SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA201T	Data Structure & Algorithm	3	-		3	40	60	100

Course Objectives	Course Outcomes
This course is intended • To understand basics of algorithm its analysis • To Learn the linear data structure like stack, queuelinked list • To emphasize implementation of linear data structure • To study implement nonlinear data structures like tree;graph • To use appropriate data structures for solving various Applications depending on behavioral properties.	**Students will be able to** 1 Understand the concept of analysis of algorithms, and implement various sorting searching algorithm 2 Implement ADT such as Stack; Queue 3 Illustrate the operation on linked 4 Select and use appropriate non-Linear data structures for data representation 5 Use an appropriate non-Linear data structures like graph and hashing techniques for data representation for solving data organization problem

Unit I: Searching Sorting **[9Hrs]**

An introduction to algorithm, time and space analysis of algorithm, general concept of data structure, types of data structures. asymptotic notations-Big O notations, omega notation & theta notation. Average, Best, Worst-case analysis, Searching-Linear and Binary search, Selection sort, Bubble sort, Insertion sort, Shell sort, quick sort

Unit II: Stacks and Queues **[9Hrs]**

Definition and Terminology, ADT stack and its operations, applications of stacks: Expression conversion and evaluation. ADT, queue and its operation, Types of queues: Simple queue, circular queue, priority queue, double ended queue. Application ofqueues.

Unit III: Linked Lists **[9Hrs]**

Singly linked lists: Representation in memory, operation on linked list, algorithms: Traversing, searching, insertion, deletion, Types of linked list: Singly linked list, Circular linked list, Doubly linked list, Circular doubly linked list; Application of Linked Lists.

Unit IV: Trees Data Structure **[9Hrs]**

Trees: Basic Tree Terminologies, representation of tree. Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, B Tree, B+ Tree. Tree traversals algorithm-Inorder, Preorder & Postorder traversal, Tree operations, Applications of trees.

Unit V: Graph & Hashing Techniques **[9Hrs]**

Graph: Basic Terminologies and Representations, Types of Graphs, Traversal algorithms: Depth First search and Breadth First Search, Spanning trees: Minimum cost spanning tree. Introduction to Hashing, Hashing Techniques & Collision handling Mechanism, Problem based on hashing.

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Programming with C and Data structures	R.S. Bichkar	1st	Universities Press
2	Data structure Algorithm	Algorithm Alferd V. Aho, John E.	1st	Pearson

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Data Structures Through C	Kanetkar, Yashavant	2nd	BPB publication
2	Data Structures : A Pseudocode Approach With C	T. H. Cormen, C. E. Leiserson, R.L.Rivest,	3rd	MITPress
3	Data Structure And Algorithm	Pandey, Hari Mohan	2nd	University Science Press

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA201P	Data Structure & Algorithm Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended	**Students will be able to**
● To understand basic of algorithm; its analysis ● To Learn the linear data structure like stack, queue linked list ● To give emphasis on implementation of linear data structure ● To study implement nonlinear data structure like tree graph ● To use appropriate data structures for solving various applications depending on behavioralproperties.	1. Analyze algorithms and implement various sorting searching algorithm 2. Implement ADT such as Stack Queue 3. Illustrate the operation on linked list through implementation 4. Select and use appropriate non-Linear data structures like tree for data representation 5. Use an appropriate non-Linear data structures like graph and hashing techniques for data representation for solving data organization problem

Expt. No.	Experiments based on
1	Searching algorithm
2	Sorting algorithm
3	Implementation of ADT-Stack
4	Implementation of ADT-Queue
5	Implementation of Linked operation
6	Implementation of nonlinear data structure-TREE
7	Implementation of BST tree traversing
8	Implementation of nonlinear data structure-Graph Algorithm (DFS; BFS)

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Programming with C and Data structures	R.S. Bichkar	1st	Universities Press
2	Data structure Algorithm	Alferd V. Aho, John E.	1st	Pearson Education

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Data Structures Through C	Kanetkar, Yashavant	2nd	BPB publication
2	Data Structures: A Pseudocode Approach With C	T. H. Cormen, C. E. Leiserson, R.L.Rivest,	3rd	MITPress
3	Data Structure and Algorithm	Pandey, Hari Mohan	2nd	University Science Press

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA202T	Software Engineering & Project Management	3	-		3	40	60	100

Course Objectives	Course Outcomes
This course is intended ● To have knowledge of basic SW engineering methods and practices, and their appropriate application. ● To understand software requirements and prepare SRS documents. ● To study the complete process of project management, monitoring and control. ● To study software development life cycle (SDLC) phases like analysis, design, coding, testing and deployment.	**Students will be able to** 1. Illustrate fundamentals of software engineering and different process models. 2. Summarize the concepts of system and requirement engineeringto construct software model 3. Relate and Utilize design engineering concepts for developmentof software 4. Outline and select appropriate software testing methodology during project development. 5. Analyze and Make use of project management techniques for software development

Unit I: Introduction to Software Engineering **[9Hrs]**

Software Engineering- A Layered Technology, Software Process Framework, Software Process Models: The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, Unified Model, Agile Process, Extreme Programming, Scaled Agile Framework (SAFe).

Unit II: Software Analysis: **[9Hrs]**

Software Requirements, IEEE SRS documents, Requirements Engineering: Requirements Analysis, Modeling approaches - Scenario based modelling, UML models, Data modeling, Class based modeling, Flow Oriented Modeling, Behavioral Model.

Unit III: Software Design: **[9Hrs]**

Design Concepts and Process, Design model, Architectural design, Component, Class based components, User Interface design, Pattern based design, Software reuse, Quality Management: Quality Concepts, Software Quality Assurance, Software Reviews, Formal Technical Review, Software Reliability

Unit IV: Software Testing **[9Hrs]**

Software Testing Strategies, Validation testing, System testing, Unit testing, Integration testing, Validation testing, Black box testing, White box testing, Object-Oriented testing methods, Art of Debugging, Change Management: Software Configuration Management, SCM Repository, SCM Process

Unit V: Software Project Management: **[9Hrs]**

Project Management concepts, People, Product, Process, Project, W5HH principle, Metrics for process & projects and quality Software measurement, Software Project estimation, Decomposition techniques, Empirical Estimation Models, Make/Buy decision, Project scheduling, monitoring and control, Software risks, Risk identification, Risk Projection, Risk refinement, RMMM, Software maintenance, Re-engineering, Reverse engineering, Restructuring, Forward engineering, Software Process, Improvement, SPI process, CMMI, Emerging trends of software engineering.

Text Books

Sr. No	Title	Authors	Edition	Publisher
1	Software Engineering-A Practitioner's Approach	Roger Pressman	8th	Tata McGraw Hill
2	Software Engineering	Ian Summerville	9th	Pearson
3	Software Engineering for students	Douglas Bell	4th	Pearson

Reference Books

Sr. No	Title	Authors	Edition	Publisher
1	The Mythical Man-Month	Frederick P Broooks	1st	Online
2	Software Engineering Project Management	Bill Brykczynski	2nd	Wiley Student Edition
3	Software Engineering, Theory and Practice	Pfleeger, Atlee	4th	Pearson

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA202P	Software Engineering & Project Management Lab		-	2	1	25	25	100

Course Objectives	Course Outcomes
This course is intended • To implement software projects using SDLC approach. • To provide software development team workingknowledge using role play • To study and test various software testing tools	**Students will be able to** 1. Identify functional and non-functional requirements for given problem statement. 2. Estimate project metrics and Create project schedule using software tools. 3. Design UML Diagrams for a given scenario. 4. Construct software project for a given problem using SDLC approach 5. Test for the performance of given project

Expt. No.	Experiments based on
1	To Study Installation of Umbrello UML Modeler Tool.
2	To create requirement gathering and analyze the requirement for the given case study topics
3	To Create SRS (Software Requirement for Specification for a given case study
4	To Design all static UML for the given case study.
5	To Design all dynamic UML for the given case study.
6	To Design front end GUI for the given case study
7	To Demonstrate the case study using Jira tool.
8	To Develop Micro Project for the case study topic (Front end development using HTML CSS)

Text Books

Sr. No	Title	Authors	Edition	Publisher
1	Software Engineering-A Practitioner's Approach	Roger Pressman	8th	Tata McGraw Hill
2	Software Engineering	Ian Summerville	9th	Pearson
3	Software Engineering for students	Douglas Bell	4th	Pearson

Reference Books

Sr. No	Title	Authors	Edition	Publisher
1	The Mythical Man-Month	Frederick P Broooks	1st	Online
2	Software Engineering Project Management	Bill Brykczynski	2nd	Wiley Student Edition
3	Software Engineering, Theory and Practice	Pfleeger, Atlee	4th	Pearson

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA203T	Computer Network	3	-		3	40	60	100

Course Objectives	Course Outcomes
This course is intended ● To understand the fundamental concepts, architecture, and protocols used in computer networks. ● To study the functions of different network layers and analyze data communication mechanisms. ● To develop knowledge of network devices, routing techniques, and network security fundamentals.	**Students will be able to** 1. Demonstrate in depth knowledge of network communications based on TCP/IP models. 2. Interpret several important link-layer concepts and technologies 3. Demonstrate a critical understanding of network models with related key protocols, services and applications 4. Evaluate different techniques / algorithms of standard Transport layer 5. Analyze network protocols for data transmission in various types of networks

Unit I: INTRODUCTION TO NETWORKS, THE PHYSICAL LAYER **[9Hrs]**

Introduction: Network Topology, Network Hardware, Network Software: Protocol Hierarchies, Design issues, Connection Oriented Vs Connection less, Service primitives, OSI Reference Model, TCP/IP, Wireless Transmission, Ethernet, Transmission Media, Digital Modulation and Multiplexing, Line codes, Switching.

Unit II: THE DATA LINK LAYER **[9Hrs]**

Error Detection and Correction: Types of Error, Error Detection, Parity Check, The Internet Checksum, Cyclic Redundancy Check, Forward Error Correction. Data Link Control Protocols: Flow Control, Error Control, HDLC. ADSL, xDSL. Medium Access Control Sublayer: Static Channel Allocation, Assumptions for Dynamic Channel Allocation, Multiple Access Protocols – Aloha, CSMA, Collision free Protocols, Limited Contention Protocols. Ethernet, Wireless LANS, Repeaters, Hubs, Bridges, Switches, Routers, and Gateways.

Unit III: NETWORK LAYER **[9Hrs]**

Routing Algorithms: The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing. The Network Layer in the Internet: IPv4 Protocol, IP Addresses, IPv6 Protocol, Internet Control Protocols - ARP, RARP, Label Switching and MPLS, OSPF Protocol, BGP Protocol,

Unit IV: TRANSPORT LAYER **[9Hrs]**

Transport Service: Transport Service Primitives, Berkeley Sockets. Elements of Transport Protocols: Addressing, Connection Establishment, Connection Release, Error and Flow Control.

The Internet Transport Protocols (UDP): Introduction to UDP, Remote Procedure Call, Real-Time Transport Protocols. The Internet Protocols (TCP): Introduction to TCP, TCP Service Model, TCP Segment Header, TCP Connection Establishment, TCP Connection Release, TCP Connection Management Modelling, TCP Sliding Window Protocol.

Unit V: INTERNET APPLICATIONS AND ADVANCED NETWORKS **[9Hrs]**

Electronic Mail, DNS and HTTP: Electronic Mail - SMTP and MIME, Internet Directory Service - DNS, Web Access and HTTP. Internet Multimedia Support: Real-Time Traffic, Voice Over IP, Session Initiation Protocol, Real-Time Transport Protocol (RTP). Advanced Networks -Case study: IoT, Mobile Networks, SDN.

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Computer Networking -A Top-Down Approach	James F. Kurose	7th	Pearson Publication
2	Data Communications and Networking	Fourauzan B.	3rd	Tata McGraw-Hill Publications,
3	Computer Networks	Tanenbaum A.	4th	PHI

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	An Engineering Approach to Computer Networking	Keshav S	2nd	PearsonEducation,
2	Computer Networks and Internet	Comer D.	2nd	PearsonEducation,
3	Local Area Networks	S. K. Basandra & S Jaiswal	3rd	Galgotia Publications

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA204T	Introduction to Internet of Things	3	-	-	3	40	60	100

Course Objectives	Course Outcomes
This course is intended ● To understand the fundamental concepts, architecture, and components of the Internet of Things (IoT). ● To study IoT communication technologies, sensors, and embedded devices used in IoT systems. ● To develop the ability to design and analyze basic IoT-based applications for real-world problems.	**Students will be able to** 1. Summarize IoT concepts, architecture, and enabling technologies. 2. Understand sensors, actuators, and communication protocols used in IoT. 3. Analyze IoT platforms and data processing techniques. 4. Design basic IoT applications using suitable hardware and software. 5. Evaluate security and privacy challenges in IoT systems.

Unit I: Introduction to IoT **[9Hrs]**

Definition and characteristics of IoT, Evolution of IoT, IoT architecture and components, Physical design of IoT, Logical design of IoT, IoT enabling technologies, IoT vs M2M, IoT applications and challenges.

Unit II: Sensors, Actuators and Devices **[9Hrs]**

Overview of sensors and actuators, Types of sensors, Sensor networks, Actuator types, Microcontrollers and embedded platforms (Arduino/Raspberry Pi overview), Interfacing basics.

Unit III: IoT Communication Technologies **[9Hrs]**

IoT communication protocols: MQTT, CoAP, HTTP, Wireless technologies: Wi-Fi, Bluetooth, ZigBee, LoRa, Cellular IoT, Networking basics for IoT, Gateway concepts.

Unit IV: IoT Data Processing and Platforms **[9Hrs]**

IoT data acquisition and analytics, Edge vs cloud computing in IoT, Overview of IoT platforms, Data storage and visualization, Introduction to IoT middleware.

Unit V: IoT Security and Applications **[9Hrs]**

Security and privacy issues in IoT, Authentication and access control, Secure communication, Case studies: Smart homes, smart cities, healthcare, industrial IoT, Future trends in IoT.

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Internet of Things: A Hands-On Approach	Arshdeep Bahga, Vijay Madisetti	1st	Universities Press
2	Internet of Things: Principles and Paradigms	Rajkumar Buyya	1st	Elsevier
3	Designing the Internet of Things	Adrian McEwen, Hakim Cassimally	1st	Wiley

Reference Books

S. No	Title	Authors	Edition	Publisher
1	The Internet of Things	Samuel Greengard	1st	MIT Press
2	Building the Internet of Things	Maciej Kranz	1st	Wiley

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA205T(i)	Introduction to Artificial Intelligence	3	-	-	3	40	60	100

Course Objectives	Course Outcomes
This course is intended ● To understand the fundamental concepts, techniques, and applications of Artificial Intelligence. ● To study problem-solving methods, knowledge representation, and search techniques used in AI. ● To develop the ability to analyze and apply basic AI algorithms for intelligent systems.	**Students will be able to** 1. Express the modern view of AI and its foundation 2. Illustrate Search Strategies with algorithms and Problems. 3. Implement Proportional logic and apply inference rules. 4. Use suitable methods for Game Playing. 5. Apply suitable techniques for NLP

Unit I: INTRODUCTION **[9Hrs]**

Introduction to AI, The Foundations of AI, AI Technique -Tic-Tac-Toe. Problem characteristics, Production system characteristics, Production systems: 8-puzzle problem. Intelligent Agents: Agents and Environments, Good Behavior: The concept of rationality – The nature of Environments, The Structure of Agents

Unit II: LOCAL SEARCH ALGORITHM **[9Hrs]**

Searching: Uninformed search strategies – Breadth first search, depth first search. Generate and Test, Hill climbing, simulated annealing search, Constraint satisfaction problems, Greedy best first search, A* search, AO* search.

Unit III: KNOWLEDGE REPRESENTATION **[9Hrs]**

Propositional logic - syntax & semantics - First order logic. Inference in first order logic, propositional Vs. first order inference, unification & lifts, Clausal form conversion, Forward chaining, Backward chaining, Resolution.

Unit IV: GAME PLAYING AND PLANNING **[9Hrs]**

Overview, Minimax algorithm, Alpha-Beta pruning, Additional Refinements. Classical planning problem, STRIPS- basic process and working of system – Planning and Acting in the Real World.

Unit V: Natural Language Processing **[9Hrs]**

Introduction, Syntax processing, Semantic Analysis, Pragmatic and DisCourse Description: Analysis - Perception.

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Artificial Intelligence	E. Rich, K. Knight	3rd	TMH, New York
2	Artificial Intelligence: A Modern Approach	S. Russell, P. Norvig	3rd	Pearson Education
3	Artificial Intelligence	E. Rich, K. Knight	3rd	TMH, New York

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Introduction to Artificial Intelligence	Eugene Charniak, Drew McDermott	2nd	Pearson Education, Singapore
2	Artificial Intelligence: Structures and Strategies for Complex Problem Solving	George F. Luger	4th	Pearson Education, Singapore
3	Artificial Intelligence: A New Synthesis	N. L. Nilsson	1st	Morgan Kaufmann, USA

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA205P(i)	Introduction to Artificial Intelligence Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended ● To provide hands-on experience in implementing basic Artificial Intelligence algorithms using programming tools. ● To develop practical skills in applying search techniques, problem-solving methods, and simple AI models. ● To enable students to design and experiment with basic AI-based applications and tools.	**Students will be able to** 1. Implement the fundamentals of Artificial Intelligence, intelligent agents, problem characteristics, and production systems. 2. Apply uninformed and heuristic search algorithms to solve classical AI problems and constraint satisfaction problems. 3. Represent knowledge using propositional and first-order logic and perform logical inference using appropriate reasoning techniques. 4. Analyze and implement game playing and planning techniques such as Minimax, Alpha–Beta pruning, and STRIPS-based planning. 5. Interpret and apply basic Natural Language Processing techniques including syntax, semantic, pragmatic, and discourse analysis.

Expt. No.	Experiments based on
1	Tic-Tac-Toe game
2	Implementation of a **Simple Reflex Agent**
3	Implementation of BFS & DFS
4	Implementation of Hill Climbing algorithm
5	Implementation of A* Search algorithm
6	Implementation of **First Order Logic (FOL)** expressions
7	Program for **Unification and Lifting**
8	Design of a **Two-Player Game** using Minimax with refinements
9	Implementation of **Syntax Processing** (Parsing simple sentences)
10	Implementation of a simple **Chatbot / Text-based AI system**.

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Artificial Intelligence	E. Rich, K. Knight	3rd	TMH, New York
2	Artificial Intelligence: A Modern Approach	S. Russell, P. Norvig	3rd	Pearson Education
3	Artificial Intelligence	E. Rich, K. Knight	3rd	TMH, New York

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Introduction to Artificial Intelligence	Eugene Charniak, Drew McDermott	2nd	Pearson Education, Singapore
2	Artificial Intelligence: Structures and Strategies for Complex Problem Solving	George F. Luger	4th	Pearson Education, Singapore
3	Artificial Intelligence: A New Synthesis	N. L. Nilsson	1st	Morgan Kaufmann, USA

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA205T(ii)	Natural Language Processing	3	-		3	40	60	100

Course Objectives	Course Outcomes
This course is intended ● To understand the fundamental concepts and techniques used in Natural Language Processing (NLP). ● To study methods for text processing, language modeling, and syntactic and semantic analysis. ● To develop the ability to apply NLP techniques for tasks such as text classification, information extraction, and sentiment analysis.	**Students will be able to** 1. Apply fundamental concepts and challenges of Natural Language Processing. 2. Apply text preprocessing and syntactic analysis techniques. 3. Analyze semantic and discourse processing methods. 4. Implement machine learning and deep learning approaches for NLP tasks. 5. Evaluate NLP applications considering performance and ethical issues.

Unit I: Introduction to Natural Language Processing **[9Hrs]**
Overview of NLP, History and evolution, Challenges in NLP, NLP applications, Levels of language processing, NLP pipeline, Ambiguity in natural language, Corpus and lexical resources.

Unit II: Text Processing and Syntax Analysis **[9Hrs]**
Text preprocessing: tokenization, normalization, stemming, lemmatization, Stop-word removal, Regular expressions, N-grams, Part-of-Speech tagging, Chunking, Parsing techniques (constituency and dependency parsing).

Unit III: Semantic Analysis **[9Hrs]**
Word sense disambiguation, Semantic relationships, Lexical semantics, Named Entity Recognition, Semantic role labeling, Introduction to knowledge graphs, Information extraction.

Unit IV: Statistical and Machine Learning Approaches **[9Hrs]**
Language models (n-gram, probabilistic models), Text representation (Bag of Words, TF-IDF, word embeddings), Classification techniques, Sequence models, Introduction to deep learning for NLP (RNN, LSTM, Transformers overview).

Unit V: Applications of NLP **[9Hrs]**
Machine translation, Sentiment analysis, Question answering systems, Chatbots and dialogue systems, Text summarization, Ethical issues and future trends in NLP.

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Speech and Language Processing	Daniel Jurafsky, James H. Martin	2nd	Pearson
2	Natural Language Processing with Python	Steven Bird, Ewan Klein, Edward Loper	1st	O'Reilly
3	Foundations of Statistical Natural Language Processing	Christopher Manning, Hinrich Schütze	1st	MIT Press

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Neural Network Methods in NLP	Yoav Goldberg	1st	Morgan & Claypool
2	Practical Natural Language Processing	Sowmya Vajjala et al.	1st	O'Reilly

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA205P(ii)	Natural Language Processing Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended ● To provide hands-on experience in implementing Natural Language Processing techniques using programming tools and libraries. ● To develop practical skills in text preprocessing, tokenization, and feature extraction from textual data. ● To implement and evaluate basic NLP applications such as text classification, sentiment analysis, and information extraction.	**Students will be able to** 1. Implement text preprocessing techniques such as tokenization, stemming, and lemmatization. 2. Apply syntactic analysis methods including POS tagging and parsing. 3. Build models for text classification and sentiment analysis. 4. Develop simple NLP applications such as chatbots or summarizers. 5. Evaluate NLP models using appropriate performance metrics.

Expt. No. Experiments based on

1 Installation and setup of Python NLP environment (NLTK / spaCy) and basic text preprocessing.
2 Implementation of tokenization, stop-word removal, stemming, and lemmatization.
3 Part-of-Speech (POS) tagging using NLP libraries.
4 Named Entity Recognition (NER) implementation.
5 Text representation using Bag of Words and TF-IDF.
6 Text classification using Naïve Bayes / Logistic Regression.
7 Sentiment analysis on a real-world dataset.
8 Syntax parsing using dependency or constituency parsing.
9 Topic modeling using LDA.
10 Mini Project: Develop an NLP application (Chatbot / Text Summarizer / Spam Classifier).

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Speech and Language Processing	Daniel Jurafsky, James H. Martin	2nd	Pearson
2	Natural Language Processing with Python	Steven Bird, Ewan Klein, Edward Loper	1st	O'Reilly
3	Foundations of Statistical Natural Language Processing	Christopher Manning, Hinrich Schütze	1st	MIT Press

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Neural Network Methods in NLP	Yoav Goldberg	1st	Morgan & Claypool
2	Practical Natural Language Processing	Sowmya Vajjala et al.	1st	O'Reilly

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA205T(iii)	Introduction to Cloud Computing	3	-	-	3	40	60	100

Course Objectives	Course Outcomes
This course is intended ● To understand the fundamental concepts, architecture, and service models of cloud computing. ● To study virtualization, cloud deployment models, and cloud service providers. ● To develop knowledge of cloud-based applications, storage, and security aspects in cloud environments.	**Students will be able to** 1. Summarize core concepts, characteristics, and challenges of cloud computing. 2. Choose the right cloud model based on specific use cases. 3. Identify key services and pricing features of major providers 4. Implement cloud security practices and IAM mechanisms. 5. Assess SLAs and cost management approaches for cloud services.

Unit I: Introduction to Cloud Computing **[9Hrs]**

Definition of cloud computing, Evolution of cloud technology, why need of cloud computing, Characteristics of cloud computing, Pros and cons of cloud computing, Challenges in adopting cloud solutions

Unit II: Cloud Reference Model **[9Hrs]**

Cloud Service Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS) Comparison and use cases, Cloud Deployment Models: Public cloud, private cloud, hybrid cloud, Considerations for choosing a deployment model, Security implications

Unit III: Cloud Providers **[9Hrs]**

Overview of major cloud service providers (e.g., AWS, Azure, Google Cloud), Understanding their offerings and pricing models, Introduction to Amazon Web Services (AWS), GCP, and Microsoft Azure

Unit IV: Cloud Security **[9Hrs]**

Cloud Security Threats: Common threats and vulnerabilities, best practices for cloud environments, Identity and Access Management (IAM): Role-based access control, multi-factor authentication, IAM services provided by cloud platforms.

Unit V: Cloud Service Management **[9Hrs]**

Service Level Agreements (SLAs): Understanding SLAs offered by cloud providers, SLA monitoring and management. Budgeting and forecasting, Cost analysis tools.

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Cloud Computing: Concepts, Technology & Architecture	Thomas Erl	1st	Pearson
2	Cloud Computing: A Practical Approach	Anthony T. Velte, Toby J. Velte	1st	McGraw-Hill
3	Mastering Cloud Computing	Rajkumar Buyya	1st	McGraw-Hill

Reference Books

S. No	Title	Authors	Edition	Publisher
1.	Cloud Computing Bible	Barrie Sosinsky	1st	Wiley
2.	Architecting the Cloud	Michael J. Kavis	1st	Wiley

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA205P(iii)	Introduction to Cloud Computing Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended ● To provide hands-on experience with cloud platforms and basic cloud services. ● To deploy and manage simple applications, storage, and virtual machines in a cloud environment. ● To develop practical skills in using cloud tools for computing, storage, and application hosting.	**Students will be able to** 1. Identify cloud service and deployment models through practical exploration. 2. Configure and manage virtual resources on cloud platforms. 3. Implement identity and access management and basic security controls. 4. Analyze pricing, monitoring, and service management tools. 5. Deploy simple applications on cloud infrastructure.

Expt. No.	Experiments based on
1	Study of cloud computing platforms and account setup (AWS / Azure / GCP free tier).
2	Creating and managing **Virtual Machines (VMs)** on a cloud platform (IaaS).
3	Deploying a simple web application using **Platform as a Service (PaaS)**.
4	Exploring **Cloud Storage services** (object storage, file storage) and uploading/downloading data.
5	Comparison of **IaaS, PaaS, SaaS** through case study and hands-on demonstration.
6	Implementation of **Identity and Access Management (IAM)**: Creating users, roles, and permissions.
7	Enabling **security features** such as multi-factor authentication and firewall rules.
8	Monitoring cloud resources using **cloud monitoring tools** and dashboards.
9	Cost estimation and analysis using **cloud pricing calculators** and budgeting tools.
10	Mini Project: Deploy and manage a simple cloud-based solution (e.g., static website hosting or cloud-based application).

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Cloud Computing: Concepts, Technology & Architecture	Thomas Erl	1st	Pearson
2	Cloud Computing: A Practical Approach	Anthony T. Velte, Toby J. Velte	1st	McGraw-Hill
3	Mastering Cloud Computing	Rajkumar Buyya	1st	McGraw-Hill

Reference Books

S. No	Title	Authors	Edition	Publisher
1.	Cloud Computing Bible	Barrie Sosinsky	1st	Wiley
2.	Architecting the Cloud	Michael J. Kavis	1st	Wiley

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA205T(iv)	Edge & Fog Computing	3	-	-	3	40	60	100

Course Objectives	Course Outcomes
This course is intended ● To understand the concepts, architecture, and significance of Edge and Fog computing in distributed systems. ● To study the integration of Edge and Fog computing with IoT and cloud environments. ● To analyze applications, resource management, and challenges associated with Edge and Fog computing.	**Students will be able to** 1. Apply the concepts, architecture, and need for edge and fog computing. 2. Compare cloud, edge, and fog paradigms for different use cases. 3. Analyze enabling technologies such as virtualization, containers, and orchestration. 4. Evaluate security, resource management, and performance issues. 5. Design edge/fog-based solutions for real-world applications.

Unit I: Introduction to Edge and Fog Computing **[9Hrs]**

Evolution from cloud to edge and fog computing, Need for low-latency computing, Characteristics and architecture of edge and fog, Comparison with cloud computing, Advantages and challenges, Use cases and applications.

Unit II: Edge and Fog Architecture and Technologies **[9Hrs]**

Fog architecture layers, Edge devices and gateways, Virtualization and containerization, Microservices, Orchestration tools, Resource discovery and provisioning.

Unit III: Networking and Communication **[9Hrs]**

Data communication in edge environments, Software Defined Networking (SDN), Network Function Virtualization (NFV), IoT integration, Communication protocols, Mobility support.

Unit IV: Security and Resource Management **[9Hrs]**

Security challenges in edge and fog, Authentication and access control, Data privacy, Trust management, Resource scheduling and load balancing, Energy efficiency.

Unit V: Applications and Case Studies **[9Hrs]**

Smart cities, Industrial IoT, Autonomous vehicles, Healthcare applications, Real-time analytics, Future trends and research directions.

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Fog and Edge Computing: Principles and Paradigms	Rajkumar Buyya et al.	1st	Wiley
2	Edge Computing: Vision and Challenges	Weisong Shi et al.	1st	IEEE Press
3	Cloud, Edge and Fog Computing	Riad Mahmud	1st	Springer

Reference Books

Sr. No	Title	Authors	Edition	Publisher
1	Architecting the Cloud	Michael J. Kavis	1st	Wiley
2	Distributed Systems: Principles and Paradigms	Andrew S. Tanenbaum	2nd	Pearson

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA205P(iv)	Edge & Fog Computing Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended ● To provide hands-on experience in implementing basic Edge and Fog computing concepts using simulation tools or development platforms. ● To develop practical skills in processing and managing data at edge devices and fog nodes. ● To design and evaluate simple applications integrating Edge/Fog computing with IoT systems.	**Students will be able to** 1. Demonstrate the setup and configuration of edge/fog computing environments. 2. Deploy containerized applications on edge platforms. 3. Implement data processing and communication between edge and cloud. 4. Apply security and monitoring mechanisms in edge environments. 5. Develop simple edge-based applications for real-time scenarios.

Expt. No.	Experiments based on
1	Study and setup of an edge computing environment using virtualization or simulators.
2	Deployment of a simple application on an edge device (local server / Raspberry Pi simulator).
3	Implementation of containerization using Docker for edge applications.
4	Communication between edge node and cloud using REST/MQTT protocol.
5	Simulation of fog architecture using virtual machines or network simulators.
6	Resource monitoring and performance analysis of edge nodes.
7	Implementation of load balancing between edge nodes.
8	Security configuration: authentication and secure communication setup.
9	Data processing at the edge (real-time data filtering or analytics).
10	Mini Project: Design and deploy a simple edge/fog solution (e.g., smart monitoring system).

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Fog and Edge Computing: Principles and Paradigms	Rajkumar Buyya et al.	1st	Wiley
2	Edge Computing: Vision and Challenges	Weisong Shi et al.	1st	IEEE Press
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1	Architecting the Cloud	Michael J. Kavis	1st	Wiley
2	Distributed Systems: Principles and Paradigms	Andrew S. Tanenbaum	2nd	Pearson

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA206P	Software Lab-II (Adv. Python)	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended ● To strengthen programming skills using advanced features of Python ● To understand object-oriented and modular programming concepts in Python ● To learn file handling, exception handling, and database connectivity ● To apply Python for data analysis, automation, and application development	**Students will be able to** 1. Apply advanced Python concepts such as comprehensions, file handling, and exception handling to solve programming problems. 2. Design and implement object-oriented programs using classes, inheritance, and polymorphism. 3. Develop modular Python programs using functions, modules, and packages. 4. Integrate Python with databases and web services for real-world applications. 5. Use Python libraries to perform data analysis and develop small-scale applications.

Expt. No. **Experiments based on**

1 Programs using advanced data types, list/dictionary comprehensions, and built-in functions .Libraries pandas, NumPy, requests
2 Read/write files and handle runtime errors using try–except–finally.
3 Implement classes, objects, constructors, inheritance, and method overriding.
4 Programs demonstrating operator overloading, data hiding, and abstraction.
5 Programs using lambda, map, filter, and reduce functions.
6 Create and use user-defined modules and packages.
7 Connect Python with a database (SQLite/MySQL) and perform CRUD operations.
8 Scrape data from web pages and consume REST APIs using Python.
9 Mini Project Using Advanced Python

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Python Programming: An Introduction to Computer Science	John Zelle	–	Franklin, Beedle & Associates
2	Fluent Python	Luciano Ramalho	2nd	O'Reilly Media

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Core Python Programming	Wesley J. Chun	–	Pearson
2	Effective Python	Brett Slatkin	–	Addison-Wesley

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA207P	Career Development II	-	-	2	1	50	--	50

Course Objectives	Course Outcomes
This course is intended • To enhance advanced communication, teamwork, and professional skills required in the workplace. • To strengthen aptitude, analytical reasoning, and problem-solving abilities for competitive exams and placements. • To prepare students for recruitment processes through resume building, group discussions, and mock interviews.	**Students will be able to** 1. Demonstrate effective verbal and written communication skills in professional settings. 2. Apply aptitude, logical reasoning, and analytical skills to solve competitive examination and placement problems. 3. Prepare professional resumes and perform effectively in group discussions. 4. Exhibit confidence and professionalism during interviews and workplace interactions. 5. Develop teamwork, leadership, and time management skills required for career growth.

Unit I **[5Hrs]**

Aptitude: Quadratic Equation
Arithmetic progression, Geometric progression, Harmonic progression
Imax: Critical Thinking, Interview Simulation, Engineering Leadership, Spatial Reasoning

Unit II **[5Hrs]**

Aptitude: Average
Mixture and Allegation
Imax: Interactive Interview Training, Start-Up & Entrepreneurship,

Unit III **[5Hrs]**

Aptitude:
Blood Relation: - Family Tree, Coding Blood Relation, Pointing to a Person Problem
Imax: Engineering Ethics, Employability, Engineering Judgment

Unit IV **[5Hrs]**

Aptitude:
Cubes and Dice Problems: - Number of cuts to be made, Number of colorful Faces of Cubes, Hidden Dice Number
Imax: Disposition for Innovation, Disposition for Start up

Unit V **[5Hrs]**

Aptitude: Clocks: - Angle made by Hour hand, Minutes hand, Mirror and water Image of Clock, Behind and Ahead time concept
Calendars: - Day on Specific date, Coded Calendars Problems, Calendars repetition
Imax: Creating A Winning Resume, Patriotism Self - respect & Start - up

Text Books

S. N.	Title	Authors	Edition	Publisher
1	Quantitative Aptitude By R. S. Aggarwal	R.S. Aggarwal	--	S.Chand
2	Quantitative Aptitude	Shripad Deo	--	Allied Publication
3	A Modern Approach to Verbal & Non-Verbal Reasoning	R.S. Aggarwal	--	

Reference Books

S. N.	Title	Authors	Edition	Publisher
1	Quantitative Aptitude for CAT by Arun Sharma	Arun Sharma	--	MCGRAW HiLL

SEMESTER II

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26MCA208P	Technical Skill Development-II	-	-	2	1	50	-	50

Course Objectives	Course Outcomes
This course is intended • To develop the dynamic web pages • To develop the interactive dynamic websites	**Students will be able to** 1. Demonstrate the importance of JavaScript for designing dynamic pages 2. Use C# control statement in Java Script. 3. Design Web pages using DoM 4. Implement concept of JavaScript OOP 5. Construct the dynamic web pages using events, exception handlingand cookies

Unit I: Introduction of JavaScript **[5Hrs]**

Introduction of JavaScript, variables, Data Types, Operators, Function.

Unit II: C# Control Statement **[5Hrs]**

Control structure statement, conditional statement, looping statement, multi-conditional statement, unconditional statement, programs on control statement, comments in java script.

Unit III: JavaScript Objects; DoM **[5Hrs]**

Java script Object, Array, String, Date, Math, Number, Boolean. JavaScript DoM- getElementByid(), getElementByClassName(),getElementByName(), getElementByTagName(), JS inner HTML Property.

Unit IV: JavaScript OOPs **[5Hrs]**

JavaScript Class, Object, Prototype, Constructor Method, Static Method, Encapsulation, Inheritance, Polymorphism, Abstraction.

Unit V: JavaScript Event, exception handling; cookies **[5Hrs]**

Responding to window events, responding to mouse movements, responding to mouse clicks, responding to on Blur form events, responding to on Focus form events, Responding to keyboard events. Exception Handling; Cookies

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	HTML; CSS: The Complete Reference	Thomas A. Powell,	5th	McGraw Hill
2	Learning PHP, MySQL, JavaScript, CSS HTML5: A Step-by-Step Guide toCreating Dynamic Websites	Robin Nixon		O'Reilly

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Java Script: The Complete Reference	Thomas Powell	2nd	McGraw Hill
2	Bootstrap: Responsive Web Development	Jake Spurlock		O'Reilly