PONDICHERRY UNIVERSITY

REGULATIONS AND SYLLABUS

for
MASTER OF SCIENCE
(Computer Science)

(For CBSC System in Pondicherry University)
(Effective from the academic year 2018-2019)

Eligibility for Admission
Candidates who have secured 55% of marks or above in any one of the following or equivalent, are eligible to apply: Bachelor’s Degree in Computer Science/ Information Technology/ Computer Applications.

Duration of the Course
The course duration shall normally be of two years’ duration spread over four semesters. The maximum duration to complete the course shall be 4 years.

Medium
The medium of instruction shall be English.

Passing & Classification
Passing Eligibility & Classification for the award of the Degree are as per the Choice Based Credit System norms.
PONDICHERRY UNIVERSITY
SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE
MASTER OF SCIENCE (COMPUTER SCIENCE)
CURRICULUM
(Effective from the academic year 2018-2019)

Course Structure

<table>
<thead>
<tr>
<th>Course Category</th>
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<tbody>
<tr>
<td>Core Courses</td>
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**FIRST SEMESTER**

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**SECOND SEMESTER**

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## SUPPORTIVE CORE COURSES (9 Credits)

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## DOMAIN SPECIFIC ELECTIVES COURSES (18 Credits)

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### LIST OF SKILL ENHANCEMENT COURSES (5 Credits)

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CSSC 411 Design and Analysis of Algorithms

Pre-requisite:
- Basic Knowledge in Data Structures and Programming.

Objectives:
- To analyze the asymptotic performance of algorithms.
- To demonstrate a familiarity with major algorithms and data structures.
- To synthesize efficient algorithms in common engineering design situations.

Module-I: Introduction
(9 hrs)

Module-II: Divide and Conquer
(9 hrs)

Module-III: Greedy method
(9 hrs)

Module-IV: Dynamic Programming and Backtracking
(9 hrs)

Module-V: Branch and Bound and NP
(9 hrs)

Text Books:

References:

CSSC 412 Advanced Computer Architecture

Pre-requisite:

- Basic knowledge in Digital Design, Microprocessor and Computer Architecture.

Objectives:

- To understand the evolution of computer architecture.
- To understand the design challenges in building a system.

Module-I: Introduction: (9hrs)


Module-II: Memory Organizations: (9 hrs)


Module-III: Pipeline and Superscalar Techniques: (9 hrs)

Pipelining and Superscalar Techniques – Linear Pipeline Processors– Nonlinear Pipeline Processors– Instruction Pipeline Design– Arithmetic Pipeline Design– Superscalar and Super Pipeline Design.

Module-IV: Parallel Computer Models:(9 hrs)


Module-V: Parallel Computer Architectures:(9 hrs)


Text Books:


References:

CSSC 413 Automata Theory and Formal Languages

Pre-requisite:
- Basic knowledge in set theory, Rational relations and Functions

Objectives:
- To understand various Computing models like Finite State Machine, Pushdown Automata, and Turing Machine.
- To understand Decidability and Undecidability of various problems.

Module-I: Finite Automata (9 hrs)

Module-II: Grammars (9 hrs)

Module-III: Pushdown Automata (9 hrs)

Module-IV: Turing Machine (9 hrs)
Turing Machines- Introduction – Formal definition of Turing machines – Instantaneous descriptions- Turing Machine as Acceptors – Turing Machine as Transducers Computable Languages and functions – Turing Machine constructions – Modifications of Turing Machines.

Module-V: Computational Complexity (9 hrs)

Text Book:

Reference Books:
Skills to be acquired:

- Able to analyze performance of algorithms and the ability to get them implemented.

Lab Software Requirements:

- Any programming Language

List of Exercises:

Programs should include but not limited to:

1. Write a program that implements Binary Search
2. Write a program that implements Quick Sort
3. Write a program that implements Strassen’s matrix multiplication
4. Write a program that implements Prim’s Algorithm
5. Write a program that implements Kruskal’s Algorithm
6. Write a program that implements All pair shortest path problem
7. Write a program that implements N-Queen Problem
8. Write a program that implements Heapsort
9. Write a program that implements Travelling Salesperson Problem
10. Write a program that implements Knapsack using greedy Method
Skills to be acquired:

- Able to Understand Computer Architecture components and the ability to implement.

Lab Software Requirements:

- Any Simulation Software.

List of Exercises:

2. Simulation of Pipeline.
3. Simulation of Instruction Level Parallelism.
4. Simulation of Cache Memory.
5. Simulation of Multiprocessor.
7. Simulation of Thread Level Parallelism.
8. Simulation of Data Level Parallelism.
CSSC 421 Modern Operating Systems

Pre-requisite:

- Computer Organizations and Data Structure

Objectives:

- To acquire knowledge in Distributed operating.
- To know the components of distributed resource management.
- To know the components and management aspects of Real time, Mobile operating systems.

Module-I: Basics of Operating Systems (9 hrs)


Module-II: Memory Management (9 hrs)


Module-III: File Systems and I/O (9 hrs)


Module-IV: Mobile and Real Time Operating Systems (9 hrs)


Module-V: Mainframe and Linux (9 hrs)


Text Books:


Reference Books:

CSSC 422 ADVANCED DATABASE SYSTEMS

Pre-requisite:
- Basic knowledge in Database systems.

Objectives:
- To introduce the fundamental concepts of database systems,
- To acquaint the students with the use of current relational database systems,
- To build a solid foundation for advanced studies in database area.

Module-I: Introduction (9 hrs)

Module-II: Transaction Management and Concurrency Control (9 hrs)

Module-III: Parallel and Distributed Databases (9 hrs)

Module-IV: Object and Object Relational Databases (9 hrs)
Object oriented Databases: Object oriented DBs - Object modeling in database systems - Object identity OODBMS architecture and storage issues - Querying persistent objects - Transactions and concurrency control clustering indexing - case study

Module-V: Multimedia and Mobile Database Technologies (9 hrs)

Text Books:
Reference Books:
CSSC 423 Operating System Lab

Skills to be acquired:

- Able to understand the design issues associated with Operating Systems.

Lab Software Requirements:

- Any Programming Language

List of Exercises:

1. Write a program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. (a) FCFS (b) SJF (c) Round Robin (pre-emptive) (d) Priority.
2. Write a program to simulate the following file allocation strategies.
   (a) Sequential (b) Indexed (c) Linked.
3. Write a program to simulate paging technique of memory management.
4. Write a program to simulate the following file organization techniques
   (a) Single level directory (b) Two level directory (c) Hierarchical.
5. Write a program to simulate Bankers algorithm for the purpose of deadlock avoidance.
6. Write a program to simulate disk scheduling algorithms
   (a) FCFS (b) SCAN (c) C-SCAN.
7. Write a program to simulate page replacement algorithms
   (a) FIFO (b) LRU (c) LFU.
8. Write a program to simulate producer-consumer problem using semaphores.
9. Write a program to simulate the concept of Dining-Philosophers problem.
Skills to be acquired:

- Able to use database efficiently in applications to handle data.

Lab Software Requirements:

- Database like MySQL / SQL Server.

List of Exercises:

1. Distributed Database for Bookstore
2. Deadlock Detection Algorithm for distributed database using wait-for graph
3. Object Oriented Database – Extended Entity Relationship (EER)
4. Parallel Database – University Counselling for Engineering colleges
5. Parallel Database – Implementation of Parallel Join & Parallel Sort
6. Active Database – Implementation of Triggers & Assertions for Bank Database
7. Deductive Database – Constructing Knowledge Database for Kinship Domain (Family Relations)
8. Study and Working of WEKA Tool
10. Designing XML Schema for Company Database
CSSC 511 Advanced Computer Networks

Pre-requisite:
- Fundamental knowledge about Computer Networks

Objectives:
- To acquaint the students with the application of networking.
- Detail description of the various TCP/IP protocols.
- Various algorithms related to it has been dealt, to get a practical approach.

Module-I: TCP/IP Protocol  (9 hrs)
Layered protocols, internet Addressing, mapping internet address to physical address, internet protocol, OSPF, RIP, RARP, BOOTP, DHCP, BGP, ARP, IP, Ipv6, ICMP Transport protocols: UDP, TCP and SNMP

Module-II: Connection oriented networks  (9 hrs)
Frame relay, B-ISDN, ATM protocol stack, ATM switching, internetworking with ATM Networks, traffic management in ATM.

Module-III: High Speed LAN  (9 hrs)
LAN Ethernet, fast Ethernet, gigabit Ethernet, FDDI, DSL, ADSL

Module-IV: Wireless communication  (9 hrs)
Wireless networks, wireless channels, channel access, network architecture, IEEE 802.11, Bluetooth.

Module-V: Network Analysis and Modelling  (9 hrs)
Queueing theory, modeling network as a graph, network management system and standard.

Text Books:

References:
CSSC 512 WEB TECHNOLOGY

Pre-requisite:

- Basic Knowledge in computer network, working of Internet and java language.

Objectives:

- To inculcate knowledge of web technological concepts and functioning of internet
- To learn and program features of web programming languages.
- To understand the major components of internet and associated protocols.
- To design an innovative application for web.

Module-I: Review of the Internet technologies (9 hrs)
Introduction Web essentials: Web Vs Internet - Clients -Servers - Communication - Internet Address - Ports – Sockets - DNS - Firewall - Proxy - Internet Service Provider - Internet Services Protocols. Introduction to static web page creation using HTML (Tables, Frames, Forms) and Cascading Style Sheets.

Module-II: Client-Side Scripting (9 hrs)

Module-III: Server-Side Scripting (9 hrs)

Module-IV: XML (9 hrs)

Module-V: AJAX (9 hrs)
AJAX: Introduction - creating and sending requests - XML in JavaScript and AJAX – server-side AJAX with PHP.

Text Books:

Reference Books:
2. David Lane, Hugh E. Williams, Web Database Application with PHP and MySQL, Second Edition
CSSC 513 Networks Lab

**Skills to be acquired:**

- Able to establish and Configure Computer Networks.

**Lab Software Requirements:**

- Any Network Simulator

**List of Exercises:**

1. To analyze the performance of various configurations and protocols in LAN.
   a. Establishing a LAN.
   b. Connecting two LANs using multi-router topology with static routes.
2. To configure Dial-On-Demand Routing.
3. To analyze the performance of RIP and OSPF redistribution.
4. To analyze the network security for improving the security of the network.
5. To Control Traffic Flow in a network.
6. To configure the standard access list for a network.
7. To configure the extended access control list for a network.
8. To configure a firewall and analyze it for a network.
CSSC 514 Web Technology Lab

Skills to be acquired:

- Able to design and develop web applications.

Lab Software Requirements:

- Dreamweaver or Xampp

List of Exercises:

1. To create a simple webpage using HTML that includes all tags.
2. Applying Style to an HTML Page Using CSS.
3. Client-Side Programming:
   a. Java script for Displaying and Comparing Date
   b. Form Validation including text field, radio buttons, check boxes, list box and other controls.
4. Online Applications using PHP.
5. Online application with data access.
7. XML document and DTD.
CSSC 431 Discrete Mathematics

Pre-requisite:

- Basic knowledge in Mathematics.

Objectives:

- Reason mathematically about basic data types and structures (such as numbers, sets, graphs, and trees) used in computer algorithms and systems; distinguish rigorous definitions and conclusions from merely plausible ones; synthesize elementary proofs, especially proofs by induction.
- Model and analyze computational processes using analytic and combinatorial methods.
- Apply principles of discrete probability to calculate probabilities and expectations of simple random processes.
- They will be able to use these methods in subsequent courses in the design and analysis of algorithms, computability theory, software engineering, and computer systems.

Module-I: Set Theory and its Relation (9 hrs)


Module-II: Propositional logic (9 hrs)


Module-III: Combinatorics (9 hrs)


Module-IV: Recurrence Relations (9 hrs)


Module-V: Algebraic Structure (9 hrs)

Binary composition and its properties definition of algebraic structure - - Monoid Groups - Abelian Group - properties of groups - Permutation Groups - Sub Group - Cyclic Group - Rings and Fields (definition and standard results)

Text Books:


Reference Books:
CSSC 432 Probability and Statistics

Pre-requisite:

- Introduction concepts in Probability/Statistics
- Basic discrete Probability
- Basic mathematical concepts like Sets, Number Line
- Equations and Inequalities

Objectives:

- Understand concepts of discrete probability, conditional probability, independence, and can apply these concepts to engineering applications (selected by instructor).
- Understand mathematical descriptions of random variables including probability mass functions (PMFs), cumulative distribution functions (CDFs), probability distribution functions (PDFs), conditional mass, conditional distribution and conditional density functions.

Module-I: Introduction (8 hrs)

Combinatorial methods- Principles of counting – Permutation – Combination – Binomial theorem- problems

Module-II: Probability (9 hrs)

Probability: Classical - relative frequency and axiomatic definitions of probability - addition rule and conditional probability - multiplication rule - total probability - Bayes’ Theorem and independence – problems.

Module-III: Random Variables (10 hrs)

Random Variables: Discrete - continuous and mixed random variables - probability mass - probability density and cumulative distribution functions - mathematical expectation – Variance- moments - probability and moment generating function - median and quantiles - Markov inequality.

Module-IV: Special Distributions (9 hrs)


Module-V: Joint Distributions (9 hrs)

Joint Distributions: Joint - marginal and conditional distributions - product moments - correlation and regression - independence of random variables - bivariate normal distribution - problems.

Text Books:


Reference Books:

CSSC433 Optimization Techniques

Pre-requisite:
- Fundamental knowledge of calculus and linear programming problem
- Mathematical models

Objectives:
- To introduce the fundamental concepts of Optimization Techniques;
- To make the learners aware of the importance of optimizations in real scenarios;
- To provide the concepts of various classical and modern methods of for constrained and unconstrained problems in both single and multivariable.

Module-I: Introduction to Classical Methods & Linear Programming Problems Terminology (9 hrs)


Module-II: Single Variable Optimization (9 hrs)


Module-III: Multivariable Optimization Algorithms (9 hrs)


Module-IV: Advance Optimization Techniques (9 hrs)


Module-V: Dynamic Programming (9 hrs)

Dynamic Programming: Genetic algorithm - Problem formulation and application in Design of continuous beam and Optimal geometric layout of a truss - Capacity expansion and Reservoir operation.

Text Books:

Reference Books:
CSSC434 Linear Programming

Pre-requisite:
- Basic mathematical concepts such as sets, functions, vectors, matrices, etc

Objectives:
- Understand the linear programming problem
- Enumerate LPP simplex methods
- Discuss LPP duality
- Differentiate Non-Linear Programming Problem and LPP

Module-I: Linear Programming Problem (9 hrs)

Module-II: LPP Simplex Method (9 hrs)

Module-III: Duality in Linear Programming (9 hrs)
Duality LPP – General Prime-Dual Pair – Formulating a Dual Problem – Primal-Dual Pair in Matrix Form – Duality Theorems– Dual Simplex Method – Two-Phase Method

Module-IV: Dynamic Programming (9 hrs)

Module-V: Network Routing and Scheduling (9 hrs)

Text Books:

Reference Books:
DOMAIN SPECIFIC ELECTIVES
(12 Credits)

DATA ANALYTICS
CSSC 441 Big Data

Pre-requisite:

- Data mining and Information Systems

Objectives:

- This course brings together several key big data technologies used for storage, analysis and manipulation of data.
- To recognize the key concepts of Hadoop framework, MapReduce, Pig, Hive, and No-SQL.
- To prepare a sample project in Hadoop API.

Module-I: Introduction to Big Data (9 hrs)

Big Data and its Importance – Four V’s of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications.

Module-II: Big Data Technologies (9 hrs)

Hadoop’s Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data – Predictive Analytics – Mobile Business Intelligence and Big Data – Crowd Sourcing Analytics – Inter- and Trans-Firewall Analytics - Information Management.

Module-III: Processing Big Data (9 hrs)

Integrating disparate data stores - Mapping data to the programming framework - Connecting and extracting data from storage - Transforming data for processing - Subdividing data in preparation for Hadoop Map Reduce.

Module-IV: Hadoop MapReduce (9 hrs)

Employing Hadoop Map Reduce - Creating the components of Hadoop Map Reduce jobs - Distributing data processing across server farms – Executing Hadoop Map Reduce jobs - Monitoring the progress of job flows - The Building Blocks of Hadoop Map Reduce - Distinguishing Hadoop daemons - Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.

Module-V: Advanced Analytics Platform (9 hrs)


Text Books:


Reference Book(s):

CSSC 442 Python Programming for Data Analytics

Pre-requisite:
- Programming knowledge in any OO language.

Objectives:
- Understanding the basic concepts of Python
- Preparing and pre-processing data
- Understanding the data aggregation and grouping concepts
- Leveraging web scraping
- Visualizing the results of analytics effectively

Module-I: Python Concepts, Data Structures, Classes (9 hrs)

Module-II: Data Wrangling (9 hrs)
Combining and Merging DataSets – Reshaping and Pivoting – Data Transformation – String Manipulation, Regular Expressions.

Module-III: Data Aggregation, Group Operations, Timeseries (9 hrs)

Module-IV: Web Scraping (9 hrs)

Module-V: Visualization in Python (9 hrs)
Matplotlib package – Plotting Graphs – Controlling Graph – Adding Text – More Graph Types – Getting and setting values – Patches.

Text Book(s):

Reference Book(s):
Pre-requisite:
- Data mining and its concepts

Objectives:
- To identify the association between various types of data.
- To apply statistical inference techniques.
- To apply methods of inference to applied business situations.
- To identify, build and validate appropriate statistical regression models

Module-I: Introduction
Data - Data Tables - Categorical and Numerical Data - Recoding and Aggregation - Time Series - Describing Categorical Data - Charts of Categorical Data - The Area Principle - Mode and Median - Describing numerical data - Summaries of Numerical Variables - Histograms and the Distribution of - Numerical Data – Boxplot - Shape of a Distribution

Module-II: Association in Categorical and Numerical Data:

Module-III: Probability

Module-IV: Inference
Samples and Surveys - Sampling Variation and Quality - Confidence Intervals - Hypothesis Tests - Alternative Approaches to Inference - Data for Comparisons - Two-sample T-test - Confidence Interval for the Difference - Rare Events - Testing Association.

Module-V: Regression Models - I
Linear Patterns - Curved Patterns - Simple Regression – Regression Diagnostics - Multiple Regressions.

Text Book(s):

Reference Book(s):
CSSC 444 Marketing Analytics

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**Pre-requisite:**
- Data mining with Statistics

**Objectives:**
- Learn how to tap a simple and cost-effective tool, Microsoft Excel, to solve specific business problems using powerful analytic techniques.
- Helps to forecast sales and improve response rates for marketing campaigns.
- Explores how to optimize price points for products and services, optimize store layouts, and improve online advertising.

**Module-I: Marketing Data Summarization**

(9 hrs)

Slicing and Dicing Marketing Data with PivotTables - Using Excel Charts to Summarize Marketing Data - Using Excel Functions to Summarize Marketing Data.

**Module-II: Forecasting Techniques**

(9 hrs)

Simple Linear Regression and Correlation - Using Multiple Regression to Forecast Sales - Forecasting in the Presence of Special Events - Modeling Trend and Seasonality - Ratio to Moving Average Forecasting Method - Winter’s Method - Using Neural Networks to Forecast Sales.

**Module-III: Customer Needs**

(9 hrs)


**Module-IV: Market Segmentation**

(9 hrs)

Cluster Analysis - User-Based Collaborative Filtering - Collaborative Filtering – Using Classification Trees for Segmentation.

**Module-V: Retailing and Market Research Tools**

(8 hrs)

Retailing - Introduction to retailing, Market Basket Analysis and Lift - Marketing Research Tools - Principal Components Analysis.

**Text Book(s):**


**Reference Book(s):**

CSSC 445 Social Network Analytics

**Pre-requisite:**
- Nil.

**Objectives:**
- Analyse the structure and evolution of networks
- Able to gain knowledge from disciplines as diverse as sociology, mathematics, computer science.
- Understand the Online interactive demonstrations and hands-on analysis of real-world data sets.

**Module-I: Introduction**

(9 hrs)

Social network data- Formal methods- Paths and Connectivity- Graphs to represent social relations- Working with network data- Network Datasets- Strong and weak ties - Closure, Structural

**Module-II: Social Influence**

(9 hrs)


**Module-III: Information Networks and The World Wide Web**

(9 hrs)


**Module-IV: Social Network Mining**

(9 hrs)

Clustering of Social Network graphs: Betweenness, Girvan Newman algorithm-Discovery of communities- Cliques and Bipartite graphs- Graph partitioning methods- Matrices- Eigen values Sim-rank.

**Module-V: Network Dynamics**

(9 hrs)


**Text Books:**


**Reference Books:**


CSSC 446 Risk Analytics

Pre-requisite:
- Nil.

Objectives:
- To understand the functioning of Banking and apply analytic techniques to mitigate risks
- To understand the operations of Insurance sector and apply analytic techniques to mitigate risks and improve profitability
- To understand the processes involved in Healthcare industry and use data analysis to improve patient care and optimize cost
- To understand human relationship management techniques for effective management of people.

Module-I: Introduction

Risk – Definition and Examples, Components and Factors; Understanding Risk Assessment, Risk Mitigation and Risk Management; Risk Analytics - Definition and Objectives.

Module-II: Risk Analytics for Banking Domain

Introduction to Banking Sector; National and International laws; Credit Risk Analytics, Internal capital Adequacy Assessment Process Related Risk Analytics, Limit Management, Risk-Adjusted Performance Management, Fraud Risk; Case Studies.

Module-III: Risk Analytics for Insurance Domain

Introduction to Insurance Sector; Property & Causality Insurance Companies and Life Insurance Companies; Using Analytics for Customer Acquisition and Retention; Detecting, Preventing and Managing Fraud using Analytics; Case Studies

Module-IV: Risk Analytics for Healthcare Domain

Introduction to Healthcare Sector; HIPAA, Four Enterprise Disciplines of Health Analytics, Health Outcome Analysis, Health Value and Cost; Customer Insights, Actuary Services, Framework for Customer Analytics; Risk Management

Module-V: Workforce Analytics

Workforce Environment and Psychology, HR Analytics and Talent Management - Understanding and Predicting Retention, Boosting Employee Engagement, Sources of Hire and Quality of Hire, Profiling High Performers

Text Books:

Reference Books:
CSSC 447 Database Systems in Big Data

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**Pre-requisite:**
- Nil.

**Objectives:**
- To understand the design of database in Big Data.

**Module-I: Getting Started With Cassandra** (9 hrs)
Introduction of NoSQL Database concepts: ACID Vs. BASE, Advantages, Where Applicable, Schema, Two Phase Commit, Sharding and Share Nothing Architecture, Feature Based, Key Based, Lookup Table Based, NoSQL Databases, Brewer’s CAP Theorem, Cassandra Definition and Features, Distributed and Decentralised, Elastic Scalability, High Availability and Fault Tolerance, Tuneable Consistency, Strict Consistency, Casual Consistency, Weak (Eventual Consistency), Column Orientation, Schema Free, High Performance, Features and comparisons of few NOSQL Databases (Cassandra, Mongo, Cloudera, CouchDB, HBase).

**Module-II: Understanding Cassandra Data Model** (9 hrs)

**Module-III: Understanding Cassandra Architecture** (9 hrs)

**Module-IV: Creating Sample Application** (9 hrs)

**Module-V: Configuring, Reading and Writing Data In Cassandra** (9 hrs)
Key spaces, Replicas, Replica Placement Strategy, Replication Factor, Partitioner, Snitches, Creating Clusters, Dynamic Ring Participation, Security, Miscellaneous Settings, Additional Tools, Query differences between RDBMS and Cassandra, Basic Write Properties, Consistency Level, Basic Read Properties, API’s, Set Up and Inserting Data, Slice Predicate, Get Range Slices, Multiget Slice, Deleting, Programmatically Defining Keyspaces and Column Families. CQL-Data Definition language (DDL) Statements, Data Manipulation Language (DML), Create and modify Users, User permission, Capture CQL output to a file, Import and export data, CQL scripts from within CQL, CQL Scripts from the command prompt.

**Text Books:**
CSSC 448 Streaming Analytics

Pre-requisite:

- Nil.

Objectives:

- Understanding the need for stream computing
- Comprehend the architecture of stream analytics
- Building data flow management pipelines for streams.
- Processing streaming data
- Delivering the results of streaming analytics

Module-I: Introduction to Stream Computing (9 hrs)


Module-II: Streaming Analytics Architecture (9 hrs)


Module-III: Data Flow Management (9 hrs)


Module-IV: Processing & Storing Streaming Data (9 hrs)


Module-V: Delivering Streaming Metrics (9 hrs)


Text Books:


Reference Book(s):

2. kafka.apache.org
3. flume.apache.org
4. zookeeper.apache.org
5. spark.apache.org
6. zeromq.org
CSSC 449 Video Processing and Analytics

Pre-requisite:
- Image processing and its working

Objectives:
- To have a better knowledge about videos
- To enrich students with data analytics
- To understand the video content analysis
- To expose the student to various applications and case studies of Video analytics.

Module-I: Video Fundamentals (9 hrs)

Module-II: Video Segmentation and Video Features (9 hrs)
Fundamentals of Motion Estimation – Optical flow - Pixel Video Features - colour, shape features, Textural features - Feature selection and Dimensionality Reduction.

Module-III: Introduction to Analytics (9 hrs)
Big-Data - Descriptive data analysis - Analytic Processes and Tools - Regression – Classification - Clustering algorithms - Validation - Multimodal approach to Image and Video data mining - Probabilistic semantic mode - Model based annotation and video mining.

Module-IV: Video Content Analysis and Analytics (9 hrs)
Introduction- Detecting Shot Boundaries in Video – Parsing a Video into Semantic Segments – Video Indexing and Abstraction for Retrievals – Affective Video Content Analysis – Automatic Video Trailer Generation - Video database - Video categorization - Video query categorization

Module-V: Emerging Trends (9 hrs)
Object Segmentation and Tracking in the Presence of Complex Background – Video In painting – Video Summarization – Forensic video analysis

Text Books:

Reference Book(s):
NETWORK COMPUTING
CSSC 451 Principles of Distributed Computing

Pre-requisite:
Basic knowledge in Operating System and Computer Networks.

Objectives:
- To learn the principles, architectures, algorithms and programming models used in distributed systems.
- To examine state-of-the-art distributed systems, such as JINI.
- To design and implement sample distributed systems.

Module-I: Introduction (9 hrs)
Definition-Goals-Hardware and Software Concepts Client/Server Model Communication – Layered Protocols RPC-Remote Object Invocation Message Oriented Communication

Module-II: Client Server and Naming Entity (9 hrs)
Threads Client Server - Code Migration - S/W Agents - Naming Entity - Location Mobile Entity

Module-III: Synchronization and Distributed Transactions (9 hrs)
Synchronization - Clock Synchronization - Logical Clocks - Global States-Election Algorithms - Mutual Exclusion - Distributed Transaction Consistence and Replication – Introduction - Data Centric Consistence - Fault Tolerance - Reliable Client/Server Communication - Distributed Commit - Recovery

Module-IV: Distributed Object Database System (9 hrs)
Distributed Object Database System: CORBA - DCOM - GLOBE.

Module-V: Distributed File System (9 hrs)
Distributed File System - Distributed Document Base System -WWW - Distributed Co-ordination Base System - JINI

Text Books:

Reference:
CSSC 452 Introduction to Parallel Computing

Pre-requisite:
- Basic knowledge in computer architecture and computer networks.

Objectives:
- To study various types of parallel computers and their architectures,
- To describe the concepts underlying the design, implementation, and use of message-passing computing and shared-memory computing,
- To set up cluster computing systems, code and evaluate the performance of parallel programs
- To choose suitable programming strategies in parallelizing computational tasks.

Module-I: Introduction (8 hrs)

Module-II: Principles of Parallel Algorithm (10 hrs)

Module-III: Analytical Modelling of Parallel programs (10 hrs)

Module-IV: Programming using Message Passing Paradigm (10 hrs)

Module-V: Parallel Algorithms and Applications (8 hrs)

Text Book(s):

Reference Books:
CSSC 453 Network Design and Management

**Perquisite:**
Basic knowledge in computer networks.

**Objectives:**
- Understand security best practices and how to take advantage of the networking gear that is already available
- Learn design considerations for device hardening, Layer 2 and Layer 3 security issues, denial of service, IPSec VPNs, and network identity
- Understand security design considerations for common applications such as DNS, mail, and web
- Identify the key security roles and placement issues for network security elements such as firewalls, intrusion detection systems, VPN gateways, content filtering, as well as for traditional network infrastructure devices such as routers and switches.
- Understand the various testing and optimizations strategies to select the technologies and devices for secure network design.

**Module-I: Introduction**
(8 hrs)

**Module-II: Protocols, Services and Interfaces**
(8 hrs)

**Module-III: Network Designs and Ethernet Networking**
(8 hrs)

**Module-IV: Wired and Wireless Media**
(9 hrs)

**Module-V: SNMP and RMON**
(8 hrs)

**Text Books:**

**Reference Books:**
CSSC 454 Web Services Computing

Pre-requisite:
- Basic knowledge in Web Technology and Computer Networks.

Objectives:
- To understand the details of Web services technologies: SOAP, WSDL, UDDI
- To learn how to implement and deploy web service clients and servers.
- To explore interoperability between different frameworks.
- To learn basic concepts of SOA.

Module-I: Fundamental Concepts and Theories (9 hrs)
Introduction to Web Services — The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.
Web Services Architecture — Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication models, basic steps of implementing web services.

Module-II: Service Oriented Architecture (8 hrs)
Overview of Service Oriented Architecture — SOA concepts, Key Service Characteristics, Technical Benefits of a SOA.
SOA and Web Services — Web Services Platform, Service-Level Data Models, Discovery, Security and Interaction Patterns, Atomic and Composite services, Service-level communication and alternative transports.

Module-III: Web Services using SOAP (8 hrs)
Fundamentals of SOAP — SOAP Message Structure, SOAP encoding, SOAP message exchange models, SOAP communication and messaging, SOAP security.
Developing Web Services using SOAP — Building SOAP Web Services, developing SOAP Web Services using Java and Axis, limitations of SOAP.

Module-IV: Tools and Technologies (9 hrs)
Describing Web Services — WSDL — WSDL in the world of Web Services, Web Services life cycle, anatomy of WSDL definition document, WSDL bindings, WSDL Tools, limitations of WSDL.
Discovering Web Services — Service discovery, role of service discovery in a SOA, service discovery mechanisms, UDDI — UDDI Registries, uses of UDDI Registry, Programming with UDDI, UDDI data structures, Publishing API, Publishing, searching and deleting information in a UDDI Registry, limitations of UDDI.

Module-V: Web Services Interoperability (8 hrs)

Text Book(s):

Reference Book(s):
2. Java Web Services, D.A. Chappell & T. Jewell, O’Reilly, SPD.
**CSSC 455 Pervasive and Ubiquitous Computing**

**Pre-requisite:**
- Basic knowledge in Distributed systems.

**Objectives:**
- The course aims at providing a sound conceptual foundation in the area of Pervasive Computing aspects.
- The course attempts to provide a balanced treatment of the mechanisms and environments of pervasive computing and initiates senior CS students to the state-of-the-art in the area.
- At the end of this course, students should be able to conceptualize, analyze and design select classes of pervasive computing systems.

**Module-I: Fundamental Concepts and Theories** (9 hrs)
Introduction to ubiquitous Computing-History, Development – The Ubiquitous Portal – Grid, RFID Technologies-Ambient Intelligence.

**Module-II: Development and Design Methodologies** (9 hrs)
Ubiquitous and Pervasive Application Design- Designing Pervasive and MultimodalInteractive System-pervasive computing: A Conceptual Framework-Deploying UserInterfaces for workflow information systems- Ubiquitous and Pervasive case study Applications.

**Module-III: Tools and Technologies** (9 hrs)
Deploying Pervasive Technologies- Embedding ubiquitous Technologies- Ubiquitous Computing Technologies in Education- Potential and possibilities, problem and pitfalls.

**Module-IV: Utilization and Application** (9 hrs)
Pervasive Healthcare: Problems and Potentials- Implementing RFID technologies in Hospital- Ubiquitous Healthcare (RFID) in Hospitals- Ubiquitous Risk Analysis, RFID: A framework of Uses and Opportunities.

**Module-V: Critical Issues and Emerging Trends** (9 hrs)

**Text Book:**

**Reference Book:**
CSSC 456 Cloud Computing

Pre-requisite:
- Basic knowledge in distributed systems.

Objectives:
- To analyze the components of cloud computing and its business perspective.
- To evaluate the various cloud development tools.
- To collaborate with real time cloud services.
- To analyze the case studies to derive the best practice model to apply when developing and deploying cloud based applications.

Module I: Introduction (9 hrs)

Module II: Infrastructure as a Service (IaaS) (9 hrs)
Infrastructure as a Service(IaaS) – Introduction- IaaS definition, virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM) - Resource Virtualization – Server, Storage, Network, Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing (storage as a service) - Examples - Amazon EC2 - Renting, EC2 Compute Unit, Platform and Storage, pricing, customers – Eucalyptus.

Module III: Platform as a Service (PaaS) (8 hrs)
Platform as a Service(PaaS) - Introduction - What is PaaS, Service Oriented Architecture (SOA) - Cloud Platform and Management – Computation, Storage – Examples - Google App Engine, Microsoft Azure, SalesForce.com, Force.com platform - Software as a Service(PaaS) - Introduction to SaaS - Web services - Web 2.0 - Web OS - Case Study on SaaS.

Module IV: Service Management in Cloud Computing (8 hrs)

Module V: Cloud Security (10 hrs)

Text Book(s):

**Reference Book(s):**

CSSC 457 Internet of Things

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**Pre-requisite:**
- Basic knowledge in computer networks and working of sensors.

**Objectives:**
- Vision and Introduction to IoT.
- Understand IoT Market perspective.
- Data and Knowledge Management and use of Devices in IoT Technology.
- Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

**Module-I: M2M and IoT- Introduction**
(9 hrs)
The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.

**Module-II: M2M and IoT-A Market Perspective**
(9 hrs)

**Module-III: M2M and IoT Technology Fundamentals**
(9 hrs)
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-IV: IoT Architecture-State of the Art**
(9 hrs)

**Module-V: IoT Reference Architecture**
(9 hrs)

**Text Book:**

**Reference Books:**
ARTIFICIAL INTELLIGENCE
CSSC 461 Introduction to Artificial Intelligence and Expert Systems

**Pre-requisite:**

- Exposure to Algorithms, Data structure and Mathematical Logic

**Objectives:**

- Explore basic concepts of AI and expert systems

**Module-I: Introduction**


**Module-II: Problem solving**


**Module-III: Search Algorithms**

Local search algorithms and optimization problems – Searching with nondeterministic Actions, Constraint satisfaction problems

**Module-IV: Expert systems**


**Module-V: Languages and Tools**

Working with LISP, Prolog – Apache Spark

**Text Books:**


**Reference Book:**

CSSC 462 Neural Networks

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**Pre-requisite:**
- Knowledge in Artificial Intelligence

**Objectives:**
- Develop the skill in basic understanding on neural network
- Explore the Advanced methods of representing information in ANN
- Exposure to many real-world control problems.

**Module-I: Introduction**
(8 hrs)


**Module-II: ANN Architectures**
(8 hrs)


**Module-III: Self organizing maps**
(8 hrs)


**Module-IV: Advances in NN**
(8 hrs)


**Module-V: Applications**
(8 hrs)

Pattern recognition-Prediction-Robotics-Case study

**Text Books:**
3. C.M. Bishop, Neural networks and Pattern recognition, 2003, Oxford University
CSSC 463 Fuzzy Logic

Pre-requisites:
- Mathematical Foundation of Computer Science and probability theory
- Knowledge in programming languages

Objectives:
- To develop an elementary practical theory for automatic control of uncertain or imperfectly modelled systems encountered in engineering applications.
- To provide a basic exposition to the goals and methods of Fuzzy Logic

Module-I: Fuzzy Set Theory (9 hrs)
The notion of fuzziness - what, why and when to apply fuzzy set, operations on fuzzy sets, fuzzy numbers, Crisp relations, fuzzy relations, Max-composition of fuzzy relation, Max_-transitive closure, probability measures of fuzzy events, fuzzy expected value, fuzzy inference principle, Examples of use of fuzzy logic in control of real-world systems

Module-II: Neural Networks and Fuzzy Logic Fundamentals (9 hrs)
Artificial Neural Network Representation, Exclusive- OR-Problem, Linear Separability, learning and training algorithms, Back propagation – Back propagation training algorithm

Module-III: Neuro Fuzzy Modelling (9 hrs)

Module-IV: Fuzziness Measures (9 hrs)
Fuzzy measures – belief, plausibility and their properties, Dempster’s rule of combination, consonant body of evidence – possibility, necessities, Measures of uncertainty Axiomatic formulation of Hartley information, Shannon’s entropy, concepts of joint and conditional entropy and their properties; measures of non-specificity, Measures of dissonance and confusion

Module-V: Case Study (9 hrs)
Fuzzy geometry Applications to some selected topics like pattern recognition, image processing, computer vision, optimization, control, data mining, Integration with other computing paradigm

Reference Books:
CSSC 464 Decision Support Systems

Pre-requisite:
- Exposure to AI and Mathematical Logic

Objectives:
- Explore basic concepts of DSS

Module-I: Decision making systems (9 hrs)


Module-II: Decision Support system (9 hrs)

Overview – DSS configurations – Characteristics and capabilities of DSS – Components of DSS – Data Management Subsystem – Model management subsystems- Knowledge management subsystem – User- hardware- Classifications- Case study
Modelling and Analysis - MSS modelling – Static and dynamic models – Certainty and uncertainty and Risk – Influence diagrams – Structure of MSS mathematical models

Module-III: Business Intelligence and DSS Development (9 hrs)

Nature and Sources of data, Data collections, problem and quality, DBMS in DSS- Data warehousing – Data Mart- Business Intelligence – OLAP- Data mining – Data visualization – GIS
Introduction to DSS development- Change management – Technology levels and tools- Platforms- Tool selections- Team developed and End user developed DSS

Module-IV: Collaborative Computing and intelligent (9 hrs)

Group decision making, communication and collaboration – Group support system – GSS technologies – GSS meeting process- Distance learning and creativity and idea generation

Module-V: Languages and Tools (9 hrs)

Working with Lumina Analytical, Open rules, paramount decisions, PROSUITE

Text Book:

CSSC 465 Introduction to Machine Learning

Pre-requisite:
- Basic knowledge in artificial intelligence, learning activities

Objectives:
- To understand the concepts of machine learning
- To appreciate supervised and unsupervised learning and their applications
- To appreciate the concepts and algorithms of learning

Module-I: Introduction (9 hrs)
Introduction: Definition-Examples of machine learning applications –Well posed learning problems- Designing a learning system- Perspectives and issues Concept learning and general to specific ordering: Inductive learning hypothesis- Concept learning as search – candidate elimination algorithm-inductive bias.

Module-II: Regression and classification (9 hrs)

Module-III: Clustering and Learning (9 hrs)

Module-IV: Probabilistic graphical models (9 hrs)

Module-V: Machine learning experiments (9 hrs)
Design-Cross validation - Measuring Performance -Hypothesis testing- Assessing Performance -Comparison of algorithms, Datasets-Case study

Text Books:
CSSC 466 Introduction to Robotics

**Pre-requisites:**
- Mathematical Foundation of Computer Science
- Machine Learning
- Natural Language Processing

**Objectives:**
- To understand the different robotic configurations and their subsystems

**Module-I: Introduction**


**Module-II: Drive systems**


**Module-III: Sensors and Machine Vision**


**Module-IV: 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: Industrial Applications and Case Studies**


**Text Books:**

**Reference Books:**
4. K.D. Richard, Chmielewski T.A and Michael "Robotic Engineering" PHI
Pre-requisites:
- Linear Algebra, Multivariate Calculus, Probability Theory
- Knowledge in programming languages

Objectives:
- To provide a strong foundation of fundamental concepts in Artificial Intelligence
- To provide a basic exposition to the goals and methods of Artificial Intelligence
- To enable the student to apply these techniques in applications which involve perception, reasoning and learning

Course Outcome

Module-I: Introduction (9 hrs)
Introduction to soft computing - brief description of separate theories, Introduction to biological and artificial neural network, Classification algorithms - Decision Trees, Bayesian classifier - Neural Networks and Probabilistic Reasoning

Module-II: Neural Networks (9 hrs)
Basic concepts of neural networks, Neural network architectures, Learning methods, Supervised and un-supervised learning, Architecture of a back-propagation network, Applications

Module-III: Fuzzy Sets (9 hrs)
Fundamentals of fuzzy sets and fuzzy logic theory, fuzzy inference principle, Examples of use of fuzzy logic in control of real-world systems

Module-IV: Optimization (9 hrs)

Module-V: Applications of computational intelligence (9 hrs)

Reference Books:
3. Goldberg : Introduction to Genetic Algorithms
SKILL ENHANCEMENT COURSES
CSSC 531 Network Management Tools

**Pre-requisite:**
- Basic knowledge about Computer Networks

**Objectives:**
- To gain knowledge on how to install, maintain, and manage Local Area Networks and internetworks.
- To understand network management architectures and protocols.
- To be comfortable with using the different TCP/IP Protocols.
- To be comfortable using a variety of network management tools.
- To be familiar with a variety of computer network security issues.

**Module-I:**
*Data Communications and Network Management Overview-Review of Computer Network Technology* (7 hrs)

**Module-II:**
*Basic Foundations: Standards, Models, and Language* (8 hrs)

**Module-III:**
*Network Management Tools and Systems - Network Management Applications - Web-Based Management* (7 hrs)

**Module-IV:**
*OpUtils - Network Management Tools* (7 hrs)

**Module-V:**
*Case study on Designing and Managing a Network* (7 hrs)

**Reference Materials:**

CSSC 532 Statistical Tools

Pre-requisite:
- Fundamentals of Statistics.

Objectives:
- Understand the difference between descriptive & inferential statistics
- Understand the concepts of hypothesis testing: risks, p-value, confidence intervals, power
- Understand the importance of sample size calculations and the required input parameters
- Analyze data more quickly and more accurately

Module-I: (7 hrs)
Introduction- Statistics and its importance–Classification of variables -Importance of identifying the type & role of variables -Descriptive statistics: Visualizing and summarizing data distributions -Frequency tables for categorical variables- Pearson’s correlation coefficient for continuous variables.

Module-II: (8 hrs)
Plotting Data: Histograms, Scatter, box-plots, bar charts-Inferential statistics - Hypothesis testing principles: Null and alternative hypothesis, one vs. two-tailed test.

Module-III: (7 hrs)
Test statistics: T-test, F-tests - Observed significance level or "p-value"-Statistical significance & decision rules -The importance of sample size calculations -Statistical inference with confidence Intervals -Numerical application to the single sample case

Module-IV: (8 hrs)
SPSS / SAS

Module-V: (7 hrs)
MATLAB

Text Books:
CSSC 533 Data Mining Tools

**Pre-requisite:** NIL

**Objectives:**

- To introduce students to the basic concepts and techniques of Data Mining.
- To develop skills of using recent data mining software for solving practical problems.
- To gain experience of doing independent study and research.

**Module - I:**

Introduction to Data Mining - Related technologies - Machine Learning, DBMS, OLAP, Statistics - Data Mining Goals - Stages of the Data Mining Process - Data Mining Techniques Knowledge Representation Methods - Data Warehouse and OLAP Data Warehouse and DBMS Multidimensional data model OLAP operations - Data preprocessing - Data cleaning - Data transformation - Data reduction.

**Module - II:**

Discretization and generating concept hierarchies - Installing Weka 3 Data Mining System - Experiments with Weka - filters, discretization - Data mining knowledge representation - Task relevant data - Background knowledge - Interestingness measures Representing input data and output knowledge Visualization techniques - Experiments with Weka - visualization - Attribute-oriented analysis - Attribute generalization - Attribute relevance Class comparison Statistical measures - Experiments with Weka - using filters and statistics.

**Module - III:**


**Module - IV:**

Experiments with Weka - training and testing - Mining real data - Preprocessing data from a real medical domain. - Applying various data mining techniques to create a comprehensive and accurate model of the data. Clustering - Basic issues in clustering - First conceptual clustering system: Cluster/2 - Partitioning methods: k-means, expectation maximization (EM) - Hierarchical methods: distance-based agglomerative and divisible clustering - Conceptual clustering: Cobweb.

**Module - V:**

Experiments with Weka - k-means, EM, Cobweb - Advanced techniques, Data Mining software and applications - Text mining: extracting attributes (keywords), structural approaches (parsing, soft parsing) - Bayesian approach to classifying text - Web mining: classifying web pages, extracting knowledge from the web.

**Required Software:**

- Weka

Data Mining System with Free Open Source Machine Learning Software in Java.

**Data Mining software and Data Sets**

- WEKA (Source: Java)
- RapidMiner
- MLC++ (Source: C++)
- SIPINA
- List from KD Nuggets (Various)
- List from Data Management Center (Various)
**Data Sets**

- IDS data sets
- Data Sets for Data Mining
- Competition Data Set
- UCI Machine learning repository
- Quest data repository
- KDNuggets

**Reference Books:**

2. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques”, 2000.
CSSC 534 Data Visualization Tools

Pre-requisite:
No previous knowledge of course material is expected. Prior experience in image editing or object oriented programming may lead to a more sophisticated final project but is not required.

Objectives:
- To introduce visual perception and core skills for visual analysis
- To understand visualization for time-series analysis
- To understand visualization for ranking analysis
- To understand visualization for deviation analysis
- To understand visualization for distribution analysis
- To understand visualization for correlation analysis
- To understand visualization for multivariate analysis
- To understand issues and best practices in information dashboard design

Module - 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

Module - 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

Module - III: DISTRIBUTION, CORRELATION, AND MULTIVARIATE ANALYSIS

Module - IV: INFORMATION DASHBOARD DESIGN I
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

Module - 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

Reference Books:
5. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
CSSC 535 CLOUD COMPUTING TOOLS

Pre-requisite:
- Nil-

Objectives:
- 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
- Compare and contrast the economic benefits delivered by various cloud models based on application requirements, economic constraints and business requirements.

Module-I: Cloud Computing
Definition, Cloud types; IaaS, PaaS, SaaS - Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications.

Module-II: Cloud Applications
Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages

Module-III: Management Of Cloud Services
Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services - Choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Redhat)

Module-IV: Application Development
Service creation environments to develop cloud based applications - Development environments for service development; Amazon, Azure, Google App.

Module-V: Cloud IT Model
Analysis of Case Studies when deciding to adopt cloud computing architecture - How to decide if the cloud is right for your requirements - Cloud based service, applications and development platform deployment so as to improve the total cost of ownership

Text Books:

Reference Books:
CSSC 536 BIG DATA TOOLS

Pre-requisite:
Processing Big Data with Apache Hadoop.

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: BIG DATA
Introduction- distributed file system -Definition and taxonomy - Big Data and its importance - Big data value for the enterprise- Setting up the demo environment- Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map

Module - II: Introduction to Hadoop
The Hadoop ecosystem-Big Data - Apache Hadoop & Hadoop EcoSystem - Moving Data in and out of Hadoop - Loading data into Hadoop - Handling files in Hadoop - Getting data from Hadoop -Understanding inputs and outputs of MapReduce - Data Serialization. Hadoop components: MapReduce/Pig/Hive/ HBase

Module - III: 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-Querying big data with Hive - From SQL to HiveQL

Module - IV: 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: 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 - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper

Software(s):
Apache, Hadoop

Reference Books:
CSSC 537 INTERNET OF THINGS (IOT) TOOLS

Pre-requisite:
- Nil

Objectives:

Students will understand the concepts of internet of Things and can able to build IoT applications objectives:

- To understand the fundamentals of Internet of Things.
- To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To apply the concept of Internet of Things in the real world scenario

Module - I: Fundamentals of IOT

Introduction to IoT- Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs

Module - II: IOT Design Methodology

Introduction to IoT - Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs- IoT systems management - IoT Design Methodology – Specifications Integration and Application Development.

Module - III: Building IOT with Raspberry PI


Module - IV: Building IOT With Galileo/Arduino

Intel Galileo Gen2 with Arduino - Interfaces - Arduino IDE – Programming - APIs and Hacks- Design challenges, Development challenges, Security challenges-Other challenges

Module - V: Case Studies and Advanced Topics

Home automation, Industry applications, Surveillance applications, Various Real time applications of IoT - Connecting IoT to cloud – Cloud Storage for Iot – Data Analytics for IoT - Software & Management Tools for IoT

Reference Books: