

MASTER OF COMPUTER APPLICATION

**Programme Code: MCA
Duration: 2 Years**

EFFECTIVE FROM SESSION: 2025-2026



CBCS

**Department of Computer Science & Information Technology
Faculty of Engineering & Technology**

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UNIVERSITY PANVEL, NAVI MUMBAI**

| MCA 1 Year - Semester 1 | | | | | | | | | | |
|-------------------------|-----------------------------|-------------|----------|----------|--------------|------------|-----------------|-----------|-------------|-----------|
| Course Code | Course Title | Hours/ Week | | | Theory Marks | | Practical Marks | | Total Marks | Credit |
| | | L | T | P | IA | ESE | IA | ESE | | |
| CSEM1010 | Advanced Data Structure | 3 | 1 | | 30 | 70 | | | 100 | 4 |
| CSEM1020 | Python Programming | 3 | | | 30 | 70 | | | 100 | 3 |
| CSEM1030 | High Performance Networks | 3 | | | 30 | 70 | | | 100 | 3 |
| CSEM1040 | IT in Management | 3 | 1 | | 30 | 70 | | | 100 | 4 |
| CSEM1050 | Research Methodology & IPR | 3 | 1 | | 30 | 70 | | | 100 | 4 |
| CSEM1011 | Advanced Data Structure Lab | | | 4 | | | 15 | 35 | 50 | 2 |
| CSEM1021 | Python Programming Lab | | | 4 | | | 15 | 35 | 50 | 2 |
| | TOTAL | 15 | 3 | 8 | 150 | 350 | 30 | 70 | 600 | 22 |

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|---|-------------------------|---------------------------------|-----------------|
| Course Title | Advanced Data Structure | Course Code: CSEM1010 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 / 1 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 4 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. To teach efficient storage mechanisms of data for easy access. 2. To design and implementation of various basic and advanced data structures and algorithm analysis 3. To introduce various techniques for representation and analysis of the data in the real world. 4. To develop applications using data structures and algorithms and analysis. 5. To improve the logical ability. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Introduction to Data Structures & Algorithms Introduction of Data structures, Abstract Data Types, Performance Analysis: Space Complexity, Time Complexity, Asymptotic Notations (Big O, Omega, Theta), Performance measurement, Divide and Conquer, Backtracking Method, Dynamic programming Sorting: Merge sort, Heap sort | | | |
| Unit-II | | | |
| Hashing Different Hashing Techniques, Address calculation Techniques, Common hashing functions, Collision resolution techniques: Linear probe, Quadratic probe, Key offset. Arrays and List: Array: Definition, Representation, Address Calculation; Searching: Linear search, Binary search; Sorting: Bubble sort, Insertion sort, Selection sort, Radix sort, Shell sort; List: Introduction, Implementation as Linked list, Circular linked List, Doubly linked list, Applications of linked list. Rehashing, Double hashing, Link list addressing. | | | |
| Unit-III | | | |
| Linear Data Structures Stack Definition, Operations, Implementation of Stacks (Array and Linked list) and applications Evaluation of postfix expression, Balancing of parenthesis Queue: Definition, Operations, Implementation of simple queue (Array and Linked list) and applications of queue-BFS Types of queues: Circular, Double ended, Priority, Implementation using linked list Types of Linked List: Singly, Doubly and Circular Linked list Definition, Operations (Insert, delete, traverse, count, search) Applications of Linked List: Polynomial Addition and Subtraction. | | | |

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| Unit-IV |
| Non-linear Data Structures Tree Definition and concepts, General Tree- Definition, Insertion and Deletion into general tree, Binary Tree- Definition, Insertion and Deletion into binary tree, Traversal of a binary tree, Reconstruction of a binary tree from traversal, Conversion of general tree into binary tree, Huffman tree, Expression tree, Binary threaded tree Binary Search Tree- Definition, Operation, Implementation AVL tree- Definition, AVL tree rotation with examples, Heaps-Definition, Operations (insertion, delete, build) M way Tree Introduction, B tree-definition and examples and B* |
| Unit-V |
| Graphs Definition, Types, Operations, Representation, Networks, Traversals of graph, Minimum spanning tree, Kruskal's Algorithm, Prim's Algorithm, Warshall's Algorithm, Shortest path algorithm-dijkstra's algorithm |
| Text /Reference Books: |
| <ol style="list-style-type: none"> 1. Richard F Gilberg Behrouz A Forouzan , “Data Structure A Pseudocode Approach with 2. C“. Second edition University of Mumbai, MCA Sem I and Sem II Rev. 2016-17 3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to ALGORITHMS”, PHI, India Second Edition. 3. Shaum's Outlines Data Structure Seymour Lipschutz TMH 4. Michael T.Goodrich “Data Structures and Algorithms in C++-“ Wiley Publications |
| Course Outcomes: |
| <ol style="list-style-type: none"> 1. CO1: Earn the basic types for data structure, implementation and application. 2. CO2: Know the strength and weakness of different data structures. 3. CO3:Demonstrate the appropriate data structure in the context of the solution of a given problem. 4. CO4:Evaluate the appropriate searching & sorting technique in given problem. 5. CO5: Develop programming skills which require solving a given problem |

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| Course Title | Python Programming | Course Code: CSEM1020 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 3 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. To introduce the fundamentals of Python and its syntax for problem-solving. 2. To apply data structures and modular programming using Python. 3. To implement object-oriented concepts for building structured applications. 4. To develop basic web applications using Python web frameworks. 5. To use Python libraries for data analysis and machine learning tasks. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Basics of Python Programming : Introduction to Python: Features, Applications. Installation, IDEs (IDLE, Jupyter, VS Code), Variables, Data Types, Type Conversion, Operators and Expressions, Conditional Statements (if, if-else, elif), Looping Statements (for, while), Break, Continue, Pass. | | | |
| Unit-II | | | |
| Data Structures and Functions in Python : Lists, Tuples, Sets, Dictionaries: Creation, Access, Methods. List and Dictionary Comprehensions, Defining and Calling Functions, Function Arguments and Return Values, Recursion, Lambda Functions, Built-in Functions: map(), filter(), reduce(), zip(), enumerate(). | | | |
| Unit-III | | | |
| Object-Oriented Programming with Python : Introduction to OOP Concepts, Classes and Objects, Constructors (__init__), Destructors, Types of Variables and Methods, Inheritance: Single, Multilevel, Multiple, Method Overriding and Polymorphism, Encapsulation and Abstraction. | | | |

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| Unit-IV |
| Python for Web Development : Introduction to Flask or Django Framework, HTTP Methods and Routing, Creating Web Pages with HTML Templates, Form Handling and Session Management, Database Connectivity using SQLite / MySQL. |
| Unit-V |
| Python for Data Analysis and Machine Learning : NumPy: Arrays, Indexing, Operations, Pandas: Series, Data Frames, Data Manipulation, Data Visualization: Matplotlib, Seaborn, Introduction to Machine Learning. |
| Text /Reference Books: |
| <ol style="list-style-type: none"> 1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson 2. Learning Python, Mark Lutz, Orielly. 3. Think Python, Allen Downey, Green Tea Press 4. Core Python Programming, W.Chun, Pearson 5. Introduction to Python, Kenneth A. Lambert, Cengage |
| Course Outcomes: |
| <p>CO-1: Demonstrate proficiency in Python programming constructs and control structures.</p> <p>CO2: Apply Python's built-in data structures and functions for modular and efficient code.</p> <p>CO3: Design object-oriented applications using Python's class-based features.</p> <p>CO4: Develop and deploy basic web applications using Flask or Django.</p> <p>CO5: Analyze data and implement machine learning models using Python libraries like NumPy, Pandas, and scikit-learn..</p> |

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|---|---------------------------|---------------------------------|-----------------|
| Course Title | High Performance Networks | Course Code: CSEM1030 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 3 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| 1. Teach basic concepts in high performance networking, with a focus on throughput and latency performance metrics; 2. Expose students to real-world architectural constraints in high performance networking; 3. Develop design skills through the practical development of a high performance network device; 4. Provide research skills for characterization and modelling of high performance network devices. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| INTRODUCTION Review of OSI, TCP/IP; Multiplexing, Modes of Communication, Switching, Routing. SONET – DWDM – DSL – ISDN – BISDN, ATM. | | | |
| Unit-II | | | |
| MULTIMEDIA NETWORKING APPLICATIONS Streaming stored Audio and Video – Best effort service – protocols for real time interactive applications – Beyond best effort – scheduling and policing mechanism – integrated services – RSVP- differentiated services. | | | |
| Unit-III | | | |
| ADVANCED NETWORKS CONCEPTS VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN.MPLS -operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections. | | | |
| Unit-IV | | | |
| TRAFFIC MODELING Little's theorem, Need for modeling , Poisson modeling and its failure, Non - poisson models, Network performance evaluation. | | | |

Unit-V

NETWORK SECURITY AND MANAGEMENT

Principles of cryptography – Authentication – integrity – key distribution and certification – Access control and: fire walls – attacks and countermeasures – security in many layers. Infrastructure for network management – The internet standard management framework – SMI, MIB, SNMP, Security and administration – ASN.1

Text /Reference Books:

1. J.F. Kurose & K.W. Ross, "Computer Networking- A top down approach featuring the internet", Pearson, 2nd edition, 2003.
2. Walrand .J. Varatya, High performance communication network, Morgan Kauffman – Harcourt Asia Pvt. Ltd. 2nd Edition, 2000.
3. LEOM-GarCIA, WIDJAJA, "Communication networks", TMH seventh reprint 2002.
4. Aunurag kumar, D. MANjunath, Joy kuri, "Communication Networking", Morgan Kaufmann Publishers, 1ed 2004.
5. Hersent Gurle & petit, "IP Telephony, packet Pored Multimedia communication Systems", Pearson education 2003.
6. Fred Halsall and Lingana Gouda Kulkarni, "Computer Networking and the Internet" fifth edition, Pearson education
7. Nader F.Mir ,Computer and Communication Networks, first edition. 8. Larry l.Peterson & Bruce S.David, "Computer Networks: A System Approach"- 1996

Course Outcomes:

After completion of this subject students will be able to

- CO1: Recall Basics of Computer Networking
- CO2: Explore Real-Time Interactive Applications
- CO3: Summarize advanced network concepts
- CO4: Analyze various network models
- CO5: Apply network security in various layers of network

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|--|-----------------------|---------------------------------|-----------------|
| Course Title | IT in Management | Course Code: CSEM1040 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 / 1 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 4 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| 1. Explain systems and management concepts and their relevance for information systems 2. Understand the importance and the need for professionalism in managing computer-based systems 3. Explain the strategic use of information technology and the effect of advances in telecommunications and other equipment 4. Discuss the need for special types of MIS and describe their components 5. Describe the issues of planning the development of computer-based applications | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Introduction: Management Concept and Nature –Types of Managers- Responsibilities and skills of Professional Manager- Functions of Management–Fayol’s Principles of Management – Administration vs. Management– Management Process – Levels of Management – Approaches to the study of Management. | | | |
| Unit-II | | | |
| Planning and Organizing Planning: Concept, Meaning and Definition, Process, Benefits and Limitations-Decision making: Concept, process & techniques- Departmentation: Concept- Basis of Power and Authority: Concept-Delegation and Decentralization: Concept and Definition, Importance and Limitations, Process – Line and Staff Organization – Conflicts between Line and Staff – Measures to overcome the Conflicts –Span of Control. | | | |
| Unit-III | | | |
| Motivation and Leadership: Motivation Concept and Definition, Types, Importance –Theories of Motivation – Motivators: Financial and Non financial- Leadership: Concept and Definition, Importance, Styles of Leadership, Theories of Leadership Leader vs. Manager. | | | |

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| Unit-IV |
| Communication and Control: Communication Concept and Definition, Importance, Process, Barriers to Effective Communication and Measures to Overcome Communication barriers- Controlling: Concept, Definition, Basic control process, Requirement of Effective control, Control Techniques. |
| Unit-V |
| Organizational Behaviour, Change and Development Concept, Meaning, Definition, Objectives, Importance and Limitations of OB – Interdisciplinary approach to Organizational Behaviour- Organizational Change: Concept, Objectives, Reasons, Resistance to change, Measures to overcome change- Organizational Development: Concept, Process, Techniques of OD. |
| Text /Reference Books: |
| 1. L.M.Prasad, Principles and Practice of Management, 7Ed, S.Chand Publishers, 2007. 2. Weihrich&Koonty, Essentials of Management, TMH, 1990. 3. Robbins.P, Essential of Organizational Behaviour, 10 Ed, PHI, 2010. 4. Fred Luthans, Organizational Behaviour, 11Ed, TMH, 2006. 5. K.Aswathappa, Organizational Behaviour, 5Ed, Himalaya Publishers, 2001. 6. Sridharan Bhat, Management and Behavioural Process, Text and Cases, Himalaya Publishers. |
| Course Outcomes: |
| CO1: Understand the concept of Business, Administration, Business management CO2: Learn how to design, implement and evaluate business projects with the help of IT. CO3: Interpret the concept, definition, theories, and leadership tackle common practical financial problems of business. CO4: Examine the ability to carry out market research projects CO5: Evaluate written sales plans and professional interactive presentations |

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|--|----------------------------|---------------------------------|-----------------|
| Course Title | Research Methodology & IPR | Course Code: CSEM1050 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 / 1 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 4 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| 1. Identify an appropriate research problem in their interesting domain. 2. Understand ethical issues, understand the Preparation of a research project thesis report. 3. Understand the Preparation of a research project thesis report. 4. Understand the law of patent and copyrights. 5. Understand the Adequate knowledge on IPR. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Meaning of Research Problem 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 problems, data collection, analysis, interpretation, Necessary instrumentations. | | | |
| Unit-II | | | |
| Literature Studies Effective literature studies approaches, analysis Plagiarism, and Research ethics. | | | |
| Unit-III | | | |
| Technical Writing Effective technical writing, how to write reports, Paper Developing a Research Proposal. Format of research proposal, a presentation and assessment by a review committee. | | | |
| Unit-IV | | | |
| Research Proposal Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT. | | | |
| Unit-V | | | |
| PATENT RIGHTS AND NEW DEVELOPMENTS IN IPR Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and | | | |

databases. Geographical Indications. 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 /Reference Books:

- Stuart Melville and Wayne Goddard, “ Research methodology: an introduction for science & engineering students”
- Stuart Melville and Wayne Goddard, “ Research methodology: an introduction for science & engineering students”
- Ranjit Kumar, 2nd Edition, “ Research Methodology: A Step by Step Guide for beginners”

Course Outcomes:

After completion of this subject students will be able to

CO1: Understand the concept research, scope of research, objective of Research.

CO2: Learn literature study and analyze Plagiarism.

CO3: Interpret and apply the knowledge to write a research paper, project report and presentation project.

CO4: Examine Intellectual Property, Copyrights, innovation, Patents..

CO5: Understand developments in IPR.

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|------------------------|-----------------------------|---------------------------------|-----------------|
| Course Title | Advanced Data Structure Lab | Course Code: CSEM1011 | |
| Teaching Scheme | | Evaluation Scheme | |
| Practicals | 4 Hrs Week | Internal Assessment Test | 15 Marks |
| Total Credits | 2 | End-Semester Examination | 35 Marks |

Course Objectives:

Implement the following using C/C++/Java

1. Write a program to perform the following operations on a singly linked list. i) Creation ii) Insertion iii) Deletion iv) Traversal.
2. Write a program to perform the following operations on a doubly linked list. i) Creation ii) Insertion iii) Deletion iv) Traversal in both ways
3. Write a program that implements stack (its operations) using i) Arrays ii) linked list
4. Write a programs that implements Queue (its operations) using i) Arrays ii) linked list
5. Write a C program that implements the Quick sort method to sort a given list of integers in ascending order.
6. Write a C program that implements the Merge sort method to sort a given list of integers in ascending order.
7. Write a C program that implements the SHELL sort method to sort a given list of integers in ascending order.
8. Write a program to perform the following: i) Creating a Binary Tree of integers ii) Traversing the above binary tree in preorder, inorder and postorder.
9. Write a C program to perform the following: i) Creating a AVL Tree of integers ii) Traversing the above binary tree in preorder, inorder and postorder.
10. Write a C program that uses functions to perform the following: i) Creating a Tree of integers ii) Traversing the above binary tree in preorder, inorder and postorder.
11. Write a C program to perform the following: i) Creating a B-Tree of integers ii) Traversing the above binary tree in preorder, inorder and postorder.
12. Write a program that implements Kruskal's algorithm using a disjoint set data structure. The program takes as input a file (data.txt), in which each line either represents a vertex or an edge. For the edge lines, the first integer on that line represents the starting vertex, the second the ending vertex, and the third the weight of the edge. Use this file to construct, line by line, the graph upon which Kruskal's algorithm will be run (do NOT hardcode this graph!).
13. Write a program to simulate various graph traversing algorithms.
14. Write a program to find the minimal spanning tree of a graph using the Prim's algorithm. The program should be able to read in the weight matrix of a graph and produce the minimal spanning tree. Generate weight matrices (using a random number generator) with a large number of nodes and estimate the time complexity of the algorithm.
15. Write a program to find the closest pair of points using a divide and conquer strategy. Use the random number generator to generate a large number of points in a unit square as input to the algorithm. Test the correctness of the algorithm by using a brute force method.

16. Use dynamic programming to find the optimal binary search tree for a given set of numbers together with their probabilities. Remember that the numbers may be generated in any order, so a presorting step is also required.

Course Outcomes:

At the end of the course, a student will be able to

CO1: Implement List ADTs and their operations.

CO2: Develop programs for sorting.

CO3: Develop programs for implementing trees and their traversal operations.

CO4: Implement graph traversal algorithms.

CO5: Apply algorithm design techniques.

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|------------------------|------------------------|---------------------------------|-----------------|
| Course Title | Python Programming Lab | Course Code: CSEM1021 | |
| Teaching Scheme | | Evaluation Scheme | |
| Practicals | 4 Hrs Week | Internal Assessment Test | 15 Marks |
| Total Credits | 2 | End-Semester Examination | 35 Marks |

Course Objectives:

1. To introduce basic programming concepts using Python such as variables, control structures, functions, and data types.
2. To develop problem-solving skills through hands-on implementation of logic using Python syntax and libraries.
3. To train students in modular and structured programming, including use of functions, recursion, and file handling.
4. To expose students to object-oriented programming principles using Python's class and object mechanisms.
5. To provide practical knowledge of Python libraries used in data handling, file I/O, and basic computational tasks.

Name of Experiment

| SR. No | Python Programming Lab |
|--------|--|
| 1. | Basic Python Syntax and Control Statements Aim: To understand variables, data types, conditional statements, and loops. Tools: Jupyter Notebook / VS Code. |
| 2. | Data Structures – Lists, Tuples, Sets, Dictionaries. Aim: To explore Python's core data structures. Tools: Jupyter Notebook / VS Code. |
| 3. | Functions and Recursion Aim: To define and call functions, and implement recursion. Tools: Jupyter Notebook / VS Code |
| 4. | Lambda and Built-in Functions Aim: To use lambda, map, filter, reduce, zip, enumerate. Tools: Jupyter Notebook / VS Code |
| 5. | Classes and Objects Aim: To implement classes, constructors, and object creation. Tools: Jupyter Notebook / VS Code |

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| 6. | Inheritance and Polymorphism Aim: To demonstrate single/multilevel inheritance and method overriding. Tools: Jupyter Notebook / VS Code |
| 7. | Web App Using Flask Aim: To create a basic Flask web application with routing. Tools: Flask, VS Code |
| 8. | Form Handling in Flask with SQLite Aim: To create a form and store data in a database. Tools: Flask + SQLite |
| 9. | Data Analysis with NumPy and Pandas Aim: To manipulate arrays and data frames. Tools: Jupyter Notebook, NumPy, Pandas |
| Course Outcomes: | |
| CO1:Apply fundamental programming concepts in Python to solve basic computational problems. CO2:Write efficient Python code using control structures, functions, and loops for structured problem-solving. CO3:Manipulate strings, lists, tuples, dictionaries, and sets to implement data-driven logic. CO4:Develop Python programs using OOP features such as classes, inheritance, and polymorphism. CO5:Use Python's built-in libraries for tasks such as file operations, basic data analysis, and error handling. | |

| MCA 1 Year - Semester 2 | | | | | | | | | | |
|-------------------------|---|-------------|----------|----------|--------------|------------|-----------------|-----------|-------------|-----------|
| Course Code | Course Title | Hours/ Week | | | Theory Marks | | Practical Marks | | Total Marks | Credit |
| | | L | T | P | IA | ESE | IA | ESE | | |
| CSEM2010 | Advanced Operating System | 3 | | | 30 | 70 | | | 100 | 3 |
| CSEM2020 | Web Technology | 3 | 1 | | 30 | 70 | | | 100 | 4 |
| CSEM2030 | Cyber & Information Securityg | 3 | 1 | | 30 | 70 | | | 100 | 4 |
| CSEM2040 | Advanced Database Management System | 3 | | | 30 | 70 | | | 100 | 3 |
| CSAM2050 | Design and Analysis of Algorithm | 3 | 1 | | 30 | 70 | | | 100 | 4 |
| CSEM2021 | Web Technology Lab | | | 4 | | | 15 | 35 | 50 | 2 |
| CSEM2041 | Advanced Database Management System Lab | | | 4 | | | 15 | 35 | 50 | 2 |
| | TOTAL | 15 | 3 | 8 | 150 | 350 | 30 | 70 | 600 | 22 |

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|---|---------------------------|---------------------------------|-----------------|
| Course Title | Advanced Operating System | Course Code: CSEM2010 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 3 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| The aim of this module is to study, learn, and understand the main concepts of advanced operating systems (parallel processing systems, distributed systems, real time systems, network operating systems, and open source operating systems); Hardware and software features that support these systems. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Introduction and Process Management Architecture, Goals & Structures of O.S, Basic functions, Interaction of O. S. & hardware architecture, System calls, Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real -time O.S. Process Concept, Process states, Process control, Threads, Uni-processor Scheduling: Types of scheduling: Preemptive, Non preemptive, Scheduling algorithms: FCFS, SJF, RR, Priority, Thread Scheduling, Real Time Scheduling. System calls like ps, fork, join, exec family, wait. | | | |
| Unit-II | | | |
| Concurrency control Concurrency Principles of Concurrency, Mutual Exclusion: S/W approaches, H/W Support, Semaphores, pipes, Message Passing, signals, Monitors, Classical Problems of Synchronization: Readers Writers, Producer Consumer, and Dining Philosopher problem. Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, System calls like signal, kill. | | | |
| Unit-III | | | |
| Memory Management Memory Management requirements, Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Fragmentation, Swapping, and Paging. Segmentation, Demand paging Virtual Memory: Concepts, management of VM, Page Replacement Policies (FIFO, LRU, Optimal, Other Strategies), Thrashing. | | | |
| Unit-IV | | | |
| I/O management & Disk scheduling and Inter Process Communication I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), RAID, Disk Cache. Basic Concepts of Concurrency, | | | |

Cooperating process, Advantage of Cooperating process, Bounded- Buffer - Shared-Memory Solution, Inter-process Communication (IPC), Basic Concepts of Inter-process Communication and Synchronization.

Unit-V

Multi-Processor Based and Virtualization Concepts

Virtual machines; supporting multiple operating systems simultaneously on a single hardware platform; running one operating system on top of another. Reducing the software engineering effort of developing operating systems for new hardware architectures. True or pure virtualization. Para virtualization; optimizing performance of virtualization system; hypervisor call interface.

Text /Reference Books:

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918 .
 2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons , Inc., 9th Edition, 2016, ISBN 978-81-265-5427-0
 3. Andrew Tannenbaum, Operating System Design and Implementation, Pearson, 3rd Edition.
 4. D.M Dhamdhare, Operating Systems: A Concept Based Approach, Mc-Graw Hill
- ❖ Maurice J. Bach, “Design of UNIX Operating System”, PHI
❖ Achyut Godbole and Atul Kahate, Operating Systems, Mc Graw Hill Education, 3rd Edition
❖ The Linux Kernel Book, Remy Card, Eric Dumas, Frank Mevel, Wiley Publications.

Course Outcomes:

- After completion of this subject students will be able to
- CO1: Understand the design approaches of advanced operating systems.
- CO2: Analyze the design issues of distributed operating systems
- CO3: Evaluate design issues of multiprocessor operating systems.
- CO4: Analyze the requirements of the Distributed File System and Distributed Shared Memory.
- CO5: Formulate the solutions to schedule the real time applications

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|--|-----------------------|---------------------------------|-----------------|
| Course Title | Web Technology | Course Code: CSEM2020 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 / 1 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 4 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. This Subject is useful for Making own Web page and how to host your own website on the internet. 2. Along with that Students will also learn about the protocols involved in internet technology | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Introduction to WWW Protocols and programs, secure connections, application and development tools, the web browser, what is server, choices, setting up UNIX and Linux web servers, Logging users, dynamic IP Web Design: Web site design principles, planning the site and navigation. | | | |
| Unit-II | | | |
| Introduction to HTML and Style sheets The development process, Html tags and simple HTML forms, web site structure Introduction to XHTML : XML, Move to XHTML, Meta tags, Character entities, frames and frame sets, inside the browser. Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2. | | | |
| Unit-III | | | |
| Javascript Client side scripting, What is Javascript, How to develop Javascript, simple Javascript, variables, functions, conditions, loops and repetition Javascript and objects, Javascript own objects, the DOM and web browser environments, forms and validations DHTML : Combining HTML, CSS and Javascript, events and buttons, controlling your browser, Ajax: Introduction, advantages & disadvantages ,Purpose of it ,ajax based web application, alternatives of ajax. | | | |

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| Unit-IV |
| XML Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Well formed, using XML with application.XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements, transforming with XSLT. |
| Unit-V |
| PHP Starting to script on server side, Arrays, function and forms, advance PHP Databases : Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP my admin and database bugs. |
| Text /Reference Books: |
| <ol style="list-style-type: none"> 1. Ralph Moseley, M.T. Savliya, "Developing Web Applications", Willy India, Second Edition, ISBN: 978-81-265-3867-6 2. "Web Technology Black Book", Dremtech Press, First Edition, 978-7722-9973 Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'REILLY, 2014. 3.http://www.ebooksbucket.com/uploads/itprogramming/javascript/Learning_PHP_MySQL_Javascript_CSS_HTML5_Robin_Nixon_3e.pdf 4. Dana Moore, Raymond Budd, Edward Benson,Professional Rich Internet Applications: AJAX and Beyond Wiley publications. https://ebooks-it.org/0470082801-ebook.htm 5. Alex Banks and Eve Porcello, Learning React Functional Web Development with React and Redux, OREILLY, First Edition |
| Course Outcomes: |
| <p>After completion of this subject students will be able to</p> <p>CO1: Create web pages using the HTML and CSS features with different layouts as per need of applications.</p> <p>CO2: Apply server-side scripting with PHP to generate the web pages dynamically using the database connectivity.</p> <p>CO3: Create simple web pages in PHP and to represent data in XML format.</p> <p>CO4: Understand the JavaScript to develop the dynamic web pages.</p> <p>CO5: Create the databases to connect with the webpages.</p> |

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|---|-------------------------------|---------------------------------|-----------------|
| Course Title | Cyber & Information Securityg | Course Code: CSEM2030 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 / 1 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 4 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. To learn foundations of Cyber Security and Ethical Hacking analysis using programming languages like python. 2. To learn various types of algorithms and its applications of Cyber Security and Ethical Hacking using forensic detection 3. To learn python toolkit required for programming Cyber Security, Ethical Hacking concepts. 4. To understand the concepts of Cyber Security, Ethical Hacking, Forensic detection image processing, pattern recognition, and natural language processing. 5. To identify insights on how to apply Cyber Security, Ethical Hacking to solve interdisciplinary problems. 6. To acquire the hands-on skills and the knowledge required for job competency. | | | |
| Detailed Syllabus: | | | |
| <p style="text-align: center;">Unit-I</p> <p>Foundations of. Cyber Security Concepts and Cryptography and Cryptanalysis</p> <p>Essential Terminologies: CIA, Risks, Breaches, Threats, Attacks, Exploits. Information Gathering (Social Engineering, Foot Printing & Scanning).Open Source/ Free/ Trial Tools: nmap, zenmap, Port Scanners, Network scanners. Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security, Security Protocols: - security at the Application LayerPGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec</p> | | | |
| <p style="text-align: center;">Unit-II</p> <p>Infrastructure and Network Security</p> <p>Python programming environment Overview. Introduction to System Security, Server Security, OS Security, Physical Security, Introduction to Networks, Network packet Sniffing, Network Design Simulation. DOS/ DDOS attacks. Asset Management and Audits, Vulnerabilities and Attacks. Intrusion detection and Prevention Techniques, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.</p> | | | |

Unit-III

Cyber Security Vulnerabilities & Guards

Internet Security, Cloud Computing & Security, Social Network sites security, Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Authorization, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, IT Audit, Authentication. Open Web Application Security Project (OWASP), Web Site Audit and Vulnerabilities assessment. Open Source/ Free/ Trial Tools: WinAudit, Zap proxy (OWASP), burp suite, DVWA kit. Hands on project and mini project.

Unit-IV

Security in Evolving Technology

Biometrics, Mobile Computing and Hardening on android and ios, IOT Security, Web server configuration and Security. Introduction, Basic security for HTTP Applications and Services, Basic Security for Web Services like SOAP, REST etc., Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges. Open Source/ Free/ Trial Tools: adb for android, xcode for ios, Implementation of REST/ SOAP web services and Security implementations Reviews and Conclusion.

Unit-V

Cyber Laws and Forensics

Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013. Introduction to Cyber Forensics, Need of Cyber Forensics, Cyber Evidence, Documentation and Management of Crime Scene, Image Capturing and its importance, Partial Volume Image, Web Attack Investigations, Denial of Service Investigations, Internet Crime Investigations, Internet Forensics, Steps for Investigating Internet Crime, Email Crime Investigations.

Text /Reference Books:

1. William Stallings, "Cryptography and Network Security", Pearson Education/PHI, 2006.
2. V.K. Jain, "Cryptography and Network Security", Khanna Publishing House.
3. Gupta Sarika, "Information and Cyber Security", Khanna Publishing House, Delhi.
4. Atul Kahate, "Cryptography and Network Security", McGraw Hill.
5. V.K. Pachghare, "Cryptography and Information Security", PHI Learning
6. Nina Godbole, "Information System Security", Wiley
7. Bothra Harsh, "Hacking", Khanna Publishing House, Delhi
8. The basic of Hacking and Penetration testing ,second edition on ethical hacking and penetration by Patrick Engebretson
9. The web application hackers handbook and LAB manual by Wiley

Course Outcomes:

After completion of this subject students will be able to

CO1: Understand system security goals and concepts, classical encryption techniques and acquire fundamental knowledge.

CO2: Understand, DOS/ DDOS attacks and Asset Management and Audits, Vulnerabilities.

CO3: Apply different message digest and digital signature algorithms to verify integrity and achieve authentication and design secure applications.

CO4: Understand the basic security for HTTP Applications and Services, Basic Security for Web Services like SOAP, REST etc.

CO5: Analyze and apply system security concept and Cyber Security Standards to recognize malicious code.

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|---|-------------------------------------|---------------------------------|-----------------|
| Course Title | Advanced Database Management System | Course Code: CSEM2040 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 3 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. Introduce the students to applications of systems designed to manage the data resources of organizations. 2. To enable design of high-quality relational databases and database applications. 3. To enable design of high-quality relational databases and database applications. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Introduction & Overview of SQL Introduction & Overview of SQL: Data Independence, Architecture of DBMS, Data Models, SQL data types and literals, Types of SQL commands: DDL, DML, TCL, DCL, SQL Operators, and Constraints. | | | |
| Unit-II | | | |
| Data modeling using the Entity Relationship Model ER model concepts, Types of Relationships, notation for ER diagram, Reduction of ER-Diagrams to Relational Model, mapping constraints, Generalization, Aggregation, Specialization, Extended ER model, relationships of higher degree. | | | |
| Unit-III | | | |
| Normalization and Functional Dependency Normalization; Normal Forms i. First Normal Form (1NF) ii. Second Normal Form (2NF) iii. Third Normal Form (3NF). Basics of Functional Dependency; Functional dependency diagram and examples; Full function dependency (FFD); Lossy Decomposition; Lossless join decomposition; Dependency Preserving Decomposition. | | | |

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| Unit-IV |
| Transaction Management Transactions: Concepts, ACID Properties, States of Transaction, Serializability, Conflict & View Serializable Schedule. |
| Unit-V |
| Advanced SQL and PL / SQL Characteristics of SQL, Tables, views and indexes, Constraints Group By and Having Clause, Order By Clause, Queries and subqueries, Aggregate Functions, Numeric Functions, String Functions, Date & Time Functions, Insert, Update and Delete operations, Unions, Intersection, Minus, Joins: Equi-Join, Natural Join, Self Join, Inner Join, Outer Join. PL/SQL Basics, Blocks, Architecture, Variables, Constants, Attributes, Character Set, Data Types, Conditional Statements, Iteration, Cursors, Exceptions, Triggers, Procedures and Functions |
| Text /Reference Books: |
| <ol style="list-style-type: none"> 1. Thomas Connolly and Carolyn Begg, “Database Systems: A Practical Approach to Design, Implementation, and Management, Addison Wesley , 5th Edition, 2010. 2. Ramakrishnan, Gehrke, “Database Management System”, McGraw Hill, 3rd Edition, Jan 2007. 3. Date C J, “An Introduction to Database System”, Addison Wesley, 8th Edition 2003. 4. Bipin C. Desai, “An Introduction to Database Systems”, Galgotia Publication, Revised Edition, 2010. 5. Majumdar & Bhattacharya, “Database Management System”, TMH, 2005. 6. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Fourth Edition, McGraw Hill, 2002. 7. N.Tamer Ozsu, Patrick Valduriez, “Principles Of Distributed Database Systems”, Prentice Hall International Inc., 1999. 8. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, McGraw Hill, |
| Course Outcomes: |
| <p>After completion of this subject students will be able to</p> <p>CO1: Execute various advance SQL queries related to Transaction Processing & Locking. CO2: Demonstrate use of Database Object, Procedures & Functions; Packages.</p> <p>CO3: Implement Armstrong’s Axioms for functional dependencies.</p> <p>CO4: Understand Functional Dependency and Functional Decomposition.</p> <p>CO5: Apply various Normalization techniques and transaction concepts; Concurrency</p> |

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|---|----------------------------------|---------------------------------|-----------------|
| Course Title | Design and Analysis of Algorithm | Course Code: CSEM2050 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 / 1 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 4 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| Study the concepts of fundamentals of algorithm, Analysis of algorithm efficiency, Brute force techniques, Divide-and-Conquer, Decrease-and-Conquer, Greedy techniques. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Introduction What is an Algorithm? Fundamentals of Algorithmic problem solving, Important problem types. Fundamental data structures. | | | |
| Unit-II | | | |
| Fundamentals of the Analysis of Algorithm Efficiency Analysis Framework, Measuring the input size, Units for measuring Running time, Orders of Growth, Worst-case, Best-case and Average-case efficiencies, Asymptotic Notations and Basic Efficiency classes, Informal Introduction, O-notation, Ω -notation, θ -notation, mathematical analysis of non-recursive algorithms, mathematical analysis of recursive algorithms. | | | |
| Unit-III | | | |
| Brute Force & Exhaustive Search Introduction to Brute Force approach, Selection Sort and Bubble Sort, Sequential search, Exhaustive Search- Travelling salesman Problem and Knapsack Problem, Depth First Search, Breadth First Search. | | | |
| Unit-IV | | | |
| Divide-and-Conquer Introduction, Merge Sort, Quick Sort, Binary Search, Binary Tree traversals and related properties. | | | |
| Unit-V | | | |
| Decrease-and-Conquer & Greedy Technique Decrease-and-Conquer: Introduction, Insertion Sort, Topological Sorting. Greedy Technique: Introduction, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm. | | | |

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| Text /Reference Books: |
| 1. Introduction to the Design and Analysis of Algorithms, 3rd edition, Anany Levitin, Pearson Publication, ISBN: 9789332583771 2. Design & Analysis of Algorithms, S. Nandagopalan, Sapna Book House. |
| Course Outcomes: |
| CO1: Discuss about the various problem types and algorithms CO2: Demonstrate to Analyze Analyze Framework and the notation. CO3: Test to analyze the different algorithm design techniques for a given search. CO4: Critically analyze the different Divide-and-Conquer properties. CO5: Construct to Modify existing algorithms to improve efficiency. |

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|--|--------------------|---------------------------------|-----------------|
| Course Title | Web Technology Lab | Course Code: CSEM2021 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 4 Hrs Week | Internal Assessment Test | 15 Marks |
| Total Credits | 2 | End-Semester Examination | 35 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. To provide fundamental knowledge of web development technologies such as HTML, CSS, JavaScript, and their roles in building static and dynamic web pages. 2. To introduce server-side programming concepts using languages like PHP, Node.js, or Python, enabling students to build interactive and data-driven web applications. 3. To develop the ability to design and deploy web applications that include both front-end and back-end integration using open-source technologies. 4. To familiarize students with modern web development frameworks and tools, such as Bootstrap for responsive design, and databases like MySQL or MongoDB for backend storage. 5. To cultivate skills in web hosting, domain management, and web security, preparing students for real-world deployment and maintenance of web-based systems. | | | |
| Detailed Syllabus: | | | |
| <ol style="list-style-type: none"> 1. Write an HTML code to display your education details in a tabular format. 2. Write an HTML code to display your CV on a web page. 3. Write an HTML code to create a Home page having three links: About Us, Our Services and Contact Us. Create separate web pages for the three links. 4. Write an HTML code to create a login form. On submitting the form, the user should get navigated to a profile page. 5. Write an HTML code to create a Registration Form. On submitting the form, the user should be asked to login with these new credentials. 6. Write an HTML code to create your Institute website, Department Website and Tutorial website for specific subjects. 7. Write an HTML code to illustrate the usage of the following: ●Ordered List · Unordered List · Definition List | | | |

8. Write an HTML code to create a frameset having header, navigation and content sections.
9. Write an HTML code to demonstrate the usage of inline CSS.
10. Write an HTML code to demonstrate the usage of internal CSS.
11. Write an HTML code to demonstrate the usage of external CSS.
11. Write a Java script to prompt for the user's name and display it on the screen.
13. Design HTML form for keeping student record and validate it using Java script.
12. Write an HTML program to design an entry form of student details and send it to a database server like SQL, Oracle or MS Access.
13. Write programs using Java script for Web Page to display browsers information.
14. Create an applet which will have a line, an Oval & a Rectangle
15. Writing a program in XML and creating a style sheet in CSS & displaying the document in internet explorer.
16. Write an XML program to display products
17. Write a program using PHP and HTML to create a form and display the details entered by the user.

Course Outcomes:

1. CO1: Develop web pages using HTML, DHTML and Cascading Styles Sheets
2. CO2: Develop a dynamic web pages using JavaScript (client side programming)
3. CO3: Develop a Program using XML, Ajax, and PHP.
4. CO4: Develop pages using suitable client side and server side web technologies.
5. CO5: Develop the PHP programs to store records in database.

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|------------------------|---|---------------------------------|-----------------|
| Course Title | Advanced Database Management System Lab | Course Code: CSEM2041 | |
| Teaching Scheme | | Evaluation Scheme | |
| Practicals | 4 Hrs Week | Internal Assessment Test | 15 Marks |
| Total Credits | 2 | End-Semester Examination | 35 Marks |

Course Objectives:

1. To provide hands-on experience with advanced database concepts such as query optimization, indexing, and transaction management using SQL and PL/SQL.
2. To enable students to implement complex queries and stored procedures using triggers, functions, cursors, and views for robust database applications.
3. To explore and apply NoSQL database technologies such as MongoDB or Cassandra for handling unstructured and semi-structured data.
4. To expose students to real-time database environments by designing ER models and implementing normalized schemas for scalable applications.
5. To develop skills in integrating databases with applications using backend connectivity and database programming tools (e.g., JDBC, Python-DB API).

1. Draw E-R diagrams and convert entities and relationships to relation tables for a given scenario. a. Two assignments shall be carried out i.e. consider two different scenarios (eg. bank, college)
2. Write relational algebra queries for a given set of relations.
3. Perform the following: a. Viewing all databases, Creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table, Saving (Commit) and Undoing (rollback)
4. Perform the following: a. Altering a Table, Dropping/Truncating/Renaming Tables, Backing up / Restoring a Database.
5. For a given set of relation schemes, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions , Math Functions Join Queries- Inner Join, Outer Join Subqueries- With IN clause, With EXISTS clause
6. For a given set of relation tables perform the following a. Creating Views (with and without check option), Dropping views, Selecting from a view
7. Write a PL/SQL program using FOR loop to insert ten rows into a database table.
8. Given the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID) write a cursor to select the five highest paid employees from the table.
9. Illustrate how you can embed PL/SQL in a high-level host language such as C/Java And demonstrates

how a banking debit transaction might be done.

10. Given an integer i, write a PL/SQL procedure to insert the tuple (i, 'xxx') into a given relation.

Course Outcomes:

At the end of the course, Students can able to

CO1: Analyze a given database application scenario to use ER model for conceptual design of the database.

CO2: Apply SQL to find solutions to a broad range of queries.

CO3: Apply normalization techniques to improve database design.

CO4: Demonstrate use of Database Object.

CO5: Develop application program using PL/SQL.

MCA 2 Year - Semester III

| Course Code | Course Title | Hours/ Week | | | Theory Marks | | Practical Marks | | Total Marks | Credit |
|-------------|--|-------------|---|----|--------------|------|-----------------|-----|-------------|--------|
| | | L | T | P | IA | ES E | I A | ESE | | |
| ITEM3440 | Software Project Management | 3 | | | 30 | 70 | | | 100 | 3 |
| CSAM3050 | Artificial Intelligence & Machine Learning | 3 | 1 | | 30 | 70 | | | 100 | 4 |
| | (Elective-1) | 3 | | | 30 | 70 | | | 100 | 3 |
| CSAM3040 | Advance Computer Network | 3 | | | 30 | 70 | | | 100 | 3 |
| CSAM3063 | Project I | | | 8 | | | 30 | 70 | 100 | 4 |
| CSAM3075 | Seminar-I | | | 4 | | | 15 | 35 | 50 | 2 |
| CSAM3041 | Advance Computer Network Lab | | | 4 | | | 15 | 35 | 50 | 2 |
| | TOTAL | 12 | 1 | 16 | 120 | 280 | 60 | 140 | 600 | 21 |

Elective-I (Any one)

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|----------|--|---|--|--|--|--|--|--|--|---|
| CSEM3540 | Machine Learning and Pattern Recognition | 3 | | | | | | | | 3 |
| CSAM3630 | Reinforcement Learning | 3 | | | | | | | | 3 |
| CSAM3730 | Blockchain | 3 | | | | | | | | 3 |

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|---|-----------------------------|---------------------------------|-----------------|
| Course Title | Software Project Management | Course Code: ITEM3440 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 3 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. To understand the Software Project Planning and Evaluation techniques. 2. To plan and manage projects at each stage of the software development life cycle (SDLC). 3. To learn about the activity planning and risk management principles. 4. To manage software projects and control software deliverables. 5. To deliver successful software projects that support organization's strategic goals. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Project Evaluation and Project Planning Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning. | | | |
| Unit-II | | | |
| Project Life Cycle and Effort Estimation Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model. | | | |
| Unit-III | | | |
| Activity Planning and Risk Management Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning – Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules. | | | |
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| Unit-IV |
| Project Management and Control Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management. |
| Unit-V |
| Software Projects Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership. |
| Text /Reference Books: |
| <p style="text-align: center;">1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.</p> <p>References:</p> <p>1. Robert K. Wysocki —Effective Software Project Management— Wiley Publication, 2011. 2. Walker Royce: —Software Project Management— Addison-Wesley, 1998.</p> <p>3. Gopalaswamy Ramesh, —Managing Global Software Projects— McGraw Hill Education (India), Fourteenth Reprint 2013.</p> |
| Course Outcomes: |
| <p>CO1: Understand Project Management principles while developing software. CO2: Recall, Understand & Apply about the basic project management concepts, framework and the process models.</p> <p>CO3: Understand the software process models and software effort estimation techniques and Apply in Software project management.</p> <p>CO4: Estimate the risks involved in various project activities.</p> <p>CO5: Define & Apply the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.</p> |

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|---|--|---------------------------------|-----------------|
| Course Title | Artificial Intelligence & Machine Learning | Course Code: CSAM3050 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 / 1 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 4 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem. 2. Analyze a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc). 3. Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming). 4. Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports. | | | |
| Detailed Syllabus: | | | |
| Unit-I Introduction | | | |
| Towards Intelligent Machines, well posed Problems, Example of Applications in diverse fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning, Machine Learning and Data Mining, Basic Linear Algebra in Machine Learning Techniques. | | | |
| Unit-II- Supervised Learning | | | |
| Rationale and Basics: Learning from Observations, Bias and Why Learning Works: Computational Learning Theory, Occam's Razor Principle and Overfitting Avoidance Heuristic Search in inductive Learning, Estimating Generalization Errors, Metrics for assessing regression, Metrics for assessing classification. | | | |
| Unit-III- Statistical Learning | | | |
| Machine Learning and Inferential Statistical Analysis, Descriptive Statistics in learning techniques, Bayesian Reasoning: A probabilistic approach to inference, K-Nearest Neighbor Classifier. Discriminant functions and regression functions, Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Fisher's Linear Discriminant and Thresholding for Classification, Minimum Description Length Principle. | | | |

Unit-IV- Support Vector Machines (SVM)

Introduction, Linear Discriminant Functions for Binary Classification, Perceptron Algorithm, Large Margin Classifier for linearly separable data, Linear Soft Margin Classifier for Overlapping Classes, Kernel Induced Feature Spaces, Nonlinear Classifier, Regression by Support vector Machines.

Learning with Neural Networks: Towards Cognitive Machine, Neuron Models, Network Architectures, Perceptron, Linear neuron and the Widrow-Hoff Learning Rule, The error correction delta rule.

Unit-V

Multilayer Perceptron Networks and error back propagation algorithm, Radial Basis Functions Networks. Decision Tree Learning: Introduction, Example of classification decision tree, measures of impurity for evaluating splits in decision trees, ID3, C4.5, and CART decision trees, pruning the tree, strengths and weakness of decision tree approach.

Text /Reference Books:

TEXT BOOKS:

1. Applied Machine Learning, M. Gopal, McGraw Hill Education
2. Machine Learning: A Probabilistic Perspective, Kevin Murphy, MIT Press, 2012
3. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2009 (freely available online)

REFERENCES:

1. Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2007
2. Programming Collective Intelligence: Building Smart Web 2.0 Applications – Toby Segaran
3. Building Machine Learning Systems with Python - Willi Richert, Luis Pedro Coelho

Course Outcomes:

- CO1: Define the concept of Artificial Intelligence
CO2: Apply AI techniques to real-world problems to develop intelligent systems
CO3: Select appropriately from a range of techniques when implementing intelligent systems.
CO4: Develop an understanding of what is involved in learning models from data
CO5: Apply principles and algorithms to evaluate models generated from data.

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| Elective - I | | | |
| Course Title | Machine Learning and Pattern Recognition | Course Code: CSAM3540 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 3 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. To understand the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms. 2. To understand and apply the basic methods of feature extraction, feature evaluation, and data mining. 3. To understand and apply both supervised and unsupervised machine learning algorithms to detect and characterize patterns in real-world data. 4. To develop prototype pattern recognition algorithms that can be used to study algorithm behavior and performance against real-world multivariate data. 5. To understand the complexity of machine learning algorithms, their limitations and open- issues. | | | |
| Detailed Syllabus: | | | |
| Unit - I | | | |
| Introduction Basic definitions; Hypothesis space and inductive bias; Data cleaning; Data transformation; Evaluation; Model Visualization; Cross-validation; Linear Regression. | | | |
| Unit - II | | | |
| Feature Extraction Curse of dimensionality, Principal component analysis; Fisher linear discriminant, Feature extraction from multivariate data, image data, Feature evaluation | | | |
| Unit - III | | | |
| Non-parametric Methods for Pattern Non-numeric data or nominal data, Linear regression, Decision tree algorithms: ID3, C4.5, Classification and Recognition: Regression Trees (CART); Overfitting and underfitting. | | | |
| Unit - IV | | | |
| Bayes Learning and Parametric Estimation Methods Maximum-Likelihood estimation; Maximum a | | | |

posteriori estimation; Naïve Bayes and Bayesian classifiers; K-nearest neighbor method; Support Vector Machines; Algorithms for clustering: K-means, Hierarchical and other methods.

Unit - V

Ensemble Classifiers Algorithmic Performance Evaluation Need and usefulness of ensemble classifiers; Bagging; Boosting, Random forests; Decorate; Vote; Stacking. Analysis of classification, clustering, prediction, association algorithms; Approaches of parameter tuning.

Text Books:

1. T. Mitchell, Machine Learning, McGraw Hill.
2. M. Gopal, Applied Machine Learning, McGraw Hill.

Reference Books:

1. A. Ethem, Introduction to Machine Learning, PHI Learning Pvt. Ltd.
2. M. Evangelia, Supervised and Unsupervised Pattern Recognition, CRC Press.
3. C. Bishop, Neural Networks for Pattern Recognition, Oxford University Press.
4. G. James, D. Witten, T. Hastie, R. Tibshirani, Introduction to Statistical Learning, Springer.

Course Outcomes:

After the completion of the course, student will be able to

CO1: Understand the fundamentals of pattern recognition and machine learning. CO2: Understand the issue of dimensionality and apply suitable feature extraction methods considering the characteristics of a given problem.

CO3: Apply parametric and non-parametric methods for pattern recognition in real-world problems.

CO4: Create solutions to real-world problems using pattern recognition and machine intelligence algorithms.

CO5: Analyze the performance of machine learning algorithms, effect of parameters and tuning of parameters.

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| Elective - I | | | |
| Course Title | Reinforcement Learning | Course Code: CSAM3630 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 3 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. To provide an overview of Deep and Reinforcement Learning as a field of study. 2. To explain the fundamental issues and principles in Deep Reinforcement Learning. 3. To Implement and use backpropagation algorithms to train deep neural networks. 4. To Construct and apply on-policy reinforcement learning algorithms with function approximation. 5. To Implement and apply Monte Carlo reinforcement learning algorithms | | | |
| Detailed Syllabus: | | | |
| Unit - I | | | |
| Introduction to Neural Networks; Shallow Neural Networks; Deep Neural Networks; Recurrent Neural Networks; Reinforcement Learning; Successful application examples; Fundamental principles and techniques to Deep Learning and Reinforcement Learning. | | | |
| Unit - II | | | |
| Deep Feedforward Networks: Example of Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms; Regularization techniques for deep learning; Optimization for Training Deep Models. | | | |
| Unit - III | | | |
| Convolutional neural networks (CNN): Fundamentals, Properties of CNN representations, Need, Architecture, Building CNN; Sequence Modeling: Recurrent and Recursive Nets, Unfolding Computational Graphs, Deep Recurrent Networks, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Recursive Neural Networks, Echo State Networks | | | |
| Unit - IV | | | |
| Fundamentals of Reinforcement Learning; Agent environment framework; Successes of reinforcement learning; Bandit problems and online learning; Markov decision processes; Returns and value functions | | | |

Unit - V

Dynamic programming algorithms for reinforcement learning; Monte Carlo methods for reinforcement learning; Temporal-Difference Learning

Fundamentals and applications of Deep Reinforcement Learning; Case studies of deep learning applications; Case studies of reinforcement learning applications; Active research topics in deep and reinforcement learning

Text /Reference Books:

1. I. Goodfellow, Y. Bengio and A. Courville, Deep Learning, MIT Press.
2. R. Sutton and A. Barto Reinforcement Learning: An Introduction, MIT Press.

Reference Books:

1. S. Ravichandiran, Hands-on Reinforcement Learning with Python, Packt Publishing.
2. N. Buduma, N. Locascio, Fundamentals of Deep Learning: Designing Next Generation MachineIntelligence Algorithms, O'Reilly.
3. G. Ciaburro, Keras Reinforcement Learning Projects, Packt Publishing.
4. C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer.

Course Outcomes:

After the completion of the course, student will be able to

CO1: Understand the basics of deep learning and reinforcement learning paradigms.

CO2: Apply optimization and regularization techniques to train deep neural networks.

CO3: Construct and train convolutional, recurrent and recursive neural networks.

CO4: Implement and apply reinforcement learning algorithms.

CO5: Analyze real-world problems for solutions using deep and reinforcement learning.

| | | | |
|---|-------------------|---------------------------------|-----------------|
| Course Title | Blockchain | Course Code: CSAM3730 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 3 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. To assess blockchain applications in a structured manner. 2. To overcome the problems of centralization using blockchain technology 3. To introduce the concept of Bitcoin & its fundamentals. 4. To make them familiar with the Bitcoin network, payments, clients and APIs. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Blockchain, the growth of blockchain technology, distributed systems, the history of blockchain and Bitcoin, types of blockchain. Decentralization, methods of decentralization, routes of decentralization, blockchain and full ecosystem decentralization, smart contracts, Decentralized organizations and platforms for decentralization. | | | |
| Unit-II | | | |
| Consensus and multiparty agreements: protocols, Proof of Work, Proof of Stake, Delegated Proof of Stake, Proof of Elapsed Time, Deposit based consensus, Proof of importance. Federated consensus or federated Byzantine consensus, Reputation-based mechanisms, Practical Byzantine Fault Tolerance. | | | |
| Unit-III | | | |
| Symmetric Cryptography, working with the OpenSSL command line, cryptographic primitives. Public Key Cryptography, asymmetric cryptography, public and private keys and financial markets and trading. | | | |
| Unit-IV | | | |
| Introducing Bitcoin, Bitcoin, digital keys and addresses, transactions, blockchain, mining. Alternative Coins. Limitations of Bitcoin. Bitcoin Network and payments, The Bitcoin network, wallets, Bitcoin | | | |

payments, innovation in Bitcoin, Bitcoin Clients and APIs

Unit-V

Hyperledger, Ethereum. Decomposing the consensus process, Hyperledger fabric components, Chaincode Design and Implementation. Blockchain-Outside of Currencies. IPFS protocol and Blockchain. Blockchain Concurrency and scalability. Network models and timing assumptions.

Text /Reference Books:

Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

- Andreas M Antonopoulos, “Mastering Bitcoin: Unlocking digital cryptocurrencies”, ORELLY,2015
- Mastering Blockchain 2nd Edition, Imran Bashir, PACKT Publication.

Course Outcomes:

- CO1: Describe the basic concepts and technology used for blockchain
- CO2: Describe the primitives of the distributed computing and cryptography related to blockchain.
- CO3: Illustrate the concepts of Bitcoin and their usage.
- CO4: Implement Ethereum block chain contract.
- CO5: Apply security features in blockchain technologies

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|--|-----------------------------|---------------------------------|-----------------|
| Course Title | Advance Computer Network | Course Code: CSAM3040 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 3 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. To review the computer networking concepts 2. To impart concepts of advanced computer networking. 3. To introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking. 4. To facilitate students in gaining expertise in some specific areas of networking such as the design and maintenance of individual networks. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Basic Network Concepts Introduction to Computer Networks, Element of Network, Type of Network: LAN, MAN, WAN, Network Topologies: Bus, Star, Mesh, Ring, etc, Data communication & Representation, Network Operating System. | | | |
| Unit-II | | | |
| Networking Device and media connection Common LAN Media: STP, UTP, Coaxial Cable, Optical Fiber, Making and Testing Cable, Straight thru cable, Cross over Cable, Connector, Jack, Patch Panels, NIC, Repeater and Hub & its type, Bridges and its Types, Switch and Router. | | | |
| Unit-III | | | |
| Network Model and Bridging/Switching and VLAN Description of Seven Layers of OSI Model, TCP/IP Model, Comparison of OSI & TCP/IP Model, Physical and Data link Layer, Network and Transport Layer, Presentation and Session Layer, Application Layer. Concepts Switching Services, Configuration of Switches, Store and Forward Techniques, VLAN Basic, VLAN Membership, Routing between VLAN, Configuration of VLAN Unit. | | | |
| Unit-IV | | | |
| Cisco Basics, IOS & Network Basic Examine Router elements, Router Boot Sequence, Managing configuration of Cisco Router, Basic Cisco IOS command, Prepare the Initial configuration of Router. | | | |

Unit-V

Routing Protocol & Network Management

Describe the three basic methods used in Networking, Routing Protocol: RIP, IGRP, EIGRP, OSPF, Routing Protocol and configuration, configure standard access list to Filter IP traffic, Monitor and verify selected Access list operation on Router, Troubleshoot Network Basic Problem.

Text /Reference Books:

1. Data and Computer Communication. "William Stallings", Prentice, Hall of India Private Limited.
2. CCNA Cisco certified Network Associate Study Guide by Todd Lammle 5th edition (BPB)
3. Data Communication and Networking 5E Forouzan Behrouz A. McGraw Hill Education (India), New Delhi, 2005, ISBN-13:978-1-25-906475-3
4. Internetworking with TCP/IP, Volume I, Fourth Edition. Comer Douglas E, Prentice Hall of India Private Limited, New Delhi, 2014 ISBN-81-203-2065-4
5. Computer Networks, Fourth Edition Tanenbaum Andrew S. PHI Learning, New Delhi 2014 ISBN-81 -203 -2175-8.
6. Advanced Computer Network B.M. Harwani and DT Editorial Services Dreamtech New Delhi- 2014 ISBN 978-93-5004-013-3
7. Computer Networks Principles, Technologies and Protocols for Network Design Natalia Olifer, Victor Olifer Wiley ISBN.

Course Outcomes:

- CO1: Understand the terminology and concepts of TCP-IP reference model and IPV6 message format and its services.
- CO2: Acquire the concepts of protocols, network interfaces, and design/performance issues in Local Area Networks and wide area networks.
- CO3: Acquire the concepts of Routing Protocol & Network Management.
- CO4: Evaluate the performance of TCP/IP over asymmetric networks.
- CO5: Identify the different types of network devices and their functions within a network.

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|---|-------------------|---------------------------------|-----------------|
| Course Title | Project I | Course Code: CSAM3063 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 8 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 4 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| 1.To prepare students to excel in computer applications to succeed in industry/ technical profession. 2. To provide students with a solid foundation in mathematical and computing fundamentals and techniques required to solve related problems and also to pursue higher studies and research. 3. To train students with good computing breadth so as to comprehend, analyze, design and create computing solutions for the real life problems. | | | |
| Detailed Syllabus: | | | |
| <p>Projects Steps & Scheduling</p> <p>☐ The Master of Computer Applications (MCA) programme prepares the learners to take up positions as Programmers, Systems Analysts, Systems Designers in the field related to computer application and information technology or learners may go for higher studies in this area.</p> <p>☐ The theoretical background of various courses provides you the necessary foundation, principles, and practices to develop effective ways to solve computing problems. ☐ The hands-on experience gained from the practical courses provide you the knowledge to work with various operating systems, programming languages and software tools. ☐ This project work is kept in the MCA program to give you an opportunity to develop quality software solutions.</p> <p>☐ During the development of the project you should be involved in all the stages of the software development life cycle (SDLC) like requirements analysis, systems design, software development/coding, testing and documentation, with an overall emphasis on the development of reliable software systems.</p> <p>☐ The primary emphasis of the project work is to understand and gain the knowledge of the principles of software engineering practices, and develop a good understanding of SDLC.</p> <p>☐ The MCA learners are encouraged to involve themselves completely on the project work in their Fifth semester. It is advised to learners to develop their project for solving problems of the software industry or any research organization.</p> <p>☐ Doing this will give more exposure to handling real life problems of project development.</p> | | | |

- ❓ Learners should take this project work very seriously.
- ❓ The project should be genuine and original in nature and should not be copied from anywhere else.
- ❓ Learners, who wish to do their Project Report from any organization, are required to take NOC from the concerned organization, to carry out the Code of the Project done.
- ❓ The project covers Study of existing system & System Requirements, Analysis, Design and Coding. Learners should submit their Project Reports as per the guidelines.
- ❓ Project Reports which are not as per the guidelines will not qualify for evaluation. Objective of the Project
 - a. To train the learner to independently formulate and solve a social, philosophical, Commercial, or technological problem and present the results in written and oral form.
 - b. To expose learners to the real life problems in the World of Work.
 - c. To provide opportunities to learners to interact with people and understand human relations.

Apply for Project

Project Scheduling

Learners are supposed to complete their project work within a period of 6 months.

| Activity | Date |
|--------------------------------|---|
| Apply for Project | After completed theory courses of 4 st Sem |
| Submission of Project Proposal | Within one month from apply the project work |
| Approval of Project work | Within 15 days from submission of project synopsis or proposal. |
| Start the project | Immediately after approval of project. |
| Project Reporting | At the end of 5 th month from start |
| Submission of Project Report | On or before 20 days of the end of examination. |
| Examination of Project Work | Date will be announced by the University. |

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| Course Outcomes: |
| <p>CO1: Discover potential research areas in the field of IT.</p> <p>CO2: Conduct a survey of several available literatures in the preferred field of study</p> <p>CO3: Compare and contrast the several existing solutions for research challenges.</p> <p>CO4: Demonstrate an ability to work in teams and manage the conduct.</p> <p>CO5:Formulate and propose a plan for creating a solution for the research plan identified.</p> <p>CO6: Report and present the findings of the study conducted in the preferred domain.</p> |

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|---|-------------------|---------------------------------|-----------------|
| Course Title | Seminar-1 | Course Code: CSAM3075 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 4 Hrs Week | Internal Assessment Test | 15 Marks |
| Total Credits | 2 | End-Semester Examination | 35 Marks |
| Course Objectives: | | | |
| <p>This is a seminar course in which students will give an oral presentation of scientific data. Students attend seminars as well as prepare and present a seminar. The seminar is expected to enhance the student's public speaking skills and to provide experience in the preparation of visuals for scientific presentations. Critique of research objectives and approaches will be gained from audience questions.</p> | | | |
| Detailed Syllabus: | | | |
| <p>Seminar Topics:</p> <ul style="list-style-type: none"> □ Quantum Computing. ... □ Fingerprint Authentication. ... □ HTML HyperText Markup Language. ... □ Pixeom. ... □ Personal Computer and AutoCAD. ... □ Big Data Analysis for Customer Behavior. ... □ FreeNet. ... □ A Secure Dynamic Multi-keyword Ranked Search Scheme over Encrypted Cloud Data. □ Employee Management System. ... □ Hotel Management System. ... □ Network Traffic Management. ... □ GSM Based Remote Switching System. ... □ Cyber and Social Terrorism. ... □ Handwritten Character Recognition: Training a simple NN for classification with MATLAB. | | | |
| Course Outcomes: | | | |
| <p>CO1: Analyze technically relevant current topics on computer science/information technology/research</p> <p>CO2: Understand the analytical approach towards choosing a research paper and acquiring research skill.</p> <p>CO3: Create technical documents and give oral presentations related to the work completed.</p> <p>CO4: Understand what constitutes plagiarism and how to use proper citation styles.</p> <p>CO5: Adhere to ethical standards of research and publication.</p> | | | |

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|---|------------------------------|---------------------------------|-----------------|
| Course Title | Advance Computer Network Lab | Course Code: CSAM3041 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 4 Hrs Week | Internal Assessment Test | 15 Marks |
| Total Credits | 2 | End-Semester Examination | 35 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. To provide an in-depth understanding of advanced networking concepts, protocols, and architectures beyond the basic networking models. 2. To analyze and evaluate the performance of network protocols and their suitability in real-world networking environments. 3. To explore advanced topics such as Quality of Service (QoS), Network Security, Software-Defined Networking (SDN), and IPv6. 4. To enable students to design, configure, and troubleshoot complex network infrastructures using simulation and open-source tools. 5. To foster research and innovation skills in modern networking technologies, trends, and emerging areas such as cloud networking and IoT networking. | | | |
| Detailed Syllabus: | | | |
| <p style="text-align: center;">List of Experiments</p> <ol style="list-style-type: none"> 1. Configuration and logging to a CISCO Router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands. 2. Configuration of IP addressing for a given scenario for a given set of topologies. 3. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address. 4. Configure, implement and debug the following: Use open source tools for debugging and diagnostics. a. ARP/RARP protocols b. RIP routing protocols c. BGP routing d. OSPF routing protocols e. Static routes (check using netstat) 5. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down. | | | |

6. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb. Use a TFTP client and repeat the experiment.
7. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mail.
8. Implement Open NMS+ SNMPD for checking Device status of devices in community MIB of Linux.

Course Outcomes:

At the end of the course, Students can able to

CO1: Explain the basics of network configuration and management, including the use of CISCO routers and DHCP servers.

CO2: Configure and manage various network protocols (e.g., ARP, RIP, OSPF) and services (e.g., DHCP, DNS, FTP).

CO3: Use diagnostic tools (e.g., Wireshark, tcpdump) to analyze network issues and performance.

CO4: Evaluate the effectiveness and efficiency of their network configurations and protocols.

CO5: Design and implement comprehensive network solutions, such as setting up mail servers and monitoring networks with OpenNMS and SNMPD.

| MCA 2 Year - Semester IV | | | | | | | | | | |
|--------------------------|----------------------|-------------|----------|-----------|--------------|------------|-----------------|------------|-------------|-----------|
| Course Code | Course Title | Hours/ Week | | | Theory Marks | | Practical Marks | | Total Marks | Credit |
| | | L | T | P | IA | ESE | IA | ESE | | |
| CSAM4010 | Mobile Computing | 3 | 1 | | 30 | 70 | | | 100 | 4 |
| | (Elective-II) | 3 | | | 30 | 70 | | | 100 | 3 |
| CSAM4030 | Software Testing | 3 | 1 | | 30 | 70 | | | 100 | 4 |
| CSAM4063 | Major Project | | | 12 | | | 50 | 150 | 200 | 6 |
| CSAM4075 | Seminar-II | | | 4 | | | 15 | 35 | 50 | 2 |
| CSAM4011 | Mobile Computing LAB | | | 4 | | | 15 | 35 | 50 | 2 |
| | Total | 9 | 2 | 20 | 90 | 210 | 80 | 220 | 600 | 21 |

| Elective-II | | | | | | | | | | |
|-------------|--------------------------------------|---|--|--|--|--|--|--|--|---|
| CSAM4750 | Internet Of Things | 3 | | | | | | | | 3 |
| CSAM4340 | Ethical Hacking and Digital Forensic | 3 | | | | | | | | 3 |

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|---|---------------------|---------------------------------|-----------------|
| Course Title | Mobile Computing | Course Code: CSAM4010 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3/1 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 4 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. To introduce the basic concepts and principles in mobile computing. This includes major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications. 2. To explore both theoretical and practical issues of mobile computing. 3. To provide an opportunity for students to understand the key components and technologies involved and to gain hands-on experiences in building mobile applications. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Introduction to Mobile Computing and GSM Mobile services : Telecommunication Generations, Cellular systems, Electromagnetic Spectrum, Antenna, Signal Propagation, Signal Characteristics, Multiplexing, Spread Spectrum: DSSS & FHSS. System Architecture, Radio interface, Protocols, Localization and Calling, Handover, security (A3,A5 & A8) GPRS system and protocol architecture, UTRAN, UMTS core network; Improvements on Core Network. | | | |
| Unit-II | | | |
| Mobile Networking : Medium Access Protocol, Internet Protocol and Transport layer , Medium Access Control: Motivation for specialized MAC, , Introduction to multiple Access techniques (MACA) , Mobile IP: IP Packet Delivery, Agent Advertisement and Discovery, Registration, Tunnelling and Encapsulation, Reverse Tunnelling, Routing (DSDV,DSR) ,Mobile TCP : Traditional TCP, Classical TCP Improvements like Indirect TCP, Snooping TCP & Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/Timeout Freezing, Selective Retransmission. | | | |
| Unit-III | | | |
| Wireless Local Area Networks Introduction, Infrastructure and ad-hoc network , IEEE 802.11:System architecture , Protocol architecture , Physical layer, Medium access control layer, MAC management, 802.11a, 802.11b , Wi-Fi security : WEP ,WPA, Wireless LAN Threats , Securing Wireless Networks , HiperLAN 1 & HiperLAN 2 ,Bluetooth: Introduction, User Scenario, Architecture, protocol stack. | | | |

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| Unit-IV |
| Mobility Management Introduction, IP Mobility, Optimization, IPv6 06, Macro Mobility: MIPv6, FMIPv6, Micro Mobility: CellularIP, HAWAII, HMIPv6. |
| Unit-V |
| Long-Term Evolution (LTE) of 3GPP : LTE System Overview, Evolution from UMTS to LTE 10, LTE/SAE Requirements, SAE Architecture, EPS: Evolved Packet System, E-UTRAN, Voice over LTE (VoLTE), Introduction to LTE-Advanced, System Aspects, LTE Higher Protocol Layers, LTE MAC layer, LTE PHY Layer, Self-Organizing Network (SON LTE), SON for Heterogeneous Networks (HetNet), Introduction to 5G. |
| Text /Reference Books: |
| <ol style="list-style-type: none"> 1. Jochen Schilller, “Mobile Communication”, Addison Wesley, Pearson Education 2. William Stallings “Wireless Communications & Networks”, Second Edition, Pearson Education 3. Christopher Cox, “An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications”, Wiley publications. 3. Raj Kamal, “Mobile Computing”, 2/e, Oxford University Press-New |
| Course Outcomes: |
| <p>CO1: Recall basic concepts and principles in computing, cellular architecture.</p> <p>CO2: Interpret the components and functioning of mobile networking.</p> <p>CO3: Summarize a variety of security techniques in mobile network.</p> <p>CO4: Utilize the concepts of WLAN for local as well as remote applications.</p> <p>CO5: Demonstrate Long Term Evolution (LTE) architecture and its interfaces.</p> |

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|--|--------------------|---------------------------------|-----------------|
| Elective-II | | | |
| Course Title | Internet Of Things | Course Code: CSAM4750 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 3 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. Understand the definition and significance of the Internet of Things 2. Discuss the architecture, operation, and business benefits of an IoT solution. 3. Examine the potential business opportunities that IoT can uncover. 4. Explore the relationship between IoT, cloud computing, and big data Identify how IoT differs from traditional data collection systems. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| <p>The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles for Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.</p> | | | |
| Unit-II | | | |
| <p>Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High-level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability.</p> | | | |
| Unit-III | | | |
| <p>Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.</p> | | | |

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| Unit-IV |
| Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems. |
| Unit-V |
| Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World. |
| Text /Reference Books: |
| <p>1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education</p> <p>2. Internet of Things, A. Bahgya and V. Madiseti, Univesity Press, 2015</p> <p>Reference Books:</p> <p>1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley</p> <p>2. Getting Started with the Internet of Things CunoPfister , Oreilly</p> |
| Course Outcomes: |
| <p>CO1: Familiarize the concepts of IoT and apply IoT to different applications</p> <p>CO2: Analyze and evaluate the data received through sensors in IoT</p> <p>CO3: Understand and be able to explain the role of big data, cloud computing and data analytic s in a typical IoT system.</p> <p>CO4: Identify how IoT differs from traditional data collection systems</p> <p>CO5: Compare and contrast the use of Devices, Gateways and Data Management in IoT.</p> |

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|--|--------------------------------------|---------------------------------|-----------------|
| Course Title | Ethical Hacking and Digital Forensic | Course Code: CSAM4340 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 3 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| <ol style="list-style-type: none"> 1. Learner should learn various aspects of network security 2. Learner should learn different technologies for website security 3. Learner should learn various aspects of mobile security 4. Lerner should learn various forensic methods for identification of fraud. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Introduction Ethical Hacking terminology, Five stages of hacking, Vulnerability Research, Legal implication of hacking, Impact of hacking. | | | |
| Unit-II | | | |
| Computer Forensics Technology Introduction to Computer Forensics, Use of Forensics in Law Enforcement, Employment Proceedings, Computer Forensics services. Types of Computer, Forensics Technology- Military, law, Spyware and Adware, Biometrics security systems. Information gathering Methodologies, Competitive Intelligence, DNSEnumerations, Social Engineering attacks, Types of Computer Forensics systems , Internet security, IDS, Firewall, Public key, Net privacy systems, Vendor and computer Forensics services. | | | |
| Unit-III | | | |
| Evidence Handling Introduction to Incident, Incident Response Methodology, Steps, Activities in Initial Response Phase after detection of an incident. Initial Response and Forensic Duplication: Initial Response & Volatile Data Collection from Windows system, Initial Response & Volatile Data Collection from Unix system, Forensic Duplication: Forensic duplication as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic Duplicate/Qualified Forensic Duplicate of a Hard Drive. Storage and Evidence Handling: File Systems: FAT, NTFS, Forensic Analysis of File systems, Storage Fundamentals: Storage Layer, Hard Drives. Evidence Handling: Types of Evidence, Challenges in evidence handling, | | | |

Digital Forensics: Introduction – Evidential potential of digital devices: closed vs. open systems, evaluating digital evidence potential, Device handling: seizure issues, device identification, networked devices and contamination.

Unit-IV

Network Forensics

Collecting Network Based Evidence, Investigating Routers, Network protocols, Email Tracing, Internet Fraud.

Unit-V

Mobile Phone Forensics Crime and mobile phones, evidence, forensic procedures, files present in SIM card, device data, external memory dump, evidence in memory card, operators systems. Android Forensics: Procedures for handling an android device, imaging android USB mass storage devices, logical and physical techniques. Scanning & Enumeration: Port Scanning, Network Scanning, Vulnerability Scanning, NMAP Scanning tool, OS Fingerprinting, Enumeration. System Hacking: Password cracking techniques, Key loggers, Escalating privileges, Hiding Files, Steganography Technologies, Countermeasures. Sniffers & SQL Injection: Active and passive sniffing, ARP Poisoning, Session Hijacking, DNS Spoofing, Conduct SQL Injection attack, Countermeasures. Systems Investigation and Ethical Issues: Data Analysis Techniques, Investigating Live systems (Windows & Unix), Investigating Hacker Tools, Ethical Issues, Cybercrime. Reconnaissance, Scanning Host discovery, Network devices discovery, service discovery, Backdoors and Trojan horses, Buffer Overflows, Covering Tracks: Networks and systems, Denial of service Attacks, Exploiting system using Netcat, IP address Spoofing, Network Sniffing, Password Attacks, rootkits, Session Hijacking and Defenses.

Text /Reference Books:

1. Kevin Mandia, chirs Proise, “Incident Response and Computer Forensic”
2. Gregory Kipper, “” Wireless Crime and Forensic Investigation”, Auerbach publication, 2007
3. Peter Stepheson,”Investigating Computer Crime: A handbook for corporate investigation”, Sept 1999
 - Skoudis E. Perlman R. counter hack: A step by step Guide to Computer Attacks and Effective Defense,Prentice Hall Professional technical Reference, 2001.
 - John R Vacca “Computer Forensic ” Second Edition
 - Hacker Techniques, Exploits and incident Handling <http://www.sans.org>

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| Course Outcomes: |
| After the completion of the course, student will be able to CO1: Understand the details steps involved in Ethical Hacking & network security. CO2: Design and Develop a secure website. CO3: Understand & Apply details process about evidence handling. CO4: Identify various security aspects with respect to mobile technology. CO5: Explain solutions for various case studies with the help of forensic techniques. |

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|---|-----------------------|---------------------------------|-----------------|
| Course Title | Software Testing | Course Code: CSAM4030 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 3 / 1 Hrs Week | Internal Assessment Test | 30 Marks |
| Total Credits | 4 | End-Semester Examination | 70 Marks |
| Course Objectives: | | | |
| 1. Study importance of Software Testing in Software Development 2. Explore appropriate Software Testing Techniques for finding bugs in Software. 3. Study various Software Testing Tools and Quality Assurance Methods. | | | |
| Detailed Syllabus: | | | |
| Unit-I | | | |
| Introduction Human and errors, Testing and Debugging, Software Quality, Requirement Behavior and Correctness, Fundamentals of Test Process, Psychology of Testing, General Principles of Testing, Test Metrics | | | |
| Unit-II | | | |
| Role of Testing in SDLC Review of software development models (Waterfall Models, Spiral Model, W Model, V Model) Agile Methodology and Its Impact on testing, Test Levels (Unit, Component, Module, Integration, System, Acceptance, Generic) | | | |
| Unit-III | | | |
| Approaches to Testing Static Testing: Structured Group Examinations - Reviews, Static Analysis, Control flow & Data flow, Determining Metrics Dynamic Testing Black Box Testing: Equivalence Class Partitioning, Boundary Value Analysis, State Transition Test, Cause Effect Graphing and Decision Table Technique and Used Case Testing and Advanced black box techniques White Box Testing: Statement Coverage, Branch Coverage, Test of Conditions, Path Coverage, Advanced White Box Techniques, Instrumentation and Tool Support Gray Box Testing, Intuitive and Experience Based Testing, Regression Testing | | | |
| Unit-IV | | | |
| Test Management and Automation Test Planning, Management, Execution and Reporting, Software Test Automation: Scope of automation, | | | |

Design & Architecture for automation, Generic requirements for test tool framework, Test tool selection, Testing in Object Oriented Systems.

Unit-V

Software Quality and Metrics

Five Views of software quality, ISO 9126 Quality Characteristics, ISO 9000:2000 s/w quality std. SQA: organizational Level Initiatives.

Text /Reference Books:

1. Andreas Spillner, Tilo Linz, Hans Schaefer, "Software Testing Foundation"
2. S. Desikan and G. Ramesh, "Software Testing: Principles and Practices", Pearson Education.
3. Aditya P. Mathur, "Fundamentals of Software Testing", Pearson Education.
4. Naik and Tripathy, "Software Testing and Quality Assurance", Wiley
5. K. K. Aggarwal and Yogesh Singh, "Software Engineering", New Age International Publication.

Course Outcomes:

CO1: Acquire knowledge of basic principles and knowledge of software testing and debugging and test cases.

CO2: Understand the perceptions on testing like levels of testing, generalized pseudo code and with related examples.

CO3: Understand the various types of testing approaches.

CO4: Analyze the difference between functional testing and structural testing.

CO5: Analyze & Evaluate the performance of fault based testing.

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| Course Title | Major Project | Course Code: CSAM4063 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Practicals | 12 Hrs Week | Internal Assessment Test | 50 Marks |
| Total Credits | 6 | End-Semester Examination | 150 Marks |
| Course Objectives: | | | |
| To provide knowledge and skills in the various aspects of computer applications and core programming. Students will also be trained in the latest trends of information technology. | | | |
| Detailed Syllabus: | | | |
| <p>A project is an inquiry, conducted personally by a trainee(s) who is responsible for using a variety of methods (e.g. analysis, interpretation, planning etc) to undertake a task or study a subject (knowledge or skill or attitude) and to write a report, or solve a problem etc., in line with the objectives of the project. A project can also be termed as an open-ended assignment, the outcome of which is not known at inception and whose progress depends mostly on the intelligence, skills, creativity and energy of the students. The project work exposes the students to real life problems and introduces them to the procedures and practices used in industry. The project work also helps the students to gain confidence in tackling problems of their own. The project work is needed to strengthen and supplement the learning experience of students. Project-based instruction is an authentic instructional model or strategy in which students plan, implement, and evaluate projects that have real-world applications beyond the classroom. Learning activities that are interdisciplinary, long term, and student centred are emphasized, rather than short, isolated lessons. Most important, students find projects fun, motivating, and challenging because they play an active role in choosing the project and in the entire planning process. Teachers are increasingly working with students who have a wide range of abilities, come from various backgrounds. Institutes are seeking ways to respond to the needs of these students. Project-based instruction provides one way to introduce a wider range of learning opportunities into the classroom. It can engage students from diverse backgrounds because students can choose topics that are related to their own experiences, as well as allow them to use individual learning styles.</p> <p>There are a wide range of project types such as service learning projects, work-based projects, task-oriented projects, problem-solving projects and so forth, but authentic projects all have in common</p> | | | |

these defining features:

- 1) Student centered, student directed
- 2) A definite beginning, middle, and end
- 3) Content meaningful to students; directly observable in their environment
- 4) Real-world problems
- 5) First hand investigation
- 6) Sensitivity to local culture and culturally appropriate
- 7) Specific goals related to curriculum and institute, district, or state standards
- 8) A tangible product that can be shared with the intended audience
- 9) Connections among academic, life, and work skills
- 10) Opportunity for feedback and assessments from expert sources
- 11) Opportunity for reflective thinking and student self-assessment
- 12) Authentic assessments (portfolios, journals, etc.)

Course Outcomes:

CO1: Discover potential research areas in the field of IT.

CO2: Conduct a survey of several available literature's in the preferred field of study

CO3: Compare and contrast the several existing solutions for research challenges.

CO4: Demonstrate an ability to work in teams and manage the conduct.

CO5: Formulate and propose a plan for creating a solution for the research plan identified.

CO6: Report and present the findings of the study conducted in the preferred domain.

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| Course Title | Seminar-II | Course Code: CSAM4075 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 4 Hrs Week | Internal Assessment Test | 15 Marks |
| Total Credits | 2 | End-Semester Examination | 35 Marks |
| Course Objectives: | | | |
| <p>This is a seminar course in which students will give an oral presentation of scientific data. Students attend seminars as well as prepare and present a seminar. The seminar is expected to enhance the student's public speaking skills and to provide experience in the preparation of visuals for scientific presentations. Critique of research objectives and approaches will be gained from audience questions.</p> | | | |
| Detailed Syllabus: | | | |
| <p style="text-align: center;">Seminar II Topics:</p> <ol style="list-style-type: none"> 1) Distributed Ledger Technology 2) Hyperledger Project 3) Blockchain Security 4) Blockchain Architecture 5) Blockchain Applications 6) Web Analytics 7) Text Analytics and Sentiment Analysis 8) Predictive Analysis 9) Big Data Challenges 10) IoT and Big Data 11) Data Mining 12) Cloud Computing 13) Fog Computing 14) Advantages of Edge Computing 15) Grid Computing 16) Distributed Computing 17) Challenges of Edge Computing 18) Applications of Edge Computing 19) Autonomous Vehicle 20) Wireless Sensor Networks 21) Multi-access Edge Computing 22) Shingled Magnetic Recording 23) Magneto resistive Random Access Memory 24) Helium Drives 25) DNA Storage | | | |

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| Course Outcomes: |
| CO1: Analyze technically relevant current topics on computer science/information technology/research CO2: Utilize technical resources CO3: Create technical documents and give oral presentations related to the work completed CO4: Acquire the confidence in presenting the topic CO5: Create audience-centered presentations CO6: Create well-rehearsed and polished presentations meeting time, content, and interactive requirements. |

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|----------------------------|----------------------|---------------------------------|-----------------|
| Course Title | Mobile Computing Lab | Course Code: CSAM4011 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lectures / Tutorial | 4 Hrs Week | Internal Assessment Test | 15 Marks |
| Total Credits | 2 | End-Semester Examination | 35 Marks |

Detailed Syllabus:

Name of Experiment

- 1 What is Mobile Computing? Explain the three tier architecture of mobile computing with diagram.
- 2 Write a WML program to create a card.
- 3 Write a WML program to create a deck that contains two cards and provide the Functionality of calling two cards from one another.
- 4 Write a WML program to display a list of following cards and provide the functionality to load a particular card, a. Sales b. Product c. Services
- 5 Write a WML program for usage of template tags.
- 6 Write a WML program to display the text in the following format. a) Bold b) Underlined c) Emphasized d) Big font e) Small font f) Strong font
- 7 Write a WML program to create the following table.

| | | |
|----------------|------------|--------|
| Honda | Suzu ki | Yamaha |
| Mitsubis hi | Ford | Maruti |

- 8 Write a WML program to implement the functionality of Login by username.
- 9 Write a WML program to display special characters on the screen.
- 10 Write a WML program to create the following selection list. a. Red b. Green c. Yellow d. Blue.
- 11 Write a WML program to create the following option group. 1. Honda 1.1 CD 100 1.2 CD Dawn 2. Suzuki 2.1 Max 100 2.2 Samurai.
- 12 Write a WML program to display the image on the screen after 5 seconds.
- 13 Write a WML program to develop the calculator.

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| Course Outcomes: |
| <p>At the end of the course, a student will be able to</p> <p>CO1: Understand the basic concepts of mobile computing.</p> <p>CO2: Apply WML to create simple mobile web applications.</p> <p>CO3: Analyze the functionality of different components in a WML application.</p> <p>CO4: Evaluate the effectiveness of WML programs in achieving desired mobile application functionalities.</p> <p>CO5: Create advanced WML programs to solve specific problems.</p> |