Symbolic regression, boolean circuit design.

Module-V: Multi-objective Optimization 8 hours
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):

**Reference Book(s):**

CSCS 863 LINEAR OPTIMIZATION

Pre-requisite:

- Basic Mathematical Knowledge

Objectives:

- To enable the students to become a sophisticated practitioner of (linear) optimization, or a researcher.

Module-I: Introduction to Linear Programming 9 hours

Module-II: Simplex Method 9 hours

Module-III: Duality theory and Sensitivity analysis 11 hours

Module-IV: Large scale Optimization 8 hours
Delayed column generation–The cutting stock problem–Cutting plane methods – Dantzig-Wolfe decomposition– Stochastic programming and Benders decomposition

Module-V: Network flow problems 8 hours

Text Books:


Reference Books:
CSCE 864 NATURE INSPIRED ALGORITHMS

L S P C
3 2 0 3

- **Pre-requisite:**
  *Basic Knowledge of optimization theory*

- **Objectives:**
  *To enable the students to understand and appreciate the design of nature inspired algorithms and to explore the Meta-heuristic techniques.*

**Module-I:** Single solution based Meta-heuristics 9 hours


**Module-II:** Evolutionary Algorithms 7 hours


**Module-III:** Swarm Intelligence 10 hours

Swarm Intelligence – ACO Algorithm - PCO Algorithm – Bacterial Optimization – Ant and Bee Colony Optimization based Algorithm – Bio-Geography Based Optimization - Accelerated PSO - Convergence Analysis: Dynamical Systems, Markov Chain Approach - Binary PSO

**Module-IV:** Physics and Chemistry based Algorithms 9 hours

Quantum computational complexity and chemistry - Digital quantum simulation - Hybrid Algorithm – Krill Herd (KH) algorithm

**Module-V:** Case studies 10 hours

Simulated annealing – Particle swarm Optimization – Differential Evolution - Firefly algorithm - Cuckoo search – Bat algorithm – Flower pollination algorithm

**Reference Books:**


**Web Resources:**

CSCE 871 ADVANCES IN COMPUTER GRAPHICS

Pre-requisite:
• Nil

Objectives:
▪ Learn basic and fundamental computer graphics techniques.
▪ Learn image synthesis techniques;
▪ Examine applications of modeling, design and visualization.
▪ Learn different color modeling and computer animation
▪ Learn hierarchical modeling and graphing file formats.

Module-I: Introduction 10 hrs
Introduction to interactive computer graphics-2D-3D,Visible-Surface Detection Methods

Module-II: Illumination Models and Surface 10 hrs
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-III: Color models 10 hrs

Module-IV: Animation 10 hrs
Raster methods, Design of animations sequences, Traditional techniques, General computer-animation functions, languages, Key-frame systems, Motion specification, Articulated figure animation, Periodic motions

Module-V: Hierarchical modeling and Graphics file formats 10 hrs
Basic modeling concepts, packages, General hierarchical modeling methods, Image-File configurations, Color-reduction methods, File-compression techniques, Composition of the major file formats.

Text Book(s):

Reference Book(s):
CSCE 872 DIGITAL IMAGE PROCESSING

Pre-requisite:
• Nil

Objectives:
• To understand the image fundamentals and mathematical transforms necessary for image processing and 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.
• To introduce the concepts of image registration and image fusion.
• To analyze the constraints in image processing when dealing with 3D data sets.

Module-I: Introduction to DIP 10 hrs

Module-II: Image Enhancement in the Spatial Domain 10 hrs

Module-III: Image Restoration 10 hrs

Module-IV: Color Fundamentals 10 hrs
Image Compression: Fundamentals, Image Compression Models, Error-free (Lossless) compression, Lossy Compression.

Module-V: Image Segmentation 10 hrs
Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

Text Book(s):
Reference Book(s):
Pre-requisite:

- Nil

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 and feature extraction.
- To study the principles of decision trees and clustering in pattern recognition.

Module-I: Introduction 10hrs
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: Representation 10hrs
Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.

Module-III: Nearest Neighbor based classifiers & Bayes classifier 10hrs
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: Decision Trees 10hrs
Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over-fitting & Pruning, Examples.

Module-V: Clustering 10hrs
Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy’s, k-means, Isodata), clustering large data sets, examples.

Text Book(s):


Reference Book(s):


CSCE 874 STEGANOGRAPHY AND DIGITAL WATERMARKING

L S P C
Pre-requisite:
- Basic knowledge of security

Objectives:
To make the student
- understand the importance of information hiding
- analyse various steganographic techniques
- learn the various watermarking techniques

Module-I: Introduction to Information hiding 10hrs

Module-II: Survey of steganographic techniques 10hrs

Module-III: Steganalysis 10hrs

Module-IV: Watermarking techniques 10 hrs
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: Fingerprints 10hrs

Text Book(s):

Reference Book(s):
Pre-requisite:
- Basic knowledge of security

Objectives:
- i) To review image processing techniques for biometric security
- ii) To understand Face, Fingerprint, Palmprint, Iris biometric technologies
- iii) To understand three-dimensional image analysis techniques
- iv) To study some applications of biometric security algorithms

Module-I: Introduction To Biometrics10 hrs

Module-II: Fingerprint Technology 10 hrs

Module-III: Face Recognition And Hand Geometry 10 hrs

Module-IV: Multimodal Biometrics And Performance Evaluation 10 hrs

Module-V: Biometric Authentication 10 hrs

Text Book(s):

Reference Book(s):
1. L C Jain, I Hayashi, S B Lee, U Haleci, “Intelligent Biometric Techniques in Fingerprint and Face Recognition”.


CSCE 876 CONTENT BASED INFORMATION RETRIEVAL

Pre-requisite:
• Basic knowledge about information retrieval

Objectives:
To make the student understand
• the various techniques used in image enhancement
• the image retrieval techniques

Module-I: Introduction 10hrs

Module-II: Image Enhancement 10hrs

Module-III: Multimedia Databases 10hrs

Module-IV: Image Retrieval 10hrs

Module-V: Content Based Image Retrieval 10hrs

Text Book(s):

Reference Book(s):
Pre-requisite:

- Nil

Objectives:

1. Ability to formulate an area of study and participate in defining a process for knowledge building in relation to the area of study.
2. Ability to orally discuss and critically analyze key issues of the subject matter studied in the course.
3. The ability to conceptualize key issues and research questions relative to the area of study.
4. Complete projects demonstrating a critical analysis of a specific dimension or aspect of the subject and its relationship to other dimensions or aspects of the subject.

Outcomes:

The subject matter of the course will relate to the student’s research interests. The primary products of this course are an extensive literature review that could serve as the foundation for the student’s subsequent project work.

The student has to submit a report containing the following:

Introduction and Statement of the Problem. The first few pages should make it clear what the paper is about and how the subject will be approached and analyzed.

Literature Review. A minimum of 30 research articles should be included as references in the review.

The literature review must include:
- an in-depth, detailed and nuanced understanding of a specific issue, topic or question in the area of study;
- the theoretical issues and arguments raised and discussed in the literature of the research area;
- an analysis of the strengths and weaknesses of the extant research literature;

Discussion. This section states and justifies the description, analysis and argument on the topic in a precise, readable and rigorous manner.

Conclusion. The conclusion summarizes the main argument of the essay as shows how the work enhances our understanding of the subject.