# CSE PG Course Structure

## I Semester

<table>
<thead>
<tr>
<th>S. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Contact hours/week</th>
<th>Credits</th>
<th>Scheme of Valuation</th>
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<tbody>
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<tr>
<td><strong>Theory Courses</strong></td>
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<tr>
<td>1</td>
<td>20CO01</td>
<td>Machine Learning</td>
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<td>20CO04</td>
<td>Digital Image Processing</td>
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<td>Advanced Operating Systems</td>
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<td>Advanced Computer Networks</td>
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<td>Object Oriented Software Engineering</td>
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<td>7</td>
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<td>Machine Learning with Python lab</td>
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### III SEMESTER

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<tr>
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<td>OE</td>
<td>Open Elective/ MOOCs</td>
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**Total Credits: 18 + 18 + 16 + 16 = 68**

### IV SEMESTER

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<th>S. No</th>
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<tr>
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<td>20CO54</td>
<td>Project Work &amp; Dissertation (Phase-II)</td>
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**Total**

|       | 0     | 0    | 32  | 16   | 40  | 60  | 100 |

**Total Credits: 18 + 18 + 16 + 16 = 68**
### List of Courses offered under Audit Course

<table>
<thead>
<tr>
<th>S.No</th>
<th>Code</th>
<th>Name of the Course</th>
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<tbody>
<tr>
<td>1</td>
<td>20AC01</td>
<td>English for research paper writing</td>
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<tr>
<td>2</td>
<td>20AC02</td>
<td>Disaster Management</td>
</tr>
<tr>
<td>3</td>
<td>20AC03</td>
<td>Sanskrit for Technical Knowledge</td>
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<tr>
<td>4</td>
<td>20AC04</td>
<td>Value education</td>
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<td>5</td>
<td>20AC05</td>
<td>Constitution of India</td>
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<tr>
<td>6</td>
<td>20AC06</td>
<td>Pedagogy Methods</td>
</tr>
<tr>
<td>7</td>
<td>20AC07</td>
<td>Stress Management by Yoga</td>
</tr>
<tr>
<td>8</td>
<td>20AC08</td>
<td>Personality Development through Life Enlightenment Skills.</td>
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</table>

### List of Open Elective Courses offered to other departments

<table>
<thead>
<tr>
<th>S.No</th>
<th>Code</th>
<th>Open Elective Name</th>
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<tbody>
<tr>
<td>1</td>
<td>20CO81</td>
<td>Advanced Computer Architecture</td>
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<tr>
<td>2</td>
<td>20CO82</td>
<td>Python Programming</td>
</tr>
<tr>
<td>3</td>
<td>20CO83</td>
<td>Introduction to Machine Learning</td>
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</table>
Pre-requisites: Fundamentals of Data Mining

Course Educational Objective: This course will

- Develop an appreciation for what is involved in learning from data
- Demonstrate a wide variety of learning algorithms.
- Demonstrate how to apply a variety of learning algorithms to data.
- Demonstrate how to perform evaluation of learning algorithms and model selection.

Course Outcomes: At the end of the course, the student will be able to
CO1: Understand the basic concepts of learning and decision trees.
CO2: Able to solve real world problems using Neural Networks and Genetic Algorithms.
CO3: Demonstrate on Bayesian and Computational Learning.
CO4: Analyze different types of learning and learning set of rules such as case based reasoning and learning first order rules.
CO5: Summarize various concepts of analytical learning and reinforcement learning in terms of FOCL algorithm and Q learning.


TEXTBOOKS
M.Tech. (I Sem.)  20CO02-Advanced Data Structures

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**Pre-requisites:** Programming Language and principles of Data Structures

**Course Educational Objective:** From the course the student will learn
- Implementation of variety of data structures including linked lists, binary trees, heaps, graphs and search trees
- Applications of Dictionaries, ADT for List, Stack, Queue, Hash table representation, Hash functions, Priority queues, Priority queues using heaps, Search trees.

**Course Outcomes:** At the end of the course, the student will be able to

**CO1:** Write and analyze algorithms for linear data structure and check it’s correctness and efficiency

**CO2:** Demonstrate various searching, sorting and trees & Graphs traversal techniques and be able to apply and solve problems of real life

**CO3:** Master a variety of advanced abstract data type (ADT) and data structures and their Implementation

**CO4:** Design and implement Priority Queues

**CO5:** Ability to compare various search trees and find solutions for IT related problems


**UNIT – II:** Searching- Linear and Binary, Search Methods, Sorting-Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort.

**Trees:** Binary trees, Properties, Representation and Traversals (DFT, BFT), Expression Trees (Infix, prefix, postfix). Graphs-Basic Concepts, Storage structures and Traversals.

**UNIT – III:** Dictionaries, ADT, The List ADT, Stack ADT, Queue ADT, Hash Table Representation, Hash Functions, Collision Resolution-Separate Chaining, Open Addressing-Linear Probing, Double Hashing.


**UNIT – V:** Search Trees- AVL Trees, Definition, Height of AVL Tree, Operations-, Insertion, Deletion and Searching, Introduction to Red-Black and Splay Trees, B-Trees, Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees.

**TEXTBOOKS**
2. *Data Structures, Algorithms and Applications in java, 2/e*, Sartaj Shani, University Press

**REFERENCE**
1. Data Structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.
2. Data Structures and Algorithms, 3/e, Adam Drozdek, Cengage
Pre-requisites: Database Systems

Course Educational Objective:
- This Subject deals with dealing data in the real world, maintaining data without any redundancy, several techniques involved in DBMS to recover the problems caused due to redundancy, storing data for quick insertion, manipulation and deletion operations in order to retrieve data from the database.
- This subject provides an introduction to multidisciplinary field of data mining, the general data features, techniques for data preprocessing, general implementation of data warehouses and OLAP, the relationship between data warehousing and other generalization methods.
- The concepts of data clustering include a different method of clustering such as k-means, k-methods, db scan algorithm, role of data mining in web mining.

Course Outcomes: At the end of the course, the student will be able to
CO1: Analyze on normalization techniques.
CO2: Elaborate on concurrency control techniques and query optimization.
CO3: Summarize the concepts of data mining, data warehousing and data preprocessing strategies.
CO4: Apply data mining algorithms.
CO5: Assess various classification & cluster techniques.

UNIT – I: Introduction: Concepts and Definitions, Relational models, Data Modeling and Query Languages, Database Objects. Normalization Techniques: Functional Dependency, 1NF, 2NF, 3NF, BCNF; Multi valued Dependency; Loss-less Join and Dependency Preservation.


UNIT – IV: Knowledge representation: background knowledge, representing input data and output knowledge, visualization techniques and experiments with weka. Data mining algorithms: association rules, mining weather data, generating item sets and rules efficiently, correlation analysis.

UNIT – V: Classification & Clustering: 1R algorithm, decision trees, covering rules, task prediction, statistical classification, Bayesian network, instance-based methods, linear models, Cluster/2, Cobweb, k-means, Hierarchical methods. Mining real data: preprocessing data from a real medical domain, data mining techniques to create a comprehensive and accurate model of data. Advanced topics: text mining, text classification, web mining, data mining software.
TEXTBOOKS


REFERENCE

Pre-requisites: Concepts of Computer Graphics

Course Educational Objective: From the course the student will learn
- Basic principles of digital image processing and their applications.
- Demonstration of Image enhancement, Image compression and Image segmentation.
- Fundamentals of Colour Image processing techniques.

Course Outcomes: At the end of the course, the student will be able to
CO1: Summarize the fundamentals of digital image processing
CO2: Apply image enhancement techniques in spatial domain
CO3: Apply color image processing techniques to improve the fidelity of images.
CO4: Analyze image compression, morphological image processing techniques for various applications.
CO5: Evaluate the methodologies for image segmentation

UNIT – I: Introduction: Examples of fields that use digital image processing, fundamental steps in digital image processing, components of image processing system. Digital Image Fundamentals: A simple image formation model, image sampling and quantization, basic relationships between pixels

UNIT – II: Image enhancement in the spatial domain: Basic gray-level transformation, histogram processing, enhancement using arithmetic and logic operators, basic spatial filtering, smoothing and sharpening spatial filters, combining the spatial enhancement methods

UNIT – III: Color Image Processing: Color fundamentals, color models, pseudo color image processing, basics of full–color image processing, color transforms, smoothing and sharpening, color segmentation

UNIT – IV: Image Compression: Fundamentals, image compression models, error-free compression, lossy predictive coding, image compression standards. Morphological Image Processing: Preliminaries, dilation, erosion, open and closing, hit or miss transformation, basic morphologic algorithms

UNIT – V: Image Segmentation: Detection of discontinuous, edge linking and boundary detection, thresholding, region–based segmentation

TEXTBOOKS

REFERENCE
2. Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology
Pre-requisites: concepts of Operating Systems

Course Educational Objective:

- To provide comprehensive and up-to-date coverage of the major developments in distributed Operating System, Multi-processor Operating System and Database Operating System and to cover important theoretical foundations including Process Synchronization, Concurrency, Event ordering, Mutual Exclusion, Deadlock, Agreement Protocol, Security, Recovery and fault tolerance.

Course Outcomes: At the end of the course, the student will be able to

CO1: Illustrate on the fundamental concepts of distributed operating systems, its architecture and distributed mutual exclusion.
CO2: Analyze on deadlock detection algorithms and agreement protocols.
CO3: Make use of algorithms for implementing DSM and its scheduling.
CO4: Apply protection and security in distributed operating systems.
CO5: Elaborate on concurrency control mechanisms in distributed systems.

UNIT – I: Architectures of Distributed Systems, System Architecture types, issues in distributed operating systems, communication networks, communication primitives. Theoretical Foundations, inherent limitations of a distributed system, lamp ports logical clocks, vector clocks, casual ordering of messages, global state, cuts of a distributed computation, termination detection. Distributed Mutual Exclusion, introduction, the classification of mutual exclusion and associated algorithms, a comparative performance analysis

UNIT – II: Distributed Deadlock Detection, Introduction, deadlock handling strategies in distributed systems, issues in deadlock detection and resolution, control organizations for distributed deadlock detection, centralized and distributed deadlock detection algorithms, hierarchical deadlock detection algorithms. Agreement protocols, introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, and applications of agreement algorithms. Distributed resource management: introduction-architecture, mechanism for building distributed file systems design issues, log structured file systems.

UNIT – III: Distributed shared memory, Architecture, algorithms for implementing DSM, memory coherence and protocols, design issues. Distributed Scheduling, introduction, issues in load distributing, components of a load distributing algorithm, stability, load distributing algorithm, performance comparison, selecting a suitable load sharing algorithm, requirements for load distributing, task migration and associated issues. Failure Recovery and Fault tolerance: introduction, basic concepts, classification of failures, backward and forward error recovery, backward error recovery, recovery in concurrent systems, consistent set of check points, synchronous and asynchronous check pointing and recovery, check pointing for distributed database systems, recovery in replicated distributed databases.

UNIT – IV: Protection and security, preliminaries, the access matrix model and its implementations. -safety in matrix model, advanced models of protection. Data security, cryptography: Model of cryptography, conventional cryptography modern cryptography, private key cryptography, data encryption standard public key cryptography, multiple encryptions, authentication in distributed systems.
UNIT – V: Multiprocessor operating systems, basic multiprocessor system architectures, interconnection networks for multiprocessor systems, caching hypercube architecture. Multiprocessor Operating System, structures of multiprocessor operating system, operating system design issues, threads, process synchronization and scheduling. Database Operating systems: Introduction, requirements of a database operating system Concurrency control: Theoretical aspects, introduction, database systems, a concurrency control model of database systems, the problem of concurrency control, serializability theory, distributed database systems, concurrency control algorithms, introduction, basic synchronization primitives, lock based algorithms, timestamp based algorithms, optimistic algorithms, concurrency control algorithms, data replication.

TEXTBOOKS

REFERENCE
1. "Modern operating system", Andrew S.Tanenbaum, PHI, 2003
**Pre-requisites:** Concepts of Networks

**Course Educational Objective:** From the course the student will
- Understand the concepts of OSI Reference Model, Protocols at different layers with special emphasis on IP, TCP & UDP and Routing algorithms.
- Learn CSMA/CD, TCP/IP implementation, LANs/WANs, internetworking technologies, Routing and Addressing.
- Know the mathematical background of routing protocols.

**Course Outcomes:** At the end of the course, the student will be able to

CO1: Illustrate reference models with layers, protocols, and interfaces.
CO2: Demonstrate the routing algorithms, Sub netting and Addressing of IP V4and IPV6.
CO3: Analyze the transport layer protocols and how they can be used to assist in network design and implementation.
CO4: Describe the concepts Wireless LANS, WIMAX, IEEE 802.11, Cellular telephony and Satellite networks.
CO5: Describe the emerging trends in networks-MANETS and WSN

**UNIT – I :** Network layer: Network Layer design issues: store-and forward packet switching, services provided transport layers, implementation connection less services, implementation connection oriented services, comparison of virtual –circuit and datagram subnets, Routing Algorithms-shortest path routing, flooding, distance vector routing, link state routing, Hierarchical routing, congestion control algorithms: Approaches to congestion control, Traffic aware routing, Admission control, Traffic throttling, choke Packets, Load shedding, Random early detection, Quality of Service, Application requirements, Traffic shaping, Leaky and Token buckets

**UNIT – II :** Internetworking and IP protocols: How networks differ, How networks can be connected, internetworking, tunneling, The network layer in the internet, IPV4 Protocol, IP addresses, Subnets, CIDR, classful and Special addressing, network address translation (NAT), IPV6 Address structure address space, IPV6 Advantages, packet format, extension Headers, Transition from IPV4 to IPV6, Internet Control Protocols-IMCP, ARP, DHCP


**UNIT – V :** Emerging trends in Computer networks: Mobile computing: Motivation for mobile computing, Protocol stack issues in mobile computing environment, mobility issues in mobile computing, security issues in mobile networks, MOBILE Ad Hoc Networks: Applications of Ad

TEXTBOOKS
1. Data communications and networking 4th edition Behrouz A Fourzan, TMH
3. Computer networks, Mayank Dave, CENGAGE

REFERENCE
M.Tech. (I Sem.) 20CO07-Internet of Things

Pre-requisites: Fundamentals of ad-hoc networks and computer networks

Course Educational Objective:
• To understand the vision of IoT from a global context.
• To understand the application of IoT.
• To learn about various IOT-related protocols
• Use of Devices, Gateways and Data Management in IoT.

Course Outcomes: At the end of the course, the student will be able to
CO1: Summarize on the term ‘internet of things’ in different contexts
CO2: Understand the design principles and standards of IoT
CO4: Visualize the effect of IoT on smart applications
CO5: Describe the implementation of Privacy and Security in IoT

UNIT – I: IoT & Web Technology

UNIT – II: M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, M2M to IoT-An Architectural Overview– Building an architecture, Main design principles, An IoT architecture outline, standards considerations.


UNIT – IV: IoT Applications for Value Creations

UNIT – V: Internet of Things Privacy, Security and Governance

TEXTBOOKS

REFERENCE
Pre-requisites: computer programming

Course Educational Objective:
• To elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project.
• To understand what software life cycle is, how software projects are planned and managed, types of resources involved in software development projects, risks are identified and assessed, predictions and assessments are made.
• To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance, and quality requirements

Course Outcomes: At the end of the course, the student will be able to

CO1: Demonstrate the various software development process models
CO2: Identify the basic components of Object oriented paradigms
CO3: Design and Plan software solutions to problems using an object-oriented strategy.
CO4: Apply the different testing strategies for delivering a quality product
CO5: Estimate the cost of constructing object-oriented software.


UNIT – II: Object oriented Paradigm, Object oriented Concepts, Classes, Objects, Attributes, Methods: and services, Messages, Encapsulation, Inheritance, Polymorphism, Identifying the elements of object model, management of object-oriented Software projects, Object Oriented Analysis, Domain Analysis, Generic Components of OOA model, OOA Process, Object Relationship model, Object Behavior Model.


UNIT – IV: Object Oriented testing: Broadening the view of Testing, Testing of OOA and OOD models, Object-Oriented testing strategies, Test case design for OO software, testing methods applicable at the class level, Interclass test case design.

UNIT – V: Technical Metrics for Object Oriented Systems: The Intent of Object Oriented metrics, The distinguishing Characteristics, Metrics for the OO Design model, Class-Oriented metrics, Operation- Oriented Metrics, Metrics for Object Oriented testing, Metrics for Object Oriented projects. CASE Tools.
TEXTBOOKS
1. Object oriented and Classical Software Engineering, 7/e, Stephen R. Schach, TMH.
2. Object oriented and Classical Software Engineering, Timothy Lethbridge, Robert Laganiere, TMH

REFERENCE
Pre-requisites: Knowledge in Engineering, English

Course Objective: To understand the research problem, to know the literature studies, plagiarism and ethics, to get the knowledge about technical writing, to analyse the nature of intellectual property rights and new developments and research related information and to know the patent rights

Course Outcomes: After the completion of the course, students should be able to

- CO1 Analyze the research problem and its formulation.
- CO2 Analyze the significance of research ethics
- CO3 Apply the information technology for better tomorrow and to develop creativity.
- CO4 Identify the importance of intellectual property rights to be promoted among students in general & engineering in particular
- CO5 Describe the IPR protection for new and better products, and in turn brings about, economic growth and social benefits.

UNIT I- RESEARCH PROBLEM AND SCOPE FOR SOLUTION
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II- FORMAT
Effective literature studies approaches, analysis, Plagiarism, Research ethics. Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT III- PROCESS AND DEVELOPMENT

UNIT IV- PATENT RIGHTS

UNIT V- NEW DEVELOPMENTS IN IPR
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.
TEXT BOOKS

2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

REFERENCES

Pre-requisites: Fundamentals of Data Mining

Course Educational Objective:
- Make use of data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.

Course Outcomes: At the end of the course, the student will be able to
CO1: Understand the implementation procedures for the machine learning algorithms
CO2: Design Python programs for various Learning algorithms.
CO3: Apply appropriate data sets to the Machine Learning algorithms
CO4: Identify and apply Machine Learning algorithms to solve real world problems

List of Experiments

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
Pre-requisites: Programming Language and Data Structures

Course Educational Objective:
- Knowing about oops concepts for a specific problem.
- Various advanced data structures concepts like arrays, stacks, queues, linked lists, graphs and trees.

Course Outcomes: At the end of the course, the student will be able to

CO1: Identify classes, objects, members of a class and relationships among them needed for a specific problem.
CO3: Organize and apply to solve the complex problems using advanced data structures (like arrays, stacks, queues, linked lists, graphs and trees.)
CO4: Apply and analyze functions of Dictionary

List of Experiments (Any of the 10 experiments are required to be conducted)
Experiment 1: Write a java program to perform various operations on single linked list
Experiment 2: Write a java program for the following
   - Reverse a linked list
   - Sort the data in a linked list
   - Remove duplicates
   - Merge two linked lists
Experiment 3: Write a java program to perform various operations on doubly linked list.
Experiment 4: Write a java program to perform various operations on circular linked list.
Experiment 5: Write a java program for performing various operations on stack using linked list.
Experiment 6: Write a java program for performing various operations on queue using linked list.
Experiment 7: Write a java program for the following using stack
   - Infix to postfix conversion.
   - Expression evaluation.
   - Obtain the binary number for a given decimal number.
Experiment 8: Write a java program to implement various operations on Binary Search Tree Using Recursive and Non-Recursive methods.
Experiment 9: Write a java program to implement the following for a graph.
   a) BFS  b) DFS
Experiment 10: Write a java program to implement Merge & Heap Sort of given elements.
Experiment 11: Write a java program to implement Quick Sort of given elements.
Experiment 12: Write a java program to implement various operations on AVL trees.
Experiment 13: Write a java program to perform the following operations:
   - Insertion into a B-tree
   - Searching in a B-tree
Experiment 14: Write a java program to implementation of recursive and non-recursive functions to Binary tree Traversals
Experiment 15: Write a java program to implement all the functions of Dictionary (ADT) using Hashing.
M.Tech. (II Sem.)       20CO09-Big Data Analytics

Pre-requisites: Fundamentals of Cloud Computing, Data Mining

Course Educational Objective:
- To understand big data analytics as the next wave for businesses looking for competitive advantage
- To understand the financial value of big data analytics
- To explore tools and practices for working with big data
- To understand how big data analytics can leverage into a key component
- To understand how to mine the data
- To learn about stream computing

Course Outcomes: At the end of the course, the student will be able to

CO1: Analyze the big data for useful business applications
CO2: Impart theoretical knowledge related to Data Analytics
CO3: Impart theoretical knowledge related to Stream Computing
CO4: Apply data science concepts and methods to solve problems in Predictive Analytics
CO5: Learn to build and maintain reliable, scalable, distributed systems with Apache Hadoop


TEXTBOOKS

REFERENCE

10. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition,
Pre-requisites: Principles of Computer networks, Security aspects in Internet and Data communication networks

Course Educational Objective:
- To Understand OSI security architecture and classical encryption techniques.
- To know fundamental knowledge on the concepts of finite fields and number theory. Understand various block cipher and stream cipher models.
- To learn the principles of public key cryptosystems, hash functions and digital signature.

Course Outcomes: At the end of the course, the student will be able to

CO1: Describe the key security requirements of confidentiality and integrity
CO2: Analyze the different process for hiding the information with conventional cryptographic algorithms
CO3: Analyze public cryptosystems and disseminate from conventional systems for the security
CO4: Apply authentication techniques to provide secure communication
CO5: Explore email security, web security and system security


TEXTBOOKS


REFERENCE

Pre-requisites: Fundamentals of artificial intelligence

Course Educational Objective:
- To understand the basic concepts of neurons, perceptron’s and back propagation networks.
- To understand feed forward and recurrent networks.
- To learn Support Vector Machines and Linear regression.
- To learn different types of unsupervised neural networks.
- To understand adaptive resonance theory and its applications.

Course Outcomes: At the end of the course, the student will be able to

CO1: Describe models of the brain and neuron function with mathematical methods.
CO2: Design and develop artificial neural networks in software.
CO3: Elaborate the Support Vector Machines for pattern recognition & Nonlinear regression
CO4: Demonstrate Unsupervised Learning Networks
CO5: Identify the Building Blocks of Adaptive Resonance


TEXTBOOKS
REFERENCES
Prerequisites: Fundamentals of computer networks

Course Objectives:
- To enable student to understand fundamentals of networks, types and challenges of adhoc networks.
- To learn various adhoc routing protocols
- To understand multicast routing in adhoc networks
- To understand the transport layer issues and security protocols
- To know issues in providing QoS.

Course Outcomes: At the end of the course, the student will be able to

CO1: Explain the Fundamental Concepts and applications of ad hoc and wireless sensor networks
CO2: Enumerate the concept of routing protocols for ad hoc wireless networks
CO3: Analyze Multicast routing protocols in Ad-hoc networks
CO4: Describe the Transport layer protocols and security protocols in Ad-hoc networks
CO5: Discuss the QoS measurements and energy management issues


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UNIT - V :QoS AND ENERGY MANAGEMENT

TEXTBOOK

REFERENCES
Pre-requisites: Knowledge of Computer and Its Architecture.

Course Educational Objective:
- To provide basic methodologies and processes for designing interfaces.
- To improve the interaction between users and computers by making computers more usable and receptive to the user’s needs.
- To provide relevant principles of behavior, mostly derived from cognitive science and psychology and other sources that describe human ethologic in particular environment, especially technological ones.
- To make the students familiar with developing new interfaces and interaction techniques.

Course Outcomes: At the end of the course, the student will be able to
CO1: Identify the elements of good user interface design through effective GUI.
CO2: Describe the importance of human characteristics and understanding business functions.
CO3: Analyze screen design principles for making good decisions based on technological considerations in interface design.
CO4: Select the window, device and screen based controls through navigation schemes.
CO5: Demonstrate the basic components and interaction devices to interact with the computers.

UNIT – I: Introduction: Importance of user Interface – definition, importance of good design, benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics - Principles of user interface

UNIT – II: Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, and understanding business junctions.


TEXTBOOKS
REFERENCE
Pre-requisites: Foundations of Computer Networks and Operating System

Course Educational Objective:
- To provide knowledge on Cloud Computing concepts, technologies, and architecture.
- To introduce the concepts of Cloud Computing fundamentals, applications, and implementations.
- To identify various areas of information systems in managing the cloud environment.

Course Outcomes: At the end of the course, the student will be able to
CO1: Interpret the key dimensions of the challenge of Cloud Computing.
CO2: Explore the PAAS and SAAS Services
CO3: Analyze the virtual machine provisioning and virtualized storage strategies.
CO4: Understand the Scientific Applications for Cloud Environments
CO5: Identify the issues in monitoring and management in cloud environment.


UNIT – IV: Understanding Scientific Applications for Cloud Environments: A Classification of Scientific Applications and Services in the Cloud , SAGA-based Scientific Applications that Utilize Clouds. The MapReduce Programming Model and Implementations: MapReduce Programming Model, Major MapReduce Implementations for the Cloud, MapReduce Impacts and Research Directions.


TEXTBOOKS
REFERENCE

4. Haley Beard Cloud computing best practices
Pre-requisites: Basic knowledge of probability & statistics, data mining

Course Educational Objective:
- To understand the concept of patterns and the basic approach to the development of pattern recognition algorithms.
- To learn methods for data pre-processing, feature extraction, and feature selection to multivariate data.
- To know supervised and unsupervised classification methods to detect and characterize patterns in real-world data.
- To develop prototype for pattern recognition algorithms that can be used to study.

Course Outcomes: At the end of the course, the student will be able to
CO1: Analyze classification problems probabilistically and estimate classifier performance
CO2: Understand the concepts of Bayesian decision theory
CO3: Apply unsupervised learning algorithms to data objects & Analyze clustering algorithms
CO4: Describe component analysis and similarity measures
CO5: Apply Hidden Markov models in real-time applications

UNIT – I: Introduction: Machine perception, pattern recognition example, pattern recognition systems, the design cycle, learning and adaptation. Bayesian Decision Theory: Introduction, continuous features – two categories classifications, minimum error-rate classification- zero–one loss function, classifiers, discriminant functions, and decision surfaces.

UNIT – II: Normal density: Univariate and multivariate density, discriminant functions for the normal density different cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context. Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case.


UNIT – IV : Similarity measures, criteria function for clustering. Component analyses: Principal component analysis, non-linear component analysis; Low dimensional representations and multi-dimensional scaling.

UNIT – V : Discrete Hidden Markov Models: Introduction, Discrete–time markov process, extensions to hidden Markov models, three basic problems for HMMs
Continuous hidden Markov models: Observation densities, training and testing with continuous HMMs, types of HMMs.

TEXTBOOKS
1. Richard O. Duda, Peter E. Hart and David G. Stroke Pattern Classifications. 2 ed Wiley Student Edition
REFERENCE
1. Earl Gose, Richard John Baugh and Steve Jost, Pattern Recognition and Image Analysis. PHI, 2004
Pre-requisites: Fundamentals of Software Engineering

Course Educational Objective:
- To understand software quality assurance framework and standards.
- To understand various software quality assurance metrics and measurements.
- To know software quality assurance metrics.
- To learn software testing environment.
- To understand various software testing techniques.

Course Outcomes: At the end of the course, the student will be able to

CO1: Describe the quality assurance framework and Quality standards
CO2: Analyze the different types of models for quality assurance
CO3: Measure various business process reengineering
CO4: Identify the mechanisms to prevent the defects
CO5: Describe risk management in software process


UNIT – III: Software Quality metrics methodology: Establish quality requirements, Identify Software quality metrics, Implement the software quality metrics, analyse software metrics results, validate the software quality metrics – Software quality indicators – Fundamentals in Measurement theory.

UNIT – IV: Software Testing Strategy and Environment: Establishing testing policy, structured approach to testing, test factors, Economics of System Development Life Cycle (SDLC) Testing, Software Testing Methodology- Defects hard to find, verification and validation, functional and structural testing, workbench concept, eight considerations in developing testing methodologies, testing tactics checklist.

TEXTBOOKS


REFERENCE

Pre-requisites: Programming Fundamentals Java and R

Course Outcomes: At the end of the course, the student will be able to

CO1: Set up single and multi-node Hadoop Clusters 
CO2: Apply Map Reduce algorithms for various algorithms  
CO3: Design new algorithms that use Map Reduce to apply on Unstructured and structured data

List of Experiments
(Any of the 10 experiments are required to be conducted)

Week 1
- Downloading and installing Hadoop
- Understanding different Hadoop modes
- Startup scripts & Configuration files

Week 2
- Setting up Hadoop pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux.

Week 3
- After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves)

Week 4
- Implement the following file management tasks in Hadoop:
  - Adding files and directories
  - Retrieving files & Deleting files

Week 5
- Implement Matrix Multiplication with Hadoop Map Reduce

Week 6
- Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

Week 7
- Running Word Counting on a Remote Cluster

Week 8
- K-means clustering using map reduce

Week 9
- Understanding Hive
- Installing Hive & Setting up Hive configurations
- Practice Hive with example

Week 10
- Installing HBase & thrift
- Practice HBase with example

Week 11
- Practice Importing and Exporting Data from Various DBs

Reference text
1. Big Data Analytics with R and Hadoop--VigneshPrajapati--2013 Packt Publishing
Course Educational Objective:
- To provide deeper understanding into cryptography, its application to network security,
- threats/vulnerabilities to networks and countermeasures.
- To explain various approaches to Encryption techniques, strengths of Traffic Confidentiality,
- Message Authentication Codes.
- To familiarize symmetric and asymmetric cryptography

Course Outcomes: At the end of the course, the student will be able to

CO1: Identify basic security attacks and services
CO 2: Use symmetric and asymmetric key algorithms for cryptography
CO 3: Make use of Authentication functions

List of Experiments

1. Implementation of Caesar Cipher technique
2. Implement the Play fair Cipher
3. Implement the Pure Transposition Cipher
4. Implement DES Encryption and Decryption
5. Implement the AES Encryption and decryption
6. Implement RSA Encryption Algorithm
7. Implementation of Hash Functions
Pre-requisites: Foundations of Information Security

Course Educational Objective:
- To get the Knowledge on basic digital forensics and techniques for conducting the forensic examination on different digital devices.
- To learn the procedure for High tech Investigations, data recovery workstations.
- To know digital evidence such as the data acquisition, identification analysis.
- To familiar with forensic analysis tools to recover important evidence for identifying computer crime.

Course Outcomes: At the end of the course, the student will be able to

CO1: Understand the definition of computer forensics fundamentals
CO2: Describe the types of computer forensics technology
CO3: Illustrate the methods for data recovery, evidence collection and data seizure
CO4: Summarize duplication and preservation of digital evidence.
CO5: Explore different computer forensics tools

UNIT – I: Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

UNIT – II: Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery workstation and software, conducting and investigations.

UNIT – III: Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

UNIT – IV: Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

UNIT – V: Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

TEXTBOOKS

REFERENCE
Pre-requisites: Foundations Neural Networks

Course Educational Objective:
- Used to formalize tasks in terms of computational Complexity via Deep Learning Architectures.
- Used to design deep learning models via Statistical approaches to solve data-rich tasks
- Helpful to Build datasets, tune and train deep learning models with advanced deep learning libraries
- To understand the inner mechanisms of Deep learning Neural techniques during training
- To analyze the performance of Optimization techniques on tasks of interest

Course Outcomes: At the end of the course, the student will be able to

CO1: Design deep architectures and algorithms for pattern recognition
CO2: Analyze classification problems probabilistically and estimate classifier performance
CO3: Explore the essentials of Deep Learning and Deep Network architectures
CO4: Elaborate different types of deep learning network models
CO5: Explore the essentials of Optimization for Training Deep Models


UNIT – III : Neural Networks for Deep Architectures: Learning Algorithms, Generalization, Capacity, over fitting and under fitting, Generalization Error, Estimators, Bias and variance, Maximum Likelihood Estimation. Learning Mechanisms: Supervised Vs Unsupervised Learning,


TEXTBOOKS

REFERENCE
Course Educational Objective:
- The learning objective of the course Social Network Analysis is to provide students with essential knowledge of network analysis applicable to real world data, with examples from today’s most popular social networks.

Course Outcomes: At the end of the course, the student will be able to

CO 1: Demonstrate social network analysis and measures.
CO 2: Analyze random graph models and navigate social networks data
CO 3: Apply the network topology and Visualization tools.
CO 4: Analyze the experiment with small world models and clustering models.
CO 5: Compare the application driven virtual communities from social network Structure.


UNIT – V: Network structure -Important vertices and page rank algorithm, towards rational dynamics in networks, basics of game theory, Coloring and consensus, biased voting, network formation games, network structure and equilibrium, behavioral experiments, Spatial and agent-based models.

TEXTBOOKS

2. D. Easley and J. Kleinberg, Networks, Crowds and Markets: Reasoning about a highly connected world-2010

REFERENCE

1. Social Network Analysis: Methods and Applications (Structural Analysis in the Social Sciences) by Stanley Wasserman, Katherine Faust, 1994