

ANNA UNIVERSITY, CHENNAI
NON- AUTONOMOUS COLLEGES
AFFILIATED TO ANNA UNIVERSITY
MASTER OF COMPUTER APPLICATIONS (2 YEARS)
REGULATIONS 2025

PROGRAMME OUTCOMES (POs):

PO	Programme Outcomes
PO1	An ability to independently carry out research /investigation and development work to solve practical problems
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PROGRAMME SPECIFIC OUTCOMES:

PSO1: Design and develop computer applications by applying programming, database, networking, and system software knowledge to meet real-world requirements.

PSO2: Apply modern computing technologies and frameworks, including AI, cloud, and web platforms, to build efficient, user-friendly, and secure applications.



ANNA UNIVERSITY, CHENNAI

POSTGRADUATE CURRICULUM (NON-AUTONOMOUS AFFILIATED INSTITUTIONS)

Programme: Master of Computer Applications (2 Years)

Regulations: 2025

Abbreviations:

BS – Basic Science (Mathematics)

L – Laboratory Course

ES – Engineering Science (Programme Core (**PC**),
Programme Elective (**PE**))

T – Theory

SD – Skill Development

LIT – Laboratory Integrated Theory

SL – Self Learning

PW – Project Work

TCP – Total Contact Period(s)

Semester – I

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P			
1.	MC25101	Mathematical Foundation of Computer Applications	T	3	1	0	4	4	BS
2.	MC25102	Networking and Communication Systems	T	3	0	0	3	3	ES (PC)
3.	MC25103	Software Testing and Automation	T	3	0	0	3	3	ES (PC)
4.	MC25104	Data Structures and Algorithms using Python	LIT	2	0	2	4	3	ES (PC)
5.	MC25105	Data Exploration and Visualization	LIT	2	0	2	4	3	ES (PC)
6.	MC25106	Advanced Java Programming	LIT	2	0	2	4	3	ES (PC)
7.	MC25107	Technical Seminar	-	0	0	2	2	1	SD
Total Credits							24	20	

Semester – II

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P			
1.	MC25201	UI & UX Design	T	3	0	0	3	3	ES (PC)
2.	---	Programme Elective I	T	3	0	0	3	3	ES (PE)
3.	MC25202	Foundations of Data Science	LIT	3	0	2	5	4	ES (PC)
4.	MC25203	Full Stack Web Development	LIT	3	0	4	7	5	ES (PC)
5.	MC25204	Mobile Application Development	LIT	3	0	4	7	5	ES (PC)
6.	MC25205	Quantum Computing	T	2	0	0	2	2	ES (PC)
7.	---	Industry-Oriented Course I	-	1	0	0	1	1	SD
8.	MC25206	Industrial Training	-	-	-	-	-	2	SD
9.	---	Self-Learning Course	-	-	-	-	-	1	-
Total Credits							28	26	

Semester – III

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P			
1.	MC25301	Machine Learning Techniques	LIT	3	0	2	5	4	ES (PC)
2.	MC25302	Cryptography and Cyber Security	T	3	0	0	3	3	ES (PC)
3.	MC25303	Research Methodology and IPR	T	3	0	0	3	3	ES (PC)
4.	---	Programme Elective II	T	3	0	0	3	3	ES (PE)
5.	---	Programme Elective III	T	3	0	0	3	3	ES (PE)
6.	---	Programme Elective IV	T	3	0	2	5	4	ES (PE)
7.	---	Programme Elective V	T	3	0	0	3	3	ES (PE)
8.	--	Industry-Oriented Course II	--	1	0	0	1	1	SD
Total Credits							26	24	

Semester – IV

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P			
1.	MC25401	Project Work	-	0	0	20	24	12	SD
Total Credits							24	12	

Programme Elective Courses (PEC)

S. NO.	Course Code	Course Title	Periods Per Week			Total Contact Periods	Credits
			L	T	P		
1.	MC25001	Big Data Analytics	3	0	0	3	3
2.	MC25002	Vibe Coding	3	0	0	3	3
3.	MC25003	Network Programming and Management	3	0	0	3	3
4.	MC25004	Software Project Management	3	0	0	3	3
5.	MC25005	E-Learning	3	0	0	3	3
6.	MC25006	Accounting and Financial Management	3	0	0	3	3
7.	MC25007	Digital and Mobile Forensics	3	0	0	3	3
8.	MC25008	Cryptocurrency and Blockchain Technologies	3	0	0	3	3
9.	MC25009	Game Programming	3	0	0	3	3
10.	MC25010	Entrepreneurship Development	3	0	0	3	3
11.	MC25011	Generative AI and Prompt Engineering	3	0	0	3	3
12.	MC25012	Wireless Sensor Networks and Body Area Network	3	0	0	3	3
13.	MC25013	Fog and Edge Computing	3	0	0	3	3
14.	MC25014	Internet of Things	3	0	0	3	3
15.	MC25015	Deep Learning Techniques	3	0	2	5	4
16.	MC25016	Artificial Intelligence	3	0	2	5	4
17.	MC25017	DevOps	3	0	2	5	4
18.	MC25018	Ethical Hacking and Penetration Testing	3	0	2	5	4
19.	MC25019	E-Commerce Technologies	3	0	2	5	4

MC25101	Mathematical Foundation for Computer Applications	L	T	P	C
		3	1	0	4
Course Objectives:					
<ul style="list-style-type: none"> To apply fundamental concepts of discrete mathematics in the context of computer science and software development. To develop the ability to model and solve computational problems using mathematical tools such as combinatorics, matrices, graph theory, and number theory. To enhance analytical and logical thinking skills necessary for designing algorithms, analyzing complexity, and supporting various applications in computer science. 					
Relations and Functions: Properties of Binary Relations, equivalence, transitive closure, compatibility and partial ordering relations – Inverse Function Composition of functions, recursive functions Lattices – Hasse diagram, Lattice and its Properties.					
Propositional and predicate Logic: Propositional logic – Logical connectives – Truth tables – Normal forms (principal conjunctive and principal disjunctive normal forms) – Predicate logic – Universal and existential quantifiers – Proof techniques – Direct and indirect proofs – Proof by contradiction – Mathematical Induction.					
Recurrence Relation and Generating Function: Generating Functions – Function of Sequences Calculating Coefficient of generating function, Recurrence relations – Solving recurrence relation by substitution and Generating funds. Characteristics roots solution of In homogeneous Recurrence Relation.					
Graph Theory: Basic terminology: Different types of graphs – Directed and undirected, Simple, Pseudo, Complete, Regular, Bipartite. Incidence and degree, Pendant and Isolated vertex and Null graph. Isomorphism, Sub graphs, Walk, Path and Circuit, Connected and disconnected graphs and components, operations on graphs. Euler Graphs, Fleury’s Algorithm – Hamiltonian circuits and paths. Traveling salesman problem. Matrix representation of graphs – Incidence and Adjacency matrices.					
Grammars and Automata: Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA) – Formal Definition, Simplified notation: State transition graph, Transition table – Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition – Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata.					
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.					
Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).					

References:

1. Trembly, J. P., & Manohar, R. (2017). Discrete mathematical structures with applications to computer science (International ed.). Tata McGraw-Hill.
2. Rosen, K. H. (2017). Discrete mathematics and its applications (7th ed.). McGraw-Hill.
3. Deo, N. (2016). Graph theory with applications to engineering and computer science. Prentice Hall.
4. Hopcroft, J. E., & Ullman, J. D. (2006). Introduction to automata theory, languages, and computation (3rd ed.). Pearson Education.
5. Sharma, J. K. (2011). Discrete mathematics (3rd ed.). Macmillan Publishers India.

E-resources:

1. <https://ocw.mit.edu/courses/6-042j-mathematics-for-computer-science-fall-2010/>
2. <https://teachyourselfcs.com/>

MC25102	Networking and Communication Systems	L	T	P	C
		3	0	0	3
<p>Course Objectives:</p> <ul style="list-style-type: none"> • To provide a comprehensive understanding of networking principles and communication models of modern communication systems. • To enable students to analyze, design, and evaluate computer networks and communication systems. • To develop skills in applying networking and communication concepts to real-world applications 					
<p>Networking Fundamentals and Protocol Models: Basics of storage, Need for modern storage, Overview of data growth and digital transformation, Features of DAS, NAS, SAN, CAS, Introduction to RAID: types, levels, and configurations, Disk subsystems, Performance and reliability considerations, Traditional vs. software-defined storage.</p> <p>Activity: Create visual OSI vs TCP/IP Model Mapping Chart with real-world protocol examples at each layer.</p>					
<p>Data Link and Network Layer Protocols: Data link layer services, design issues, error detection and correction, Medium Access Control (MAC): Ethernet, CSMA/CD, CSMA/CA, Network layer functions and IP routing, store and forward packet switching, connection less and connection, oriented networks, Routing algorithms: Distance vector, Link state, OSPF, BGP, ARP, ICMP, and DHCP operations</p> <p>Activity: Simulate IP Routing in a Virtual LAN using Packet Tracer Tool.</p>					
<p>Transport and Application Layer Protocols: Transport service, elements of transport protocol, Simple Transport Protocol, Internet transport layer protocols: UDP and TCP, Domain name system, electronic mail, World Wide Web: architectural overview, dynamic web document and http. Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol.</p> <p>Activity: Demonstration of Transport and Application layer protocols.</p>					
<p>Wireless and Mobile Communication Systems: Cellular networks and mobile IP, Wireless LANs and IEEE 802.11, Bluetooth, ZigBee, and NFC basics, Mobile communication challenges: handoff, roaming, latency, MANETs and VANETs</p> <p>Activity: Realization of Blue Tooth and ZigBee Network</p>					
<p>Modern Network Trends, IoT, Cloud & Secure Networking: Cloud networking and virtualization, IoT architecture and protocols (MQTT, CoAP), Edge and fog computing, Network security basics: firewalls, encryption, VPNs, Network challenges in modern computing (5G, SDN, NFV)</p>					

Activity: Demonstration of IoT Architecture for Home Automation
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.
Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).
References: <ol style="list-style-type: none"> 1. Tanenbaum, A. S., & Wetherell, D. J. (2014). Computer Networks. Pearson Education, Elsevier Inc. 2. Gupta, P. C. (2014). Data communications and computer network. PHI Learning Pvt Ltd. 3. Forouzan, B. A. (2013). Introduction to data communication & networking. McGraw Hill Education Pvt Ltd. 4. Larry, P., Peterson, L., & Davis, B. S. (2014). Computer networks: A system approach. Elsevier Inc. 5. Forouzan, B. A. (2022). Data communications and networking. McGraw-Hill.
E-RESOURCES: <ol style="list-style-type: none"> 1. Computer Networks by Prof. S. K. Sinha, IIT Kharagpur https://nptel.ac.in/courses/106105183 2. Introduction to Wireless and Cellular Communications by IIT Madras https://nptel.ac.in/courses/117106114

	Description of CO	PO	PSO
CO1	Elaborate the fundamental concepts of data communication, OSI, and TCP/IP models.	--	--
CO2	Apply transmission media, switching, and error control techniques to optimize communication efficiency	PO1(3)	PSO1(3)
CO3	Design and simulate routing, congestion control, and network protocols for efficient communication systems.	PO3(2)	PSO2(2)
CO4	Evaluate and justify emerging networking technologies and security mechanisms for real-world applications.	PO2(1)	PSO1(3)

MC25103	Software Testing and Automation	L	T	P	C
		3	0	0	3
<p>Course Objectives:</p> <ul style="list-style-type: none"> • To impart knowledge of software testing principles and life cycle models for ensuring software quality and reliability. • To enable students to design effective test cases and utilize automation tools for functional and non-functional testing. • To develop skills in implementing automated testing frameworks for real-world software projects. 					
<p>Foundations of Software Testing: Foundations of Software Testing Introduction to test Software, Black-Box Testing and White-Box Testing-Software Testing Life Cycle, V- model of Software Testing-Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing, Unit Testing-Integration Testing, System Testing.</p> <p>Activities:</p> <ul style="list-style-type: none"> • Creation of Black-Box and White, Box test cases based on functional and Non-functional requirements. • Simulation of Software Testing Life Cycle to understand the stages of testing 					
<p>Test Planning: The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.</p> <p>Activities:</p> <ul style="list-style-type: none"> • Design a comprehensive test plan for a sample software project, • Bug Reporting and Metrics Simulation. 					
<p>Test Design and Execution: Test Objective, Identification, Test Design, Factors, Requirement, identification, Testable, Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing-Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model, Driven Test Design, Test Procedures, Test Case Organization and Tracking-Bug Reporting, Bug Life Cycle.</p> <p>Activities:</p> <ul style="list-style-type: none"> • Conduct load, stress, volume, fail-over, recovery, and configuration tests on a sample application • Test a web or mobile application for usability, compatibility, security. 					

Advanced Testing Concepts: Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing-Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment-Testing Web and Mobile Applications.

Activities:

- Perform configuration tests on a web or mobile application using performance testing tools
- Performing iterative testing in an Agile environment on web and mobile applications.

Test Automation and Tools: Automated Software Testing, Automate Testing of Web Applications-Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test-Test Reports.

Activities:

- Use Selenium WebDriver to generate test reports.
- Design automated test scripts on a sample web application

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

References:

1. Desikan, S., & Ramesh, G. "Software testing: Principles and practices". Pearson Education.
2. Westerveld, D. (2021). "API testing and development with Postman". Packt Publishing.
3. Gundecha, U. "Selenium Web Driver 3 practical guide". Packt Publishing.
4. Rodrigues, A. G. "Mastering JMeter: From load testing to DevOps". Packt Publishing.
5. Menon, V. "TestNG beginner's guide". Packt Publishing.

E- Resources:

1. NPTEL: Software Testing by Prof. Yogesh Singh
2. Postman Tutorials: Postman.com
3. JMeter Documentation: <https://jmeter.apache.org/>
4. TestNG Documentation: <https://testng.org/doc/>

	Description of CO	PO	PSO
CO1	Explain software testing principles and defect management to ensure software reliability.	--	--
CO2	Apply test planning strategies using black-box and white-box techniques.	PO1(3)	PSO1(3)
CO3	Develop automated test scripts to validate functionality, performance, and security.	PO3(2)	PSO2(2)
CO4	Evaluate advanced testing methodologies to address real-world challenges.	PO2(1)	PSO1(3)

MC25104	Data Structures and Algorithms using Python	L	T	P	C
		2	0	2	3
<p>Course Objectives:</p> <ul style="list-style-type: none"> • To provide a strong understanding of fundamental data structures and their implementation in Python. • To enable students to design, analyze, and implement efficient algorithms for searching, sorting, and problem-solving using Python. • To develop skills in applying algorithmic thinking and data structure concepts to real-world computational problems 					
<p>Python Programming and Algorithmic Analysis: Python environment, variables, operations, control flow, conditionals, loops, and functions, Python types and expressions, Strings, lists, and tuples, names, mutable and immutable values, List operations and slicing, Dictionaries, Functions, Object oriented programming, Abstract data types, Classes and objects, Encapsulation and data abstraction, Inheritance, Namespace and Object Orientation.</p> <p>Practical:</p> <ul style="list-style-type: none"> • Student Record Management System (Procedural Approach) • Bank Account Simulation Using OOP 					
<p>Abstract Data Types and Linear Structures: Abstract Data Types (ADTs), ADTs and classes, introduction to OOP, classes in Python, inheritance namespaces, shallow and deep copying Introduction to analysis of algorithms, asymptotic notations divide & conquer, recursion, analyzing recursive algorithms- Stack ADT, Queue ADT</p> <p>Practical:</p> <ul style="list-style-type: none"> • Implement Custom Stack and Queue ADTs with Recursion and Algorithm Analysis • Recursive Merge Sort with Operation Count and Custom Object Sorting 					
<p>Sorting and Searching: Sorting Algorithms: Bubble sort, selection sort, insertion sort, merge sort, quick sort, analysis of sorting algorithms, Searching Techniques: linear search, binary search, hashing, hash functions, collision handling, load factors, rehashing, and efficiency</p> <p>Practical:</p> <ul style="list-style-type: none"> • Implement sorting algorithms in Python Bubble Sort, Selection Sort • Implement Linear Search, Binary Search, Hash Table with Collision Handling 					
<p>Tree Structures: Tree ADT, Binary Tree ADT, tree traversals, binary search trees, AVL trees, heaps, multiway search trees</p> <p>Practical:</p> <ul style="list-style-type: none"> • Implement Binary Tree ADT • Implement an AVLTree class with Rotations (LL, RR, LR, RL) 					

Graph Structures: Graph ADT, representations of graph, graph traversals, DAG, topological ordering, greedy algorithms, dynamic programming, shortest paths, minimum spanning trees, Introduction to complexity classes and intractability

Practical:

- Implement Breadth-First Search (BFS), Depth-First Search (DFS)
- Implement Dijkstra's Algorithm for shortest path (Greedy)

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20)

References:

1. Agarwal, B., & Baka, B. (2018). Hands-on data structures and algorithms with Python: Write complex and powerful code using the latest features of Python 3.7. Packt Publishing.
2. Goodrich, M. T., Tamassia, R., & Goldwasser, M. H. (2021). Data structures & algorithms in Python (Indian adaptation). John Wiley & Sons.
3. Lee, K. D., & Hubbard, S. (2015). Data structures and algorithms with Python. Springer.
4. Necaie, R. D. (2011). Data structures and algorithms using Python. John Wiley & Sons.
5. Weiss, M. A. (2014). Data structures and algorithm analysis in C++. Pearson Education.

E-resources:

1. <https://runestone.academy/ns/books/published/pythonds/index.html>
2. <https://www.geeksforgeeks.org/data-structures-and-algorithms-in-python/>

	Description of CO	PO	PSO
CO1	Elaborate programming concepts and object-oriented paradigms to solve computational problems using python.	--	--
CO2	Apply linear and nonlinear data structures to solve algorithmic problems efficiently.	PO1(3)	PSO1(3)
CO3	Evaluate and implement classical algorithms for sorting, searching, traversing, and optimization with complexity analysis.	PO3(2)	PSO2(2)
CO4	Design and implement Python-based applications using ADTs to solve real-world computational challenges	PO2(1)	PSO1(3)

MC25105	Data Exploration and Visualization	L	T	P	C
		2	0	2	3
<p>Course Objectives:</p> <ul style="list-style-type: none"> • To provide students with the ability to explore datasets to uncover patterns. • To enable learners to create effective visualizations to communicate insights clearly. • To develop skills in presenting data-driven insights for informed decision-making. 					
<p>Exploratory Data Analysis: Identifying Data Quality, Missing Values, Irregular Cardinality, Outliers, Handling Data Quality, Describing Data, Preparing Data Tables, Understanding Relationships, Identifying and Understanding Groups, Building Models from Data, Significance, Classical and Bayesian Analysis</p> <p>Practical:</p> <ul style="list-style-type: none"> • Identification of missing values and detection of outliers • Creation of summary table and visualization of data distribution 					
<p>Univariate and Bivariate Analysis: Distributions and Types of Variables, Numerical Summaries (Level and Spread), Scaling and Standardizing, Measures of Inequality, Smoothing Time Series, Relationships Between Two Variables, Percentage Tables, Analyzing Contingency Tables.</p> <p>Practical:</p> <ul style="list-style-type: none"> • Generation of Plots and application of scaling. • Creation of a scatterplot and interpret the relationship. 					
<p>Multivariate and Time Series Analysis: Multivariate Analysis, Causal Explanations, Three, Variable Contingency Tables and Beyond, Longitudinal Data, Fundamentals of Time Series Analysis (TSA), Characteristics of Time Series Data, Data Cleaning, Time, Based Indexing, Grouping, Resampling.</p> <p>Practical:</p> <ul style="list-style-type: none"> • Creation of a three–variable contingency table • Time series data analysis for clean missing or inconsistent timestamps 					
<p>Data Visualization and Exploration: Visualization Objectives and Key Factors, Data Representation and Presentation, Stages of Data Visualization, Visualization Tools and Widgets, Mapping and Geographic Data, Time Series Visualization, Correlations and Scatterplots, Trees, Hierarchies, Networks</p> <p>Practical:</p> <ul style="list-style-type: none"> • Visualization of dataset using multiple subplot. • Generation of correlation heatmap and a map-based plot u. 					

Interactive Data Visualization: Text and Document Visualization, Levels of Text Representations, Single Document Visualizations, Document Collection Visualizations, Interaction Concepts and Techniques, Designing Effective Visualizations, Comparing and Evaluating Visualization Techniques.

Practical:

- Visualization of word frequencies from a small text dataset.
- Creation of chart using interactive visualization libraries.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20)

References:

1. Mukhiya, S. K., & Ahmed, U. (2020). Hands-on exploratory data analysis with Python. Packt Publishing.
2. Sharma, T. (2023). Mastering exploratory data analysis with Python: Gain a solid understanding of exploratory data analysis and data visualization techniques using Python. Packt Publishing.
3. Schwabish, J. (2021). Better data visualizations: A guide for scholars, researchers, and wonks. Columbia University Press.

E-Resources:

1. <https://app.datacamp.com/learn/courses/statistical-thinking-in-python-part-1>
2. <https://realpython.com/python-data-visualization-bokeh>

	Description of CO	PO	PSO
CO1	Explain the data analysis using statistical and exploratory techniques	--	--
CO2	Apply univariate, bivariate, and multivariate analysis methods to extract insights from data.	PO1(3)	PSO1(3)
CO3	Design effective visualizations to communicate complex data patterns.	PO3(2)	PSO2(2)
CO4	Evaluate interactive visualizations for real-world applications	PO2(1)	PSO1(3)

MC25106	Advanced Java Programming	L	T	P	C
		2	0	2	3
<p>Course Objectives:</p> <ul style="list-style-type: none"> To provide in-depth knowledge of advanced Java concepts. To enable students to develop Java applications using object-oriented and event-driven programming techniques. To develop proficiency in using Java frameworks, APIs, and libraries for building real-world applications. 					
<p>Core Java Fundamentals: Java Virtual Machine, data types, variables, keywords, operators, expressions, control statements, classes, objects, constructors, access control, method overloading, static members, Arrays, Strings, Inheritance: types, constructors in inheritance, method overriding, use of super, abstract classes – interfaces, dynamic method dispatch. Packages and exception handling</p> <p>Practical:</p> <ul style="list-style-type: none"> Write a Java program that demonstrates the use of classes, objects, constructors, method overloading, inheritance, super, and abstract classes. Create a Java application that includes built-in and user-defined exception handling using try, catch, finally, throw, and throws. 					
<p>Multithreading, JDBC, and Web Client UI Development: Java Thread Model, Concurrent Programming, Thread Life Cycle, Thread Priorities, Creating and Managing Threads, Thread Methods and Exceptions, Inter-thread Communication, Synchronization. JDBC Architecture and Drivers, CRUD Operations – Connecting to Relational Databases. Web Client UI: HTML and CSS, Responsive Web Design using Bootstrap, JavaScript, React JS, Creating Reusable UI Components with React.</p> <p>Practical:</p> <ul style="list-style-type: none"> Implement multiple threads in Java using the Thread class and Runnable interface. Demonstrate thread lifecycle, priorities, and synchronization. Connect to a relational database (MySQL/PostgreSQL) and perform Create, Read, Update, and Delete operations using JDBC 					
<p>Java Servlets: Java EE Architecture - Application Servers and Containers, Servlet API and Lifecycle, Handling Client Requests and Responses - Working with Databases through Servlets-Servlet Advanced Concepts: Request Dispatcher -Session Management, Cookies and Http Session, Working with Files, Non- blocking I/O in Servlets.</p> <p>Practical:</p> <ul style="list-style-type: none"> Implement a servlet for uploading files to the server and downloading them using Multipart Config and File Output Stream Develop a servlet to handle HTTP GET and POST methods. Accept form data (e.g., user registration) and display it. 					

Java Server Pages and JSTL: JSP Architecture and Lifecycle, Action Elements, Implicit Objects, Scripting Elements, Scope and EL (Expression Language), JSP Standard Tag Libraries (JSTL), Developing Dynamic Web Applications with JSP.

Practical:

- Design a responsive UI form using Bootstrap and React to capture user input and display the result
- Create a JSP application using scripting elements, EL for data display, and JSTL for conditional and loop-based rendering.

Java Frame works: MVC Architecture, Spring Framework, Spring Modules, Spring MVC and Spring Boot, Hibernate Framework, Other Popular Frameworks. Maven Installation, Maven Core Concepts - Basic Structure of the POM File, Maven Build Life Cycles, Phases and Goals - Maven Build Profiles

Practical:

- Build a Java application using Hibernate and JPA annotations to perform CRUD operations on a Student entity.
- Mini-project integrating Spring and Hibernate framework.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20)

References:

1. Schildt, H. (2019). Java: The complete reference (9th ed.). Tata McGraw Hill Publishing Company Limited.
2. Balagurusamy, E. (2017). Programming with Java: A primer (5th ed.). Tata McGraw Hill Publishing Company Limited.
3. Horstmann, C. S., & Cornell, G. (2013). Core Java volume I – Fundamentals (9th ed.). Pearson Education.
4. Schildt, H. (2014). Java: A beginner's guide (6th ed.). Tata McGraw Hill Publishing Company Limited.
5. Moraes, E. (2018). Java EE 8 cookbook: Build reliable applications with the most robust and mature technology for enterprise development. Packt Publishing.
6. Shah, S., & Shah, V. (2017). Java EE 7 for beginners. SPD.

E-Resources:

1. <https://docs.oracle.com/javase/tutorial/>
2. <https://www.baeldung.com/java-thread>
3. <https://docs.oracle.com/javaee/7/tutorial/index.html>

	Description of CO	PO	PSO
CO1	Elaborate advanced Java programming concepts to develop scalable software solutions.	--	--
CO2	Design database-driven applications using JDBC, servlets, and JSP.	PO1(3)	PSO1(3)
CO3	Develop dynamic web applications using Java frameworks and MVC architecture.	PO3(2)	PSO2(2)
CO4	Integrate modern Java tools and frameworks to build secure enterprise-level applications.	PO2(1)	PSO1(3)

MC25201	UI & UX Design	L	T	P	C
		3	0	0	3
<p>Course Objective:</p> <p>To provide a sound knowledge of UI and UX principles; to recognize the importance of user interface and user experience in product design; to explore various research methods applied in design thinking; to investigate and utilize tools commonly used in UI and UX processes; and to develop practical skills in creating wireframes and prototypes for user-centered design solutions.</p>					
<p>Essentials of Interaction Design UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy</p> <p>Activities:</p> <ul style="list-style-type: none"> • Empathy Mapping Workshop • Game storming Session <p>UI Design Fundamentals Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides</p> <p>Activities:</p> <ul style="list-style-type: none"> • UI Component Audit • Create a Mini Style Guide <p>User Research and Experience Introduction to User Experience - User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals</p> <p>Activities:</p> <ul style="list-style-type: none"> • User Interview Simulation • Persona Creation <p>Wireframing, Prototyping and Testing Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wire flows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration</p> <p>Activities:</p> <ul style="list-style-type: none"> • Wireframe a Key Flow • Usability Testing Roleplay <p>Research, Designing, Ideating, & Information Architecture Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture</p> <p>Activities:</p> <ul style="list-style-type: none"> • User Flow Mapping • Card Sorting for IA 					

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

References:

1. Alan Dix, Janet Finlay, Gregory Abowd, and Russell Beale, "Human-Computer Interaction", 5th Edition, Pearson Education, 2023.
2. Rex Hartson and Pardha Pyla, "The UX Book: Agile UX Design for a Quality User Experience", 2nd Edition, Morgan Kaufmann, 2019.
3. Joel Marsh, "UX for Beginners: A Crash Course in 100 Short Lessons", O'Reilly Media, 2016.
4. Thomas Michaud, "Foundations of Web Design: Introduction to HTML & CSS", New Riders, 2021.
5. Russ Unger and Carolyn Chandler, "A Project Guide to UX Design: For User Experience Designers in the Field or in the Making", 2nd Edition, New Riders, 2019.

E-RESOURCES:

1. <https://www.designkit.org>
2. <https://developer.apple.com/design/human-interface-guideline>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, principles, and processes involved in user interface and user experience design for digital systems.	--	--
CO2	Analyze user requirements, interaction patterns, and usability factors to understand user behavior and design effectiveness in UI/UX solutions.	PO1 (3)	PSO1 (3)
CO3	Evaluate UI/UX design methodologies, usability testing techniques, and design standards to assess the quality and effectiveness of user-centered designs.	PO3 (2)	PSO2 (2)
CO4	Design intuitive and user-centered interfaces by applying appropriate UI/UX principles, prototyping tools, and usability guidelines for real-world applications.	PO2 (1)	PSO1 (3)

MC25202	Foundations of Data Science	L	T	P	C
		3	0	2	4
<p>Course Objectives: The objective of this course is to enable students to understand the fundamentals and processes of data science. It aims to develop the ability to describe and summarize data effectively within the data science workflow. Students will also learn to analyze relationships between different data variables. In addition, the course emphasizes the use of Python libraries for data wrangling and equips students with skills to present and interpret data using visualization tools in Python.</p>					
<p>Data Science Basics Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Statistical descriptions of Data</p> <p>Practical:</p> <ul style="list-style-type: none"> • Exploration of open data sets • Exploration of open-source analytics tool. <p>Describing Data Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores</p> <p>Practical :</p> <ol style="list-style-type: none"> 1. Study R Languages, Commands, Consider 80 observations(dataset), generating random data using functions provided, like rbinom, performing basic statistical computations using built-in functions of R. 2. Discussion of R graphics. Histograms. Stem and leaf plots. Boxplots. Scatterplots, Bar graphs plotting the data using line graph, histograms, multiple graphs, etc. Generate 3D graphs or plots. 3. Measures of Central Tendency: Given a sample of 50 Observations (from any dataset), use possible functions R or Python and calculate mean, SD, var, min, max, median, range, and quantile. Discuss the properties of this distribution. Generate bell curve of a random normal distribution. <p>Describing Relationships Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean</p> <p>Practical :</p> <ol style="list-style-type: none"> 1. Reshaping a data frame. Basics of text processing. Reading unusual data files. Basics of variable coercion. Hypothesis testing and t-test for any given dataset. Find out null hypothesis, alternate hypothesis, draw the picture (graph) to visualize problem. Test the value of population mean. 					

2. State alpha level and rejection region, estimate the maximum likelihood and inference.

Python Libraries for Data Wrangling

Basics of NumPy arrays –aggregations –computations on arrays –comparisons, masks, Boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

Practical :

1. Binomial simulation: Making the computer flip coins for you, Make use of rbinom function of R to generate samples, and other functions: counts, avgs, mean, sd, sqrt, hist (histogram). Bayesian Hypothesis testing on any given dataset or dataframe.
2. Use seaborn and combines simple statistical fits with plotting on pandas dataframes. Working on Linear Algebra and Linear Systems

Data Visualization

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three-dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

Practical :

1. Working on Monte Carlo Integration (Quasi-random numbers and find out the variance on any dataframe)

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20)

References:

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-on Exploratory Data Analysis with Python", Packt Publishing, 2020. ISBN: 9781838826034.
2. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 2nd Edition, O'Reilly Media, 2022. ISBN: 9781098104030.
3. Joel Grus, "Data Science from Scratch: First Principles with Python", 2nd Edition, O'Reilly Media, 2019. ISBN: 9781492041139.
4. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", 3rd Edition, O'Reilly Media, 2022. ISBN: 9781098104030.
5. Alberto Boschetti, Luca Massaron, "Python Data Science Essentials", 3rd Edition, Packt Publishing, 2021. ISBN: 9781801072123.

E-Resources:

1. <https://www.edx.org/course/data-8-foundations-of-data-science>
2. <https://pll.harvard.edu/course/data-science-r-basics>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, terminology, and workflow of data science, including data collection, preprocessing, analysis, and interpretation.	--	--
CO2	Analyze datasets using statistical methods and exploratory data analysis techniques to identify patterns, trends, and insights.	PO1 (3)	PSO1 (3)
CO3	Evaluate data science methods, models, and analytical results to assess their validity, reliability, and applicability to real-world problems.	PO3 (2)	PSO2 (2)
CO4	Design data-driven solutions by selecting appropriate data science tools, techniques, and workflows to solve practical problems.	PO2 (1)	PSO1 (3)

MC25203	Full Stack Web Development	L	T	P	C
		3	0	4	5

Course Objective:

The course aims to provide students with a comprehensive understanding of core web technologies and modern frameworks. It enables learners to design and develop responsive front-end applications using HTML, CSS, and JavaScript, and to implement robust backend APIs using Node.js and Express.js. Students will gain hands-on experience in managing data with MongoDB.

Web Technologies and HTML

Overview of web architecture – Frontend, Backend, Full Stack. Introduction to the MERN stack – MongoDB, Express.js, React, Node.js. Setting up the development environment – VS Code, npm, browser tools. HTML syntax, structure, tags, forms, media tags, meta tags, and accessibility basics.

Practical :

1. A platform where users can browse, register for, and manage events, while organizers can create and track event participation.
2. A personal finance tracker that allows users to log income and expenses, categorize transactions, and view analytical charts.

CSS, Responsive Design, and Bootstrap

CSS syntax, box model, selectors, typography, and layouts (flex, grid). Responsive design with media queries – mobile-first approach. Bootstrap framework – grid system, components (navbar, cards, buttons), and utility classes. Customizing Bootstrap themes and styling.

Practical :

1. A learning management system where instructors can upload courses and students can enroll, access content, and take quizzes.
2. An appointment booking system for clinics or professionals, allowing users to schedule, confirm, and manage their appointments.

JavaScript, ES6 Essentials & Version Control

JavaScript variables, functions, arrays, objects, events, and DOM manipulation. ES6 features – arrow functions, template literals, destructuring, modules, and classes. Basic form validation and interactive UI elements. Version control – Git basics: init, clone, commit, push, pull, branch, merge.

Practical :

1. A job portal where recruiters can post vacancies and applicants can search jobs, upload resumes, and apply online.
2. A complaint or support ticket system where users can raise issues, track their status, and receive responses from administrators.

Node.js, Express.js and MongoDB

Node.js fundamentals – npm, event-driven programming, creating a server. Express.js – routing, middleware, REST APIs, static file handling. Introduction to NoSQL with MongoDB – documents, collections, CRUD operations. Mongoose – schema design, validation, MongoDB-Node integration.

Practical:

1. A library management application for searching, reserving, borrowing, and returning books, with inventory tracking for admins.

React.js and Capstone Integration Project

React fundamentals – JSX, components (functional/class), props, state, hooks (useState, useEffect). Routing with React Router – nested and dynamic routes. Form handling and validation in React. Integration – build a full-stack app (frontend + backend + database). Flutter basics – widgets, state management, and connecting to backend APIs. Overview of deployment platforms – Netlify, Render, Vercel, Heroku-React Native-flutter application development.

Practical:

1. A donation platform where users can create or contribute to fundraising campaigns, with live progress tracking and donor details.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20)

References:

1. Jon Duckett, "HTML and CSS: Design and Build Websites", Wiley, 2011.
2. Ethan Brown, "Web Development with Node and Express: Leveraging the JavaScript Stack", O'Reilly Media, 2019 (2nd Edition).
3. Alex Banks and Eve Porcello, "Learning React: Functional Web Development with React and Redux", O'Reilly Media, 2020 (2nd Edition).
4. Robin Nixon, "Learning Full-Stack JavaScript Development: MongoDB, Node.js, Express, and React", McGraw-Hill Education, 2022

E-RESOURCES:

1. Mark Myers, "A Smarter Way to Learn JavaScript", CreateSpace Independent Publishing Platform, 2016.
2. MDN Web Docs – <https://developer.mozilla.org>
3. React Official Documentation – <https://reactjs.org/docs>
4. MongoDB University Courses – <https://university.mongodb.com>
5. Node.js Documentation – <https://nodejs.org/en/docs>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, architectures, and technologies involved in full stack web development, including client-side, server-side, and database components.	--	--
CO2	Analyze web application requirements and system components to understand data flow, performance, and integration across the full stack.	PO1 (3)	PSO1 (3)

CO3	Evaluate full stack web development frameworks, tools, and deployment strategies to assess their suitability for building scalable and secure web applications.	PO3 (2)	PSO2 (2)
CO4	Design end-to-end web applications by selecting appropriate front-end technologies, back-end frameworks, and databases to meet real-world requirements.	PO2 (1)	PSO1 (3)

MC25204	Mobile Application Development	L	T	P	C
		3	0	4	5
<p>Course Objective:</p> <p>This course provides a hands-on introduction to building mobile applications, focusing on both native Android and iOS platforms. It covers platform-specific programming concepts, architecture, UI/UX design, and app deployment strategies. Through hands-on development using Android Studio and Xcode in building native mobile apps that interact with databases, web services, and device features.</p>					
<p>Foundation to Mobile Platforms and Android Studio</p> <p>Android, iOS, and emerging platforms - Android platform architecture: Linux kernel, Libraries, Android Runtime, Application Framework, and Apps - Installing and configuring Android Studio and SDK tools - Creating the first Android project: app structure, AndroidManifest.xml, Gradle files - Android components: Activities, Services, Broadcast Receivers, Content Providers- Emulators vs real device deployment.</p> <p>Practical:</p> <ol style="list-style-type: none"> 1. Install and configure Java Development Kit (JDK), Android Studio, Android SDK, and Xcode. Create and deploy a basic 'Hello World' app on both Android and iOS simulators. <p>UI/UX Design Principles and XML Layouts</p> <p>Layout managers: Linear Layout, Relative Layout, Constraint Layout, Frame Layout - UI widgets: Buttons, Text View, Edit Text, Image View, Check Box, Spinner - Event handling and input validation - Material Design principles and guidelines - Designing adaptive UI: screen densities, multi-language support, orientation handling - Introduction to themes, styles, drawable resources, and custom views.</p> <p>Practical:</p> <ol style="list-style-type: none"> 1. Design a user interface using basic widgets: buttons, text fields, image views, and spinners in Android. Create an equivalent UI layout in iOS using Storyboard and UIKit. 2. Develop a mobile app that responds to user interactions using event listeners. Demonstrate layout switching, form submission, and feedback using Android's XML layouts and iOS View Controllers. <p>Activity Lifecycle, Intents, and Navigation</p> <p>Activity lifecycle: onCreate(), onStart(), onResume(), onPause(), onStop(), onDestroy() - Explicit and Implicit Intents: launching apps and components - Passing data between activities using Bundle, Serializable, Parcelable - Using Fragments for reusable UI components - Introduction to Jetpack Navigation Component for seamless screen transitions - Back-stack management and deep linking.</p> <p>Practical :</p> <ol style="list-style-type: none"> 1. Implement a four-function calculator that performs addition, subtraction, multiplication, and division. Use platform-specific UI controls, and validate user input in both Android and iOS versions. 					

2. Create custom views and animations using Android's Canvas and Animator classes. Implement transitions and interactive animations in iOS using Swift and UIView animation APIs.

Data Persistence and SQLite

Shared Preferences: storing simple key-value pairs - Working with SQLite databases using SQLite Open Helper - Introduction to Room Database: Entities, DAOs, and Live Data - Performing CRUD operations on local databases - Handling migrations and database versioning- Best practices for secure and efficient data storage.

Practical:

1. Create an application to perform insert, update, delete, and display operations using SQLite in Android. Use Core Data or SQLite in iOS for basic CRUD operations with a local database.
2. Build an app that integrates Firebase to send SMS or email notifications from an Android device. Use Firebase Messaging or Apple Push Notification Service (APNs) for sending alerts in iOS.

Web API Integration and Networking

HTTP/HTTPS protocols and API formats (JSON/XML) - Consuming RESTful APIs using Retrofit and Volley - JSON parsing and serialization/deserialization - Error handling, timeouts, and retry mechanisms - API authentication (API keys, OAuth basics - Integrating third-party APIs (e.g., Google Maps, Firebase)

Practical:

1. Implement file reading/writing on external storage (SD card) in Android. Use Notification Manager to display persistent and time-based notifications. Implement similar functionality using iOS File Manager and Notification Center.

iOS Application Development

Introduction to iOS architecture and MVC pattern - Xcode interface, project structure, and build settings - Swift programming basics: data types, control flow, optionals, functions, closures - Storyboards and Interface Builder: designing UI for iPhone/iPad – View Controllers, Segues, and Navigation Controller for screen transitions - Connecting UI to code with IBOutlets and IBActions- Debugging, testing, and running on simulator or real device.

Practical :

1. Create a location-aware Android app using Google Maps SDK that displays user position and geofencing alerts. Develop a similar iOS app using Core Location framework to track GPS, region monitoring, and motion detection.
2. Design a simple 2D game (e.g., tapping or matching game) using Android's Canvas and View logic. Create an equivalent mini game or interactive utility in iOS using SpriteKit or UIKit Dynamics.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20)

References:

1. Barry Burd, Android Application Development for Dummies, 5th Edition, Wiley, 2023.
2. Joseph Annucci Jr., Lauren Darcey, Shane Conder, Android Programming: The Big Nerd Ranch Guide, 4th Edition, Addison-Wesley, 2022.
3. John Horton, Android Programming for Beginners, 3rd Edition, Packt Publishing, 2023.
4. Matt Neuburg, Programming iOS 14 with SwiftUI, O'Reilly Media, 2021.
5. Raywenderlich Tutorial Team, iOS Apprentice (Swift 5.5), Razeware LLC, 2022.

E-Resources:

1. Android Developers: <https://developer.android.com>
2. NPTEL Android Course: <https://archive.nptel.ac.in/courses/106/106/106106156/>
3. Kotlin Docs: <https://kotlinlang.org/docs/home.html>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, architectures, and development environments used in mobile application development.	--	--
CO2	Analyze mobile application requirements and platform-specific constraints to understand performance, usability, and resource management issues.	PO1 (3)	PSO1 (3)
CO3	Evaluate mobile application frameworks, tools, and deployment strategies to assess their effectiveness for building robust mobile solutions.	PO3 (2)	PSO2 (2)
CO4	Design user-centric mobile applications by selecting appropriate platforms, frameworks, and interface guidelines to address real-world needs.	PO2 (1)	PSO1 (3)

MC25205	Quantum Computing	L	T	P	C
		2	0	0	2
Course Objective:					
<ol style="list-style-type: none"> 1. To provide a mathematical foundation for Quantum Computing and provide the basics of working 2. To interpret the various aspects and applications of quantum computing. 3. To examine the factors that affect Quantum computation 					
Physical properties and mathematical foundations					
Double Slit Experiment; Light: Particle Vs Wave; Heisenberg Uncertainty Principle. Vector spaces – basis; Inner product; Outer product; Tensor product; Linear operators					
Activities:					
<ul style="list-style-type: none"> • Simulate the experiment using an interactive virtual lab • Construct simple operators and visualize action on vectors 					
Quantum computing postulates and gates					
Review of postulates, Bloch sphere, Single qubit states and gates, superposition; Two Qubit States and Gates - Bell States, Entanglement, CNOT gate, Phase oracles, Pauli Gates.					
Activities:					
<ul style="list-style-type: none"> • Group quiz to match postulates to physical implications • Visualization with Bloch sphere simulators 					
Quantum computing circuits					
Dirac's notation for quantum computing, Computational Basis, Orthonormality, Hadamard and Phase Gates- building quantum circuits					
Activities:					
<ul style="list-style-type: none"> • Use IBM Q Composer to build and simulate custom circuits • Hands-on: Apply X, H, Z gates and observe results on simulators 					
Fundamental Quantum Algorithms					
Deutsch–Josza Algorithm, Grover search algorithm: Problem definition, Amplitude amplification, Grover oracle, diffuser, multiple solutions in the search space					
Activities:					
<ul style="list-style-type: none"> • Construct DJ circuit for a 3-bit input function • Simulation of Grover's algorithm with multiple marked elements 					
Programming on a real quantum computer					
Coding a real time quantum computer via IBMQ to carry out basic quantum measurement and state analysis.					

<p>Activities:</p> <ul style="list-style-type: none"> • Connect Qiskit with IBMQ using personal API token • Hands-on: Create 1- and 2-qubit circuits using Hadamard, X, Z, and measurement gates • Compare real and simulated results and Observe impact of quantum noise
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Chuck Easttom, “Quantum Computing Fundamentals”, 1st edition, Published by Addison-Wesley Professional (June 1st 2021) 2. Qiskit TextBook - https://qiskit.org/textbook/preface.html (2022)
<p>References:</p> <ol style="list-style-type: none"> 1. Kasirajan, Venkateswaran. Fundamentals of quantum computing. Springer International Publishing, 2021. 2. Chris Bernhardt, Quantum Computing for Everyone, The MIT Press, Cambridge, 2020 3. Nielsen, Michael A., and Isaac L. Chuang, “Quantum Computation and Quantum Information” Cambridge University Press (5 April 2013)
<p>Weightage: Continuous Assessment:40%, End Semester Theory Examination: 60%</p>
<p>Assessment Methodology: Assignments (30), Quiz (10), Virtual demonstration (25), Flipped Classroom (10), Review of GATE & IES questions (25).</p>

CO	Description of CO	PO	PSO
CO1	Describe the fundamental principles, postulates, and computational models of quantum computing and their significance in next-generation computing systems.	--	--
CO2	Analyze quantum algorithms and quantum circuit models to understand their computational advantages, limitations, and performance characteristics.	PO1 (3)	PSO1 (3)
CO3	Evaluate quantum computing paradigms, error correction techniques, and hardware technologies for their suitability in solving complex computational problems.	PO3 (2)	PSO2 (2)
CO4	Design quantum circuits and algorithmic solutions by selecting appropriate quantum gates, qubit architectures, and computational models for real-world problem scenarios.	PO2 (1)	PSO1 (3)

MC25302	Cryptography and Cyber Security	L	T	P	C
		3	0	0	3
<p>Course Objective: To understand the fundamental ideas and mathematical techniques that governs cryptography and cybersecurity. It aids in analyzing and implementing symmetric encryption algorithms, as well as in observing security protocols. It is necessary to test and actively use public-key cryptography together with digital signatures in real-world network environments.</p>					
<p>Foundations of Cryptography and Security Overview of Cybersecurity, Information Security, and Network Security – The OSI Security Architecture – Security Attacks, Services, and Mechanisms – Overview of Cryptographic Algorithms – Number Theory Essentials: Euclidean Algorithm – Modular Arithmetic and Prime Numbers – Fermat’s and Euler’s Theorems – Testing for Primality – The Chinese Remainder Theorem – Discrete Logarithms</p> <p>Activities:</p> <ul style="list-style-type: none"> • Seminar on evolution of cryptography • Problem-solving techniques on modular arithmetic, GCD, and discrete logarithms <p>Symmetric Cryptography and Block Ciphers Classical Encryption Techniques: Symmetric Cipher Model – Substitution Techniques – Transposition Techniques – Block Ciphers and Stream Ciphers – Data Encryption Standard: Traditional Block Cipher Structure – The Data Encryption Standard – DES Example – Block Cipher Design Principles – Advanced Encryption Standard: Finite Field Arithmetic – AES Structure – AES Transformation Functions – AES Key Expansion – An AES Example – AES Implementation – Block Cipher Operation: Multiple Encryption and Triple DES.</p> <p>Activities:</p> <ul style="list-style-type: none"> • Implementation of AES or DES in Python/C • Mode simulation workshop on block ciphers <p>Asymmetric Cryptography and Digital Signatures Symmetric vs. Asymmetric Cryptography – Practical Aspects of Public-Key Cryptography – RSA Cryptosystem: Key Generation and Proof of Correctness – Encryption and Decryption: Fast Exponentiation – Speed-up Techniques for RSA – Padding, Attacks, Implementation in Software and Hardware – Digital Signatures: Principles of Digital Signatures and Security Services – Elgamal Digital Signature Scheme – Elliptic Curve Digital Signature Algorithm – RSA Algorithm.</p> <p>Activities:</p> <ul style="list-style-type: none"> • Implement RSA encryption and digital signature • Case study: How SSL uses certificates and PKI <p>Network and Internet Security Transport-Level Security: Web Security Considerations – Transport Layer Security – HTTPS and Secure Shell (SSH) – Wireless Network Security: Wireless Network Threats and Security Measures – Mobile Device Security – IEEE 802.11i Wireless LAN Security – Network Endpoint Security: Firewalls – Intrusion Detection Systems – Malicious Software and Distributed Denial of Service Attacks – Cloud Security: Service and</p>					

Deployment Models – Cloud Security Concepts – Cloud Security Risks and Countermeasures – Cloud Security As A Service

Activities:

- Group discussion on packet analysis of HTTPS, TLS, and SSH with Wireshark
- Build a basic ID using Python, exploring different IDS types and functionalities, and analyzing attack scenarios.

Real-World Applications

IBM Secret-Key Management Protocol – Kerberos – KryptoKnight – Privacy – Enhanced Mail – Smart Cards – Public–Key Cryptography Standards (PKCS) – Universal Electronic Payment System (UEPS) – Clipper and Capstone – National Security Agency (NSA) – National Computer Security Center (NCSC) – National Institute of Standards and Technology (NIST) – Cypherpunks

Activities:

- Presentation on NIST PQC standard candidates
- Case Studies and Projects. Ex: Capstone Project

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

REFERENCES:

1. William Stallings, “Cryptography and network security: Principles and practice”, 8th Global Edition, Pearson Education, 2023.
2. Stallings, W., & Brown, L., “Computer security: Principles and practice”, 2nd Edition, Prentice Hall, 2012.
3. Paar, C., & Pelzl, J., “Understanding cryptography: A textbook for students and practitioners”, Springer, 2010.
4. Schneier, B., “Applied cryptography: Protocols, algorithms, and source code in C”, 2nd Edition, John Wiley & Sons. 1996.
5. Stallings, W., “Network security essentials: Applications and standards”, 4th Edition, Prentice Hall, 2011.

E-RESOURCES:

1. <https://nptel.ac.in/courses/106105162>

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, principles, and techniques of cryptography and cyber security for securing information and communication systems.	--	--
CO2	Analyze cryptographic algorithms, security protocols, and cyber threats to understand system vulnerabilities and security requirements.	PO1 (3)	PSO1 (3)

CO3	Evaluate cryptographic techniques, security mechanisms, and cyber defense strategies to assess their effectiveness against various security attacks.	PO3 (2)	PSO2 (2)
CO4	Design secure systems by selecting appropriate cryptographic methods, security architectures, and cyber security controls for real-world applications.		

MC25303	Research Methodology and IPR	L	T	P	C
		3	0	0	3

Course Objective:

This course develops an understanding of research significance, methodologies, and objective formulation. It equips students with skills in selecting suitable data collection and analysis methods, enhances research documentation and writing abilities, and promotes awareness of publication ethics. It also provides foundational knowledge of intellectual property rights, including patents and copyrights, and familiarizes learners with relevant legal frameworks and patenting procedures.

Fundamentals of Research

Objectives of Research – Types of Research – Research Approaches – Significance of Research – Research Methods versus Methodology – Research and Scientific Method – Overview of Research Process: Problem Identification/Selection – Review of Literature – Defining the Research Problem – Data Collection – Data Analysis – Documentation.

Activity:

- Define a technical research problem in your field with clear objectives and a brief literature background.

Research Design

Research Plan: Need – Features – Framework – Components – Data Collection: Data Types – Sampling – Measurement Scales – Data Collection Methods – Selection of Appropriate Method for Data Collection.

Activity:

- Prepare a research plan including data types, sampling method, and a Gantt chart for a small project.

Data Analysis and Documentation

Research Techniques and Tools: Basics of Statistics – ANOVA – Multivariate Analysis – Testing of Hypothesis – Overview of Software Packages for Data Analysis – Documentation: Types of Reports – Techniques of Interpretation – Significance of Report Writing – Guidelines for Writing Report – Publication Ethics – Software for Plagiarism and Language Grammar Checking.

Activity:

- Analyze a data set using basic statistics and hypothesis testing in software like SPSS or R; write a brief report.

Intellectual Property Rights

Introduction – Types of Intellectual Property – Origin and Development – An Overview: Copyrights – Trademarks – Patents – Designs – Utility – Models – Trade Secrets – Geographical Indications – IPR Development Process.

Activity:

- Identify different types of IP related to your area and summarize their importance in innovation.

Patent

Introduction to Patent Law – Indian Patent Law: An Overview – Concept of Patent – Process Patents and Terminology – Procedure for Filing of Patent Application – Types of Applications.

Activity:

- Draft a simple patent application outline for an invention or process relevant to your specialization.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

REFERENCES:

1. C.R.Kothari and Gaurav Garg, "Research Methodology: Methods and Techniques" New Age International Publications, 5th Edition 2024.
2. Ranjit Kumar, "Research Methodology a step-by-step guide for beginners", SAGE publications Ltd 4th Edition 2024.
3. Stuart Melville and Wayne Goddard, "Research Methodology: An Introduction for Science & Engineering students", Juta and Co., Limited, 2nd Edition, 2014.
4. William M. Trochim, "Research Methods Knowledge Base", Atomic Dog publishing, 2nd Edition, 2016.
5. Dr. Kantha Babu, "Textbook on Intellectual Property Rights", Centre for Intellectual Property Rights, Anna University, Chennai, 2nd Edition, 2020.

E-RESOURCES:

1. Stuart Russell & Peter Norvig – Artificial Intelligence: A Modern Approach <http://aima.cs.berkeley.edu/>
2. MIT OpenCourseWare – Artificial Intelligence (6.034) by Prof. Patrick Winston <https://ocw.mit.edu/courses/6-034-artificial-intelligence-fall-2010/>
3. GeeksforGeeks – Artificial Intelligence Tutorials (Concepts, algorithms, and coding examples) <https://www.geeksforgeeks.org/artificial-intelligence/>
4. IBM SkillsBuild – AI Fundamentals Learning Path (Free interactive course with certification option) <https://skillsbuild.org/>

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts of research methodology, research ethics, and intellectual property rights, including patents, copyrights, and trademarks.	--	--
CO2	Analyze research problems, methodologies, and data collection techniques to formulate effective research designs and protect intellectual property.	PO1 (3)	PSO1 (3)
CO3	Evaluate research methodologies, research outcomes, and intellectual property protection mechanisms to ensure validity, reliability, and legal compliance.	PO3 (2)	PSO2 (2)
CO4	Design research proposals and documentation by selecting appropriate methodologies, analytical tools, and intellectual property strategies for real-world research problems.	PO2 (1)	PSO1 (3)

MC25301	Machine Learning Techniques	L	T	P	C
		3	0	2	4
<p>Course Objective: To provide students with a comprehensive understanding of machine learning concepts, enabling them to build, optimize, and evaluate ML models. The course emphasizes hands on learning using modern tools, promotes independent exploration of ML research, and encourages ethical deployment of AI technologies.</p>					
<p>Foundation of Machine Learning Definitions and types of ML: Supervised- Unsupervised- Reinforcement Learning. Machine Learning workflow: Data preprocessing- feature engineering- model selection. Bias–Variance tradeoff. Tools and libraries: Python-scikit–learn- pandas-matplotlib- Jupyter/Colab.</p> <p>Practical :</p> <ol style="list-style-type: none"> 1. Explore the ML Workflow: Perform data preprocessing, feature engineering, and visualization using Python libraries (pandas, matplotlib, scikit-learn). 2. Implement Supervised Learning Models: Apply Linear Regression and Logistic Regression on real-world datasets. <p>Supervised Learning Techniques Linear and Logistic Regression – Decision Trees and Random Forests- Naïve Bayes Classifier-k-Nearest Neighbors - Support Vector Machines (SVM). Evaluation metrics: Confusion Matrix- Accuracy - Precision- Recall- F1-Score. ROC-AUC – Validation techniques: Train-test split- k-Fold cross-validation.</p> <p>Practical :</p> <ol style="list-style-type: none"> 1. Build and Evaluate Classifiers: Use Naïve Bayes, k-Nearest Neighbors (k-NN), and Support Vector Machines (SVM) with performance metrics (confusion matrix, precision, recall, F1-score). 					
<p>Unsupervised Learning & Dimensionality Reduction Clustering: k–Means- Hierarchical.DBSCAN – Dimensionality Reduction- PCA- Feature Selection and Transformation- Instance-Based Learning-t-SNE: Nonlinear visualization for high-dimensional data- Use in data exploration. Applications in real–world domains.</p>					

Practical:

1. Unsupervised Learning Techniques: Apply k-Means, Hierarchical Clustering, on unlabelled datasets; visualize and compare clusters.
2. Dimensionality Reduction and Visualization: Perform PCA and t-SNE for reducing and visualizing high-dimensional data.

Neural Networks- Optimization & Ethics

Perceptron and activation functions- Error Propagation-BPN. Introduction to Deep Learning: ANN and CNN – Model optimization: L1/L2 regularization-dropout-Gradient Descent Optimization- Grid Search- Random Search – Interpretability: Introduction to SHAP- LIME – Ethical AI: Bias- fairness- responsible AI practices.

Practical:

1. Neural Network Implementation: Build a simple Artificial Neural Network (ANN) using Tensor Flow/Keras for image or tabular classification tasks.
2. Model Optimization and Explainability: Use L1/L2 regularization and hyper parameter tuning (Grid Search/Random Search); interpret model results using SHAP or LIME

Machine Learning Applications & Emerging Trends

ML Applications: NLP- Healthcare- Finance- Image Recognition – Research paper review and critical analysis – Introduction to Reinforcement Learning and its use cases – Overview of Explainable AI-AutoML- and Federated Learning-GPT.

Practical :

1. Predict the likelihood of diabetes **or** heart disease using logistic regression or decision trees.
2. Build a CNN model to classify handwritten digits (MNIST dataset)

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20)

References:

1. AurélienGéron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow”, 3rd Edition, O'Reilly Media, 2022.
2. Tom M. Mitchell, “Machine Learning”, 1st Edition, McGraw-Hill Education, 1997.
3. EthemAlpaydin, “Introduction to Machine Learning”, 4th Edition, MIT Press, 2020.
4. Ian Goodfellow, YoshuaBengio, and Aaron Courville, “Deep Learning”, MIT Press, 2016
5. Cathy O’Neil and Rachel Schutt, “Doing Data Science”, O'Reilly Media, 2013.

E-RESOURCES:

1. NPTEL: Machine Learning by Prof.Sudarshanlyengar (IIT Ropar)
2. Google Machine Learning Crash Course
3. Scikit–learn Documentation
4. Keras Documentation
5. Edutech:<https://www.edutechlearning.com/learningresourcesdesc/computer-science/cse-lab-solutions/machine-learning-lab-resource>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, learning paradigms, and techniques used in machine learning for data-driven problem solving.	--	--
CO2	Analyze machine learning algorithms and models to understand their performance, assumptions, and applicability to different datasets.	PO1 (3)	PSO1 (3)
CO3	Evaluate machine learning techniques and model evaluation metrics to assess their effectiveness in solving real-world problems.	PO3 (2)	PSO2 (2)
CO4	Design machine learning solutions by selecting appropriate algorithms, feature representations, and training strategies for practical applications.	PO2 (1)	PSO1 (3)

MC25001	Big Data Analytics	L	T	P	C
		3	0	0	3

Prerequisites: SQL/Database Knowledge, Java/Scala/Python Programming

Course Objective:

To understand the need of Big Data, challenges and different analytical architectures, installation and understanding of Hadoop and its ecosystems. The Processing of Big Data with Advanced architectures like Hive, Pig and statistical R Programming.

Introduction to Big Data and Hadoop

Types of Digital Data – Introduction to Big Data – Challenges of conventional systems – Web data – Evolution of Analytic scalability – Analytic Processes and Tools – Analysis vs Reporting – History of Hadoop – Apache Hadoop – Analyzing Data with Hadoop.

Activity:

- Assignment on Setting up and Installing Hadoop

HDFS & Hadoop I/O

Hadoop Distributed File System: The Design of HDFS– HDFS Concepts – The Command – Line Interface – Hadoop File Systems – Data Flow – Parallel Copying with DistCp – Hadoop Archives – Hadoop I/O: Data Integrity – Compression – Serialization.

Activities:

- Seminar on HDFS Command Reference
- Develop a Project on Listing contents of directory, Displaying and printing disk usage, Moving files & directories, Copying files and directories
- Develop a Project to implement the file management tasks in Hadoop: Writing a file into HDFS, Reading data from HDFS, Retrieving files, Deleting files

Hadoop and MapReducer

Analyzing the Data with Hadoop- MapReduce Types- Input Formats- Output Formats –MapReduce Features - MapReduce Works - Anatomy of a MapReduce Job Run – Failures – Job Scheduling – Shuffle and Sort – Task Execution.

Activity:

- Develop a Project on basic Word Count Map Reduce program to understand Map Reduce Paradigm with Weather Dataset

Hadoop Related Tools

Pig: Introduction to PIG- Execution Modes of Pig-Comparison of Pig with Databases-Grunt-Pig Latin- User Defined Functions, Data Processing operators-Hive: Hive Shell, Hive Services-Hive Metastore-Comparison with Traditional Databases-HiveQL- Tables-Querying Data-Data Ingestion and Management tools-Sqoop-Flume-

Zookeeper-Oozie-Mahout.

Activities:

- Install and Run Pig then write Pig Latin scripts to sort, group, join your data
- Install and Run Hive then use Hive to create, alter, and drop databases, tables

R Programming

History and overview of R – Overview, Programming structures: Data Types – Control statements – Operators – Functions – Recursion – Replacement functions, R data structures – Vectors –Matrices and arrays – Lists –Data frames – Classes, Input/output, String manipulations.

Activities:

- Learn the basics of functions in R and implement them with examples
- Implement different data structures in R
- Implement different String Manipulation functions in R

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

References:

1. V. K. Jain, Big Data and Hadoop, Khanna Publishing House, 2022.
2. Tom White, Hadoop: The Definitive Guide, 4th Edition, O'Reilly Media, 2020.
3. Alan Gates, Programming Pig, O'Reilly Media, 2nd Edition, 2021.
4. Edward Capriolo, Dean Wampler, and Jason Rutherglen, Programming Hive, O'Reilly Media, 2020.
5. Garrett Golemund, Hands-On Programming with R: Write Your Own Functions and Simulations, O'Reilly Media, 2021.

E-RESOURCES:

1. <https://nptel.ac.in/courses/106/104/106104189>

CO PO Mapping

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, architectures, and tools used in big data analytics for processing and analyzing large-scale datasets.	--	--
CO2	Analyze big data processing frameworks and analytical techniques to understand scalability, performance, and data handling challenges.	PO1 (3)	PSO1 (3)
CO3	Evaluate big data analytics platforms, tools, and	PO3 (2)	PSO2

	algorithms to assess their effectiveness in extracting insights from large and complex datasets.		(2)
CO4	Design big data analytics solutions by selecting appropriate frameworks, storage models, and analytical methods for real-world applications.	PO2 (1)	PSO1 (3)

MC25002	Vibe Coding	L	T	P	C
		3	0	0	3
Prerequisites - Data Structures and Algorithms using Python					
<p>Course Objective: The course aims to enhance creative and expressive programming through music, art, and real-time interactivity; introduce frameworks and tools used in live coding environments; develop coding skills that integrate sound synthesis, visual rendering, and sensory feedback; apply vibe coding techniques for real-time collaborative, artistic, and biometric applications; and explore security and privacy considerations in interactive coding environments used in performance contexts.</p>					
<p>Foundation of Vibe Coding Definition – Origins of Live Coding – Real-Time Creative Expression – Applications in Music, Visual Arts, Biometric Systems – Tools: Sonic Pi, TidalCycles, Hydra – IDEs for creative coding.</p> <p>Activities:</p> <p>Activity 1: Hands-on Demo – Create a basic musical loop using Sonic Pi or TidalCycles and demonstrate live changes. Activity 2: Group Discussion – Explore the evolution of live coding from traditional programming to real-time artistic expression.</p> <p>Coding For Audio-Visual Systems Sound Synthesis – Audio Loops – Visual Output with Hydra – Shader Programming – Generative Art – Signal Processing for Real-Time Interaction – Synchronization of Visual and Audio Streams.</p> <p>Activities:</p> <p>Activity 3: Mini Project – Use Hydra to create a generative visual synchronized to an audio beat. Activity 4: Shader Lab – Modify a basic GLSL shader to respond to sound amplitude in real-time.</p> <p>Sensory Integration and Biometrics Integration of biometric sensors (EEG, EMG, heart rate) – Data mapping for expressive coding – Haptic feedback – Emotion-based coding – Case studies on therapeutic and surveillance applications.</p> <p>Activities:</p> <p>Activity 5: Sensor Demo – Integrate a simple biometric sensor (heart rate or EEG) with a creative coding environment to change visuals based on signal input. Activity 6: Case Study Presentation – Present real-world applications of biometric-integrated vibe coding in therapy or surveillance.</p> <p>Security And Collaborative Coding Multi-user Vibe Coding Systems – Secure Session Sharing – Real-Time Encryption of Code Streams – Identity Authentication in Live Performance – Versioning and Auditability – Cybersecurity in generative environments.</p>					

Activities:

Activity 7: Simulation – Use a collaborative coding tool (like Estuary or Hydra multi-user mode) and simulate a secure coding session.

Activity 8: Debate – “Should live code performances be encrypted?” Explore the balance between openness and security.

Frameworks, Ethics And Future Trends

Platforms: Sonic Pi, FoxDot, Max/MSP, OpenFrameworks – Privacy in Creative Code – AI-assisted vibe coding – Ethical Concerns in Manipulative Code Art – Future of human-centered programmatic expression.

Activities:

Activity 9: Tool Review – Compare Sonic Pi, FoxDot, and Max/MSP in terms of features, ease of use, and performance contexts

Activity 10: Poster Presentation – Ethical implications of AI-assisted generative art: privacy, authorship, and bias.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

References:

1. Thor Magnusson, "Sonic Writing: Technologies of Material, Symbolic and Signal Inscriptions", Bloomsbury Academic, 2019.
2. Alex McLean, Geraint Wiggins, "The Oxford Handbook of Algorithmic Music", Oxford University Press, 2021.
3. Eli Field steel, "Creative Live Coding with Supercollider", Routledge, 2023.
4. Nick Collins, Julio d'Escriván, "The Cambridge Companion to Electronic Music", 2nd Edition, Cambridge University Press, 2021.
5. Ge Wang, "Artful Design: Technology in Search of the Sublime", Stanford University Press, 2018.

E-RESOURCES:

1. <https://thebookofshaders.com>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, philosophy, and practices of vibe coding and its role in modern collaborative software development.	--	--
CO2	Analyze vibe coding workflows, tools, and team practices to understand their impact on productivity, creativity, and code quality.	PO1 (3)	PSO1 (3)
CO3	Evaluate vibe coding approaches, platforms, and community-driven practices to assess their	PO3 (2)	PSO2 (2)

	effectiveness in real-world software development scenarios.		
CO4	Design software development solutions using agile coding principles by selecting appropriate tools, collaboration strategies, and creative workflows.	PO2 (1)	PSO1 (3)

MC25003	Network Programming and Management	L	T	P	C
		3	0	0	3

Prerequisites - Networking and Communication Systems

Course Objective:

The course aims to provide an in-depth understanding of network protocols, APIs, and tools for network application development and management. Students will learn to create networked applications using sockets, perform traffic analysis, and understand network security principles. Emphasis is given to real-world protocols and cloud/network monitoring tools.

Sockets and Application Development

Introduction to Socket Programming – System Calls – Address Conversion Functions – POSIX Signal Handling – Server with Multiple Clients – Boundary Conditions – Server Process Crashes, Server Host Crashes, Server Crashes and Reboots, Server Shutdown – I/O Multiplexing – I/O Models – TCP Echo Client/Server with I/O Multiplexing.

Activities:

Activity 1: Develop a simple TCP client-server application where the server handles multiple clients using I/O multiplexing (select() or poll() system call).

Activity 2: Simulate and analyze the behavior of a server under different failure scenarios (e.g., host crash, server process crash, unexpected shutdown) and demonstrate graceful recovery.

Socket Options

Socket Options – getsockopt and setsockopt Functions – Generic Socket Options – IP Socket Options – ICMP Socket Options – TCP Socket Options – Multiplexing TCP and UDP Sockets – Domain Name System – gethostbyname, gethostbyaddr, getservbyname and getservbyport functions – Protocol Independent Functions – getaddrinfo and free addrinfo Functions.

Activities:

Activity 3: Create a C program to modify socket behavior using setsockopt(), such as enabling SO_REUSEADDR, setting TCP_NODELAY, and changing buffer sizes.

Activity 4: Write a program that performs domain name resolution using gethostbyname(), getaddrinfo(), and demonstrate interoperability with IPv6.

Advanced Sockets

IPv4 and IPv6 Interoperability – Threaded Servers – Thread Creation and Termination – TCP Echo Server using Threads – Mutex – Condition Variables – Raw Sockets – Raw Socket Creation – Raw Socket Output – Raw Socket Input – Ping Program – Trace Route Program.

Activities:

Activity 5: Implement a multi-threaded TCP server that can handle multiple clients in parallel using pthread_create() and use mutexes and condition variables to manage shared resources.

Activity 6: Build a simple Ping and Traceroute utility using raw sockets, and analyze the ICMP packets with tools like Wireshark.

Simple Network Management

SNMP Network Management Concepts – SNMPv1 – Management Information – MIB Structure – Object Syntax – Standard MIB 's – MIB-II Groups – SNMPv1 Protocol and Practical Issues – Overview of RMON – Statistics and Collection – Alarms and Filters.

Activities:

Activity 7: Design and simulate an SNMP agent that can respond to MIB-II queries, such as system uptime, interface status, and packet counters.

Activity 8: Prepare a poster or present a seminar on RMON and how it differs from SNMP in terms of traffic monitoring and remote data collection.

Network Management Tools & Systems

System Utilities – Network Status Tools – Traffic monitoring Tools – Network Routing Tools – SNMP Tools – Network Statistics measurement systems – NMS Design – Network Management Systems.

Suggested Activities:

Activity 9: Use Wireshark or NetFlow to analyze and log network traffic from a local network, and interpret the results (protocols, IPs, throughput).

Activity 10: Demonstrate a basic Network Management System (NMS) setup using open-source SNMP tools like Nagios/Zabbix/Cacti, and show how they track device status.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

References :

- 1.W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, "UNIX Network Programming: The Sockets Networking API", 3rd Edition, Pearson Education, 2022.
- 2.James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson, 2021.
- 3.Michael J. Donahoo, Kenneth L. Calvert, "TCP/IP Sockets in C: Practical Guide for Programmers", 2nd Edition, Morgan Kaufmann, 2022.
- 4.Olivier Bonaventure, "Computer Networking: Principles, Protocols and Practice", Self-Published (Open Textbook), 2020.
- 5.Thomas A. Limoncelli, Christina J. Hogan, Strata R. Chalup, "The Practice of System and Network Administration", 3rd Edition, Addison-Wesley, 2021.cc

E-RESOURCES:

- 1.https://books.google.com/books/about/UNIX_Network_Programming.html?id=ptSCQgAACAAJ

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, protocols, and architectures involved in network programming and network management systems.	--	--
CO2	Analyze network protocols and programming models to understand data communication,	PO1 (3)	PSO1 (3)

	performance, and reliability in networked systems.		
CO3	Evaluate network management techniques, tools, and security mechanisms to assess their effectiveness in maintaining and optimizing network operations.	PO3 (2)	PSO2 (2)
CO4	Design network-based applications and management solutions by selecting appropriate protocols, programming interfaces, and monitoring strategies for real-world networks.	PO2 (1)	PSO1 (3)

MC25004	Software Project Management	L	T	P	C
		3	0	0	3
Prerequisites - Software Engineering Concepts					
<p>Course Objective: To understand and apply project management methodologies in software development, gain knowledge of risk management tactics and software effort estimation methodologies, and then successfully implement these ideas in practical situations. To equip with practical skills in managing people, organizing teams, and fostering effective team dynamics within the framework of software projects.</p>					
<p>Introduction to Software Project Management Defining of Software Development Process - Process - Tailoring the Process - Improving the process discipline - Need for implementing discipline. Software Production Process - Identify the Software Model - Software Process Models: Waterfall Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, Component Assembly Model - Software Life Cycle.</p> <p>Activities:</p> <p>Activity 1: Identify and Classify Software Projects Activity 2: Draw and Explain Project Management Life Cycle</p> <p>Software Development Software Development Team - Three Vital Aspects of Software Project Management - The Team - Meaning of Leadership - Communicating in Harmony - Personality traits - Project Organizations. Project Planning: Top-Down and Bottom-Up Planning - Types of Activity - Project Duration: Schedule Monitoring Tools - Gantt Chart, PERT Chart, Critical Path.</p> <p>Activities:</p> <p>Activity 3: Create a Project Schedule Using Gantt Chart Activity 4: Draw a Network Diagram and Identify the Critical Path</p> <p>Project Review Tracking Meetings - Recovery plans - Schedule Work & Escalation Meetings. Project Engineering: Product Requirements - Understanding the Customer Problem to solve - Initial Investigation, Strategies for determining information requirements, Information gathering Tools - Product Objectives.</p> <p>Activities:</p> <p>Activity 5: Identify and categorize different types of risks in real-world software projects.</p> <p>Activity 6: In pairs or small teams, review each other's code focusing on design integrity and maintainability.</p> <p>Problem Solving Product Specifications - Defining the Final Product - Data Flow Diagram, Data Dictionary, Structured English, Decision Trees, Decision Tables - Feasibility Study. Software Testing:</p>					

Test Plan - Development Testing - Verification and Validation - General Testing Methods: White Box and Black Box Testing - Unit Testing - System Integration Testing - Validation Testing - System testing-Agile Testing.

Activities:

Activity 7: Teams develop test plans covering unit, integration, system tests using white-box and black-box methods.

Activity 8: Identify and classify at least 2 maintenance tasks under the following categories of any software system (e.g., College ERP System, Banking App, or Web-based Email System): Corrective, Adaptive, Perfective and Preventive

Software Quality

Software Quality - Quality Measures - FURPS - Software Quality Assurance - Software Reviews - Format Technical Review (FTR) Formal Approaches to SQA - Software Reliability - Introduction to SQA - The Software Quality Assurance Plan - Formal approaches to SQA - Clean room Methodology

Activities:

Activity 9: Students calculate reliability indicators and map functionality/usability/performance to the FURPS framework.

Activity 10: Create Product and Process Metrics, Learn how to define and apply software metrics.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

References:

1. Gregory M. Horine, "Project Management Absolute Beginner's Guide", 5th Edition, Que Publishing, 2022.
2. Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", 6th Edition, McGraw Hill Education, 2020.
3. Robert K. Wysocki, "Effective Project Management: Traditional, Agile, Extreme", 8th Edition, Wiley, 2023.
4. Pankaj Jalote, "Software Project Management in Practice", 1st Edition, Pearson Education, 2021.
5. Bennatan, E.M., "Software Project Management: A Practical Approach", 4th Edition, McGraw Hill, 2022.

E-Resources:

1. <https://archive.org/details/software-project-management-hughes>
2. <https://www.smartsheet.com/critical-path-method>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, processes, and methodologies involved in software project management.	--	--
CO2	Analyze software project requirements, schedules, and resource allocation strategies to ensure effective project planning and execution.	PO1 (3)	PSO1 (3)
CO3	Evaluate software project management tools, risk management techniques, and quality assurance practices to assess project success and outcomes.	PO3 (2)	PSO2 (2)
CO4	Design software project plans by selecting appropriate management methodologies, tools, and metrics to deliver successful software projects.	PO2 (1)	PSO1 (3)

MC25005	E-Learning	L	T	P	C
		3	0	0	3

Pre-requisites:

1. Explain the components, types, and workflow of e-learning environments.
2. Apply instructional design models to structure learning content and strategies.
3. Create multimedia-rich and interactive e-learning packages using authoring tools.
4. Implement AI-based personalization and analytics within LMS environments.

Course Objective:

This course synthesizes the instructional, psychological, technological, and data-driven elements of modern e-learning. It integrates design thinking, multimedia development, platform integration, and AI/analytics to equip CS/IT students to build intelligent, interactive, and effective e-learning solutions.

Foundations of E-Learning and Design Thinking

History and Need for E-Learning Types: Synchronous, Asynchronous, Blended Learning–Components of E-Learning Systems–Workflow to Produce and Deliver E-Content–Design Thinking in E-Learning (Empathy → Ideation → Prototype → Test)–Quality Frameworks (SCORM, UDL, ADDIE)–Output: Learning model comparison + design sprint reflection

Activities:

Activity 1: Conduct a group seminar on different types of e-learning environments.

Activity 2: Collaborative workshop on applying design thinking to a real-world learning scenario.

Instructional Design & Learning Psychology

Theories of Learning (Behaviorism, Cognitivism, Constructivism)–Instructional Design Models: ADDIE, SAM, Gagné’s Events, Bloom’s Taxonomy–Multimedia Learning Principles (Mayer’s Theory)– Gamification & Motivation in Learning–Mapping outcomes and assessments (ABCD, Mager)–Output: Storyboard + lesson plan aligned to ID model

Activities:

Activity 3: Seminar on comparing major learning theories and their impact on e-learning.

Activity 4: Group task to develop an instructional plan using the ADDIE model

Multimedia & Interactive Content Development

Authoring Tools: Adobe Captivate, H5P, Canva, Figma–Scriptwriting, Storyboarding, and Visual Flow– Image, Audio, and Video Design for Education–Web–based Interactivity and Usability–Augmented Reality (AR), VR, and GamE-based learning elements–Output: Prototype interactive lesson using a chosen authoring tool

Activities:

Activity 5: Hands–on lab: Create a multimedia storyboard using Canva or Figma.

Activity 6: Seminar on best practices in creating educational videos and animations.

Platforms, LMS, and AI in E-Learning

LMS Architecture: Moodle, Canvas, Custom LMS–xAPI, LTI, SCORM integration– User management, plugin development, webhooks–AI in learning: Recommender Systems, Chatbots (Rasa/GPT), Personalization–Cloud-based deployment, APIs, and LMS analytics dashboards-Output: Mini LMS setup + chatbot or adaptive logic integration

Activities:

Activity 7: Seminar on LMS platforms and their extensibility features (Moodle, Canvas).

Activity 8: Mini project — Develop a simple chatbot using GPT for a learning topic.

Evaluation, Analytics & Capstone Project

Learning Analytics: metrics, dashboards, dropout prediction–A/B Testing, Learner Profiling, UX Feedback–Assessment Strategies (formative, summative, QTI–based MCQs)–Ethics & Privacy in EdTech — AI bias–Final Project: Design, Develop & Demonstrate a Smart E-Learning Module-Output: Capstone project + analytics + final pitch/demo

Activities:

Activity 9: Capstone Project

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

References:

1. Clark, R. C., & Mayer, R. E., “E-learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning”. Wiley, 2016.
2. Horton, W., “E-learning by Design”, Pfeiffer, 2011.
3. Ally, M., “Mobile Learning: Transforming the Delivery of Education and Training”, Athabasca University Press, 2009.
4. Siemens, G., & Baker, R., “Learning Analytics and Educational Data Mining: Towards Communication and Collaboration”, 2012.
5. Mayer, R. E., “Multimedia Learning”, 3rd Edition, Cambridge University Press. 2021.

E-Resources:

1. <https://www.adobe.com/products/captivate.html>
2. <https://www.classcentral.com/subject/elearning> (MOOCs on E-learning)
3. <https://learninganalytics.net/>
4. <https://developer.mozilla.org> (for HTML5/JS based interactivity).

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, models, and technologies used in e-learning systems and digital education platforms.	--	--
CO2	Analyze e-learning architectures, content delivery methods, and learner interaction mechanisms to understand effectiveness and accessibility.	PO1 (3)	PSO1 (3)
CO3	Evaluate e-learning tools, instructional design strategies, and assessment methods to assess learning outcomes and system performance.	PO3 (2)	PSO2 (2)
CO4	Design e-learning solutions by selecting appropriate platforms, content structures, and pedagogical approaches for diverse learning environments.	PO2 (1)	PSO1 (3)

MC25006	Accounting And Financial Management	L	T	P	C
		3	0	0	3

Course Objective:

This course aims to help them gain familiarity in the process of capturing, recording and communicating accounting information and to provide in-depth knowledge on successful way of mobilizing and managing finance in a business enterprise.

Financial Accounting

Meaning and Scope – Principles – Concepts – Conventions. Journal – Ledger – Trial Balance - Trading Account – Profit and Loss Account – Balance Sheet - Accounting Ratio Analysis– Funds Flow Statement – Cash Flow Statement - Computerized Account.

Activity:

- Conduct a group seminar on accounting principles, concepts, and preparation of final accounts.

Cost and Management Accounting

Cost Accounting: Meaning. Objectives, Scope and Uses of Cost and Management Accounting — Difference between Cost and Management, Cost and Financial Accounting - Elements of Cost - Cost Volume Profit Analysis - Break Even Analysis. Budgetary Control – Meaning and Types of Budgets – Sales Budget – Production Budget - Cash Budget – Master Budget – Flexible Budgeting – Zero Base Budgeting.

Activity:

- Collaborative workshop on cost classification, break-even analysis, and budget preparation.

Financial Management

Meaning, objectives and scope of financial management. Basis of time value - Finding future value - Discounting and Present value - Future and Present Value of Annuity - Periodicity of Compounding and Discounting. Cost of capital — Measurement of Costs - Equity, Debt and Preference shares — WACC. Capital structure: Determinants — Theories –Optimal capital structure - Leverages — Types.

Activity:

- Conduct a group seminar on time value of money, cost of capital, and capital structure decisions.

Capital Budgeting Decisions

Objectives and significance - Capital budgeting process - Capital budgeting decisions - Information required for capital budgeting - Techniques and evaluating projects - Risks in capital budgeting - Independent projects and capital rationing - Mutually exclusive projects - Capital budgeting and price level adjustments.

Activity:

- Collaborative workshop on evaluating investment projects using capital budgeting techniques.

Dividend Policy and Working Capital Management

Dividend policy formulation- Dividend Types - Dividend models - Relevance Vs irrelevance of - Theory of relevance. Working capital management- Operating cycle - Working capital policy - Estimation of working capital requirements - sources of working capital financing - Inventory management, Receivables management, Cash management — Baumol, Miller & Orr Model.

Activity: Conduct a group seminar on dividend policy models and working capital management strategies.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

REFERENCES:

1. Eugene F. Brigham & Louis C. Gapenski, "Financial Management Theory and Practice", Thomson Learning, 10th Edition, 2012.
2. Prasanna Chandra, "Financial Management", Tata McGraw Hill, New Delhi, 2021.
3. R.S.N. Pillai Bagavathi, "Fundamentals of Advanced Accounting", Sultan Chand Publications. 2019.
4. Dr. Ashok Sehgal and Dr. Deepak Sehgal, Accounting for Management, Taxmann Publications (P) Ltd., New Delhi, 2020.
5. T. P. Ghosh, Financial Accounting for Managers, Taxmann Publications (P) Ltd., New Delhi, 4th Edition, 2018.

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, principles, and practices of accounting and financial management in organizational decision-making.	--	--
CO2	Analyze financial statements, accounting data, and financial indicators to understand the financial performance and position of organizations.	PO1 (3)	PSO1 (3)
CO3	Evaluate financial management techniques, investment decisions, and budgeting methods to assess their impact on organizational objectives.	PO3 (2)	PSO2 (2)
CO4	Design financial plans and control mechanisms by selecting appropriate accounting tools and financial strategies for effective resource management.	PO2 (1)	PSO1 (3)

MC25007	Digital and Mobile Forensics	L	T	P	C
		3	0	0	3

Pre- requisites:

1. Basic knowledge of computer architecture and operating systems
2. Understanding of file systems (FAT, NTFS, ext2/ext3, etc.)
3. Introductory knowledge of cybersecurity principles and threats
4. Basic hands-on skills with computers and mobile devices
5. Exposure to programming or scripting languages

Course Objective:

This course provides foundational knowledge of digital and mobile forensics, focusing on principles, tools, and techniques used in the investigation of cyber incidents. It covers procedures for acquiring, analyzing, and preserving digital evidence, while addressing legal and ethical aspects. Students will also gain exposure to mobile forensics and hands-on experience using forensic tools for real-world investigations.

Foundations of Digital Forensics

Introduction to Digital Forensics – Chain of custody and evidence handling procedures – Phases of digital forensic investigation – Legal issues: Overview of Indian IT Act and admissibility of digital evidence.

Activity:

Activity 1: Case-based discussion on cybercrime scenarios

Evidence Acquisition and Preservation

Imaging and hashing: Write blockers, disk cloning – Basics of file systems: FAT, NTFS, ext2/ext3 – Evidence acquisition tools: FTK Imager – EnCase – Autopsy – Memory forensics and volatile data collection – Best practices in evidence preservation

Activity:

Activity 2: Hands-on session with imaging tools + flipped classroom session

Forensic Analysis Techniques

Data carving and file recovery – Log file and metadata analysis – Email forensics, Internet artifacts – Anti-forensics techniques and detection – Forensic report writing – maintaining chain of custody and proper documentation.

Activity:

Activity 3: Poster presentation on analysis techniques

Mobile Device Forensics

Overview of Android and iOS architecture – Mobile acquisition methods: logical, physical, and cloud – based – SIM and SD card analysis – Mobile forensic tools: Cellebrite, MOBILedit, Oxygen – App data extraction and analysis.

Activity:

Activity 4: Group seminar on mobile forensic tools

Emerging Trends and Case Studies

IoT forensics and challenges – Overview of cloud forensics – Blockchain and cryptocurrency forensics – Case studies of real– world investigations – Ethics and future of digital forensics.

Activity:

Activity 5: Steganography Puzzle Challenge – Use tools to uncover hidden data within media files

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

References:

1. Joakim Kävrestad, “Fundamentals of Digital Forensics: Theory, Methods, and Real-Life Applications”, 2nd Edition, Springer, 2020.
2. Greg Gogolin, “Digital Forensics Explained”, 2nd Edition, CRC Press, 2021.
3. Marie-Helen Maras, “Computer Forensics: Cybercriminals, Laws, and Evidence”, 3rd Edition, Jones & Bartlett Learning, 2021.
4. Anchit Bijalwan, “Digital Forensics: Threatscape and Best Practices”, Wiley, 2023.
5. Darren R. Hayes, “A Practical Guide to Digital Forensics Investigations”, Pearson, 2020.

E- Resources:

1. NPTEL Course: “Computer Forensics” by Prof. Santosh Biswas
2. DFIR Training (<https://www.dfir.training>)
3. Autopsy Tool Documentation (<https://www.sleuthkit.org/autopsy/docs.php>)

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, principles, and processes involved in digital and mobile forensics investigations.	--	--
CO2	Analyze digital and mobile devices, data sources, and forensic artifacts to understand evidence acquisition and analysis techniques.	PO1 (3)	PSO1 (3)
CO3	Evaluate digital and mobile forensic tools, methodologies, and legal considerations to assess their effectiveness in investigations.	PO3 (2)	PSO2 (2)
CO4	Design digital and mobile forensic investigation workflows by selecting appropriate tools, procedures, and documentation methods for real-world cases.	PO2 (1)	PSO1 (3)

MC25008	Cryptocurrency and Blockchain Techniques	L	T	P	C
		3	0	0	3
Prerequisite: Networking and Communication Systems in Modern Computing, Cryptography and Cyber Security					
<p>Course Objective: To introduce the major concepts of cryptocurrencies, blockchains, and cryptographic tools. Design, develop and apply smart contracts on blockchain application using Ethereum and emphasis on blockchain privacy and security.</p>					
<p>Foundations of Blockchain and Bitcoin History and evolution of blockchain – Blockchain architecture and its functionalities. Types of blockchain: Public, Private, Consortium, Tokenized vs. Tokenless, Layer 1 vs. Layer 2. Bitcoin architecture – Cryptographic keys, addresses, transactions, Merkle trees, SPV. Bitcoin mining – Bitcoin test blockchains: Testnet, Segnet, Regtest – Bitcoin network overview.</p> <p>Activities:</p> <p>Activity 1: Team Discussion: Usecases in different types of blockchain technologies Activity 2: Quiz: <i>Cryptography</i> concepts using real Bitcoin hash examples.</p> <p>Consensus Algorithms and Mining Introduction to consensus – Design and classification – CFT and BFT algorithms. Decentralized consensus – Transaction verification – Mining process and block creation. Block headers – Hashing race – Chain assembly – Hard Forks vs. Soft Forks – Consensus attacks. Consensus software development and versioning.</p> <p>Activities:</p> <p>Activity 3: Simulation: Consensus algorithms using Python. Activity 4: Implementation: PoS vs PoW vs BFT techniques</p> <p>Smart Contracts and Ethereum Ecosystem Introduction to smart contracts – Ricardian contracts – Templates and oracles. Deployment of smart contracts – DAO and advancements – Ethereum architecture. Keys, addresses, EVM, blocks, transactions, accounts, wallets, client software. Protocols supporting Ethereum: Whisper and Swarm.</p> <p>Activities:</p> <p>Activity 5: Deploy a smart contract on Ethereum Testnet Activity 6: Simulate DAO for the usecase roleplay using DAOStack</p> <p>Hyperledger, Tokenization and Enterprise Blockchain Overview of Hyperledger projects – Reference architecture – Hyperledger Fabric. Tokenization – Types of tokens, token standards, ERC-20 – Building and deploying tokens. Enterprise blockchain vs. public blockchain – Design and architecture – VMware, Quorum. Setting up a Quorum network using IBFT.</p>					

Activities:**Activity 7:** Mini Project: ERC–20 Token Development and Deployment**Activity 8:** Team–based simulation: Quorum Network Setup with IBFT**Bitcoin and Blockchain Security**

Bitcoin security principles – User security best practices. Privacy protocols: Homomorphic encryption, Coinswap, TumbleBit, Dandelion, zkledger, MimbleWimble. Blockchain privacy using zero-knowledge proofs and anonymous signatures. Blockchain security layers – Layer 2 attacks – Threat modeling – Security tools and mechanisms.

Activities:**Activity 9:** Comparative analysis on privacy protocols**Activity 10:** Simulating security mechanisms in Bitcoin wallets**Weightage:** Continuous Assessment: 40%, End Semester Examinations: 60%.**Assessment Methodology:** Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).**References:**

1. Imran Bashir, “Mastering Blockchain: Inner workings of blockchain, from cryptography and decentralized identities, to DeFi, NFTs and Web3”, 4th Edition, Packt Publishing, 2023.
2. Andreas M. Antonopoulos, “Mastering Bitcoin: Programming the Open Blockchain”, 2nd Edition, O’Reilly Media, 2017.
3. Andreas M. Antonopoulos and Gavin Wood, “Mastering Ethereum: Building Smart Contracts and DApps”, 1st Edition, O’Reilly Media, 2018.
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, 1st Edition, Princeton University Press, 2016.
5. Roger Wattenhofer, “The Science of the Blockchain”, 1st Edition, CreateSpace Independent Publishing, 2016.

E- RESOURCES:

1. <https://github.com/bitcoinbook/bitcoinbook>
2. <https://hyperledger-fabric.readthedocs.io/>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, technologies, and operational principles of cryptocurrencies and blockchain-based systems.	--	--
CO2	Analyze cryptocurrency mechanisms, blockchain protocols, and consensus techniques to understand security, transparency, and performance aspects.	PO1 (3)	PSO1 (3)

CO3	Evaluate blockchain platforms, cryptocurrency models, and smart contract techniques to assess their effectiveness for decentralized applications.	PO3 (2)	PSO2 (2)
CO4	Design blockchain and cryptocurrency-based solutions by selecting appropriate architectures, protocols, and implementation strategies for real-world use cases.	PO2 (1)	PSO1 (3)

MC25009	Game Programming	L	T	P	C
		3	0	0	3
<p>Prerequisite: Programming, Data Structures and Algorithms using Python, Enterprise Java Software Development, Full Stack Web Development.</p>					
<p>Course Objective: This course aims to introduce students to the foundational principles of game programming, including game design, graphics, physics, and AI. It equips learners with theoretical knowledge of modern game engines and industry practices to conceptualize, design, and evaluate interactive digital games. The course also explores emerging trends, ethical considerations, and business models in the game development ecosystem.</p>					
<p>Game Fundamentals and Engines Introduction to Game Programming – Evolution and classification of games – Genres :action, RPG, simulation, puzzle – Game development life cycle –Overview of Game engine – Unity, Unreal Engine, Godot – Architecture & Scripting models – Game loop and input systems – Game loop structure: update-render-input cycle – Real time input handling (keyboard, mouse, mobile touch) Game Documentation–Game Design Document (GDD) structure – Creating wireframes and flowcharts for gameplay logic</p> <p>Activities:</p> <p>Activity 1: Poster Presentation – Compare Unity, Unreal Engine, and Godot in terms of scripting, asset management, rendering capabilities, and platform support.</p> <p>Activity 2: Micro Project – Game Concept Design Create a one-page design document for a proposed 2D/3D game including genre, story, characters, and gameplay mechanics.</p> <p>Graphics and Animation Concepts 2D Graphics and Coordinator systems – 3D Graphics – Basics– 3D models. Meshes, Materials– Lighting –Camera positioning and Projection, Animation Techniques – Frame-based and skeletal animation, curves –blending, Shaders and Effects – Basics – Visual effects. Graphics Optimization</p> <p>Activities:</p> <p>Activity 3: Tool Demo– Explore a Sprite Animation Tool Activity 4: Micro Project – Visual Asset Design Brief</p> <p>Physics and AI in Games Game Physics Concepts – Rigid bodies, gravity, mass, friction –real time simulation Vs arcade-style physics. Collision Detection – AABB, circle, polygon collision, Bounding boxes and raycasting. Physics engine overview – Box2D, Bullet and PhysX integration. AI Fundamentals in Games – Finite State Machines – Decision trees and scoring systems. Path finding & Navigation – A* algorithm, NavMesh concepts</p> <p>Activities:</p> <p>Activity 5: Presentation – Physics Engine Comparison Activity 6: Micro Project – Design an AI Behavior Tree</p>					

Game Architecture and Design Patterns

Game Architecture Overview – Entity-component system model– Layered architecture. Design Pattern for Games – Singleton, Observer, Factory, Component, patterns. Scene and State management – Game states – scene transition logic. Event-driven programming – Data structures in Games

Activities:

Activity 7: Presentation – Design Patterns in Game Engines

Activity 8: Micro Project – Game Loop Pseudocode

Industry Practices and Trends

Game Publishing & Monetization Models – Freemium, premium, ads, in-app purchases, App Store Optimization. Production Pipelines and DevOps for Games – Asset pipelines, Version control (Github), continuous integration. Ethical Issues in Game development – ViolenceE-addiction –privacy – loot boxes. AR/VR and cloud Gaming – Trends and case studies

Activities:

Activity 9: Presentation – Game Monetization Models

Activity 10: Tool Demo –Micro Project – Business Plan for Indie Game

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

References:

1. Casey Hardman, “Game Programming Using Unity and C#”, Publisher: Mercury Learning & Information, 2023
2. Jonathan Linowes, “Unity 2023 By Example: Learn about game and virtual reality development by creating five engaging projects”, 5th Edition, Packt Publishing, 2023.
3. Alan Thorn, “Mastering Unity: A Beginner's Guide”, BPB Publications, 2021.
4. Penny de Byl, “Game AI Pro 360: Guide to Movement and Pathfinding”, CRC Press, 2021.
5. Kelsey Gilbert Kreider and Chris Totten, “Designing Game Worlds: Narrative, Architecture, and Interaction”, CRC Press, 2022.

E- RESOURCES:

1. <https://docs.unity3d.com/Manual/Graphics.html>
2. https://docs.godotengine.org/en/stable/tutorials/ai/behavior_tree.html

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, architectures, and development processes involved in game programming.	--	--

CO2	Analyze game mechanics, algorithms, and system components to understand performance, interactivity, and user experience in games.	PO1 (3)	PSO1 (3)
CO3	Evaluate game engines, programming techniques, and development tools to assess their effectiveness for building engaging and efficient games.	PO3 (2)	PSO2 (2)
CO4	Design interactive games by selecting appropriate game engines, programming frameworks, and design principles to meet real-world requirements.	PO2 (1)	PSO1 (3)

MC25010	Entrepreneurship Development	L	T	P	C
		3	0	0	3
<p>Course Objective: The students develop and can systematically apply an entrepreneurial way of thinking that will allow them to identify and create business opportunities that may be commercialized successfully.</p>					
<p>Introduction to Entrepreneurship Entrepreneurship – Entrepreneurial mindset – Characteristics of successful entrepreneurs – Types of entrepreneurs – Role of entrepreneurship in economic development – Innovation and creativity – Intrapreneurship – Barriers to entrepreneurship – Entrepreneurship ecosystem – Entrepreneurial process – Start-up India initiative – Women entrepreneurship – Rural entrepreneurship – Social entrepreneurship – Difference between entrepreneur and manager</p> <p>Activities:</p> <p>Activity 1: Quiz: Basics of entrepreneurship definitions and scope. Activity 2: Flipped classroom: Case study discussion on companies promoting the entrepreneurship.</p> <p>Business Planning Business plan – Purpose of business planning – Components of a business plan – Feasibility analysis – Market analysis – Financial feasibility – Technical feasibility – Project identification – Project selection – Project appraisal – SWOT analysis – Business model canvas – Value proposition – Revenue models – Elevator pitch – Cost estimation – Risk analysis – PrE-feasibility study</p> <p>Activities: Activity 3: Seminar: Evaluating Technical Resources for Startups. Activity 4: Poster Presentation: Visual risk matrix for a business idea.</p> <p>Entrepreneurial Finance and Funding Sources of finance – Angel investors – Venture capital – Seed funding – Crowdfunding – Bootstrapping – Bank loans – Government schemes and subsidies – Financial institutions supporting entrepreneurship – Working capital management – Break-even analysis – Cash flow management – Budgeting for start-ups – Income statement – Balance sheet basics – Investment pitching – Return on investment – Cost-benefit analysis.</p> <p>Activities: Activity 5: Quiz: Identify bootstrap-friendly business ideas. Activity 6: Field Visit: Visit a local bank to understand start-up loan options.</p> <p>Business Operations Operations planning – Supply chain management – Inventory management – Quality control – Vendor management – Business scalability – Intellectual property rights – Patents and trademarks – Licensing – Business process automation – Lean start-up methodology – Minimum viable product – Time management – Human resource planning – Organizational structure – Customer relationship management</p>					

Activities:**Activity 7:** Flipped Classroom: Analyze how a startup scaled operations**Activity 8:** Seminar: Business Licensing Essentials for Entrepreneurs.**Technical Aspects and Ethics in Entrepreneurship**

Business ethics – Corporate social responsibility – Legal compliance – Ethical decision making – Global entrepreneurship trends – Technology and entrepreneurship – E-commerce start-ups – Digital marketing for entrepreneurs – Artificial intelligence in business – Blockchain and entrepreneurship – Social media strategies – Mental health for entrepreneurs – Work–life balance – Resilience and leadership – Future of entrepreneurship

Activities:**Activity 9:** Quiz: Principles of business ethics and compliance.**Activity 10:** Industrial Visit: Visit a legal consultancy or startup incubator.**Weightage:** Continuous Assessment: 40%, End Semester Examinations: 60%.**Assessment Methodology:** Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).**References:**

1. S. S. Khanka, "Entrepreneurial development", S. Chand & Co. Ltd., New Delhi, 1999.
2. Kuratko & Hodgetts, "Entrepreneurship-Theory, Process and practices", Thomson Learning 6th Edition, 2003.
3. Hisrich R D and Peters M P, "Entrepreneurship", 5th Edition Tata McGraw–Hill, 2002.
4. Mathew J Manimala, "Entrepreneurship theory at cross roads, paradigms and praxis" Dream tech, 2nd Edition 2006.
5. Donald F Kuratko, T.V Rao., "Entrepreneurship: A South Asian perspective", Cengage Learning, 2012.
6. Dr. Vasant Desai, "Small Scale Industries and Entrepreneurship", HPH, 2006.

E- Resources:

1. <https://nptel.ac.in/courses/110/106/110106141>
2. <https://www.bplans.com/business-planning/feasibility-study/>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, principles, and processes involved in entrepreneurship and venture creation.	--	--
CO2	Analyze business opportunities, market conditions, and entrepreneurial challenges to understand feasibility and growth potential.	PO1 (3)	PSO1 (3)
CO3	Evaluate entrepreneurial strategies, business models, and financial plans to	PO3 (2)	PSO2 (2)

	assess their viability and sustainability.		
CO4	Design business plans and entrepreneurial solutions by applying appropriate tools, strategies, and innovation techniques for real-world ventures.	PO2 (1)	PSO1 (3)

MC25011	Generative AI and Prompt Engineering	L	T	P	C
		3	0	0	3

Prerequisite: Foundations of Data Science, Machine Learning Techniques

Course Objective:

This course enables students to analyze the foundational principles of Transformer models and Generative AI, apply fine-tuning techniques for text and image generation tasks, and evaluate model performance using standard metrics. It also encourages learners to design and implement generative AI solutions using frameworks such as TensorFlow and PyTorch, while critically assessing ethical considerations in model development and deployment.

Evolution of AI

Fundamentals of Neural Networks – Evolution from Traditional ML to Deep Learning – Basics of Forward and Backpropagation – Optimization Techniques – Activation Functions – AI Ethics and Responsible AI

Activity 1: Implement a basic neural network using TensorFlow – Discuss AI ethics challenges

Foundations of Transformers and Self-Attention Mechanisms

Introduction to Transformers – Understanding Self-Attention – Positional Encoding – Multi-Head Attention – Key Transformer Architectures: BERT, GPT – Applications of Transformers in AI

Activity 2:

Fine-tune a simple Transformer model – Analyze self-attention behavior

Generative AI Techniques and Models

Generative Adversarial Networks (GANs) – Variational Autoencoders (VAEs) – Diffusion Models – Fine-Tuning for Text and Image Generation – Evaluation Metrics: FID, IS, Perplexity – Ethical Implications in AI-Generated Content

Activity 3: Implement GANs for image generation – Explore bias detection in AI-generated text

Transformer Optimization and Deployment

Training and Optimization Techniques – Hyperparameter Tuning – Large Language Models (LLMs) – Parameter-Efficient Fine-Tuning (LoRA, QLoRA) – Deployment Strategies: Hugging Face, OpenAI API – Case Studies on Real-World Deployments

Activities:

Activity 4: Fine-tune BERT for NLP tasks – Deploy a generative AI model using Hugging Face

Advanced Topics in Transformers and Security Considerations

Vision Transformers – Diffusion Models for Image Generation – Adversarial Attacks

and AI Security – Robustness in AI Models – Bias and Explainability in AI Systems – Future Trends in Transformer Architectures

Activities:

Activity 5: Investigate adversarial attack defenses – Compare Vision Transformers with CNNs

Practical Applications and Future Research Directions

Real-World Use Cases of Generative AI – AI in Creative Industries – AI-Assisted Content Creation – Emerging Trends in Multimodal AI – AI in Healthcare and Scientific Research – Ethical Challenges and Regulatory Considerations

Activities:

Activity 6: Discuss AI impact on industries – Implement a final project using Generative AI

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

References:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 1st Edition, 2016, ISBN: 978-0262035613
2. Lewis Tunstall, Leandro von Werra, Thomas Wolf, “Natural Language Processing with Transformers”, O'Reilly Media, 2022, ISBN: 978-1098136796
3. David Foster, “Generative Deep Learning”, O'Reilly Media, 2023, ISBN: 978-1098134181
4. Denis Rothman, “Transformers for Natural Language Processing” Packt Publishing, 2022, ISBN: 978-1803247335
5. Jeremy Howard, Sylvain Gugger "Deep Learning for Coders with fastai and PyTorch", O'Reilly Media, 2020, ISBN: 978-1492045526

E-RESOURCES:

1. NPTEL: Introduction to Deep Learning & Generative Models – IIT Madras
2. MOOC: Transformers and NLP – Stanford University
3. SWAYAM: Artificial Intelligence: Basics to Advanced – IISc Bangalore
4. Additional Resources: Hugging Face Tutorials, OpenAI Documentation, TensorFlow & PyTorch Guides

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, architectures, and applications of generative artificial intelligence and prompt engineering techniques.	--	--
CO2	Analyze generative AI models and	PO1 (3)	PSO1 (3)

	prompt engineering strategies to understand model behavior, output quality, and performance characteristics.		
CO3	Evaluate generative AI systems and prompting techniques to assess their effectiveness, reliability, and ethical implications in real-world use cases.	PO3 (2)	PSO2 (2)
CO4	Design generative AI solutions by crafting effective prompts and selecting suitable models and deployment strategies for practical applications.	PO2 (1)	PSO1 (3)

MC25012	Wireless Sensor Networks and Personal Area Networks	L	T	P	C
		3	0	0	3

Prerequisites:

1. Basic knowledge of computer networks and communication models (e.g., OSI, TCP/IP).
2. Familiarity with programming languages such as C or Python.
3. of embedded systems or microcontroller basics.
4. Fundamental concepts of wireless technologies like Bluetooth, ZigBee, or RF.
5. Analytical skills for evaluating protocols, security, and energy efficiency in networks

Course Objective:

To provide students with the basic understanding and the fundamental concepts, architecture, and components of Wireless Sensor Networks (WSNs) and Personal Area Networks (PANs). And also to analyze various communication protocols and routing techniques used in WSNs and PANs. Identify energy– efficient techniques and challenges related to power management in wireless sensor devices. Explore security issues, threats, and solutions specific to WSNs and PANs. Examine real– world applications of WSNs and PANs, especially in healthcare and environmental monitoring.

Wireless Sensor Networks

Definition and characteristics of WSNs– Applications of WSNs (environmental monitoring, military, industrial, healthcare)– Sensor node architecture and hardware components– Types of sensors and actuators– Network topology and deployment strategies

Activity 1: Short MCQ or reflection quiz (Google Form or LMS) on types of sensors.

Communication Protocols and Layers in WSN

Wireless communication fundamentals (RF, ZigBee, Bluetooth, etc.)– MAC protocols for WSN – Routing protocols – Data aggregation and dissemination techniques– Energy efficiency and power management– Addressing and routing challenges in WSNs– Quality of Service (QoS) and reliability– Transport protocols and congestion control– Cross– layer design considerations

Activity 2: Simulate the network using a WSN simulator and document the key aspects related to communication, protocols, and performance metrics.

Security in Wireless Sensor Networks

Security challenges and threats in WSNs– Key management, authentication, and encryption– Secure routing and intrusion detection– Privacy and trust management

Activity 3: Poster presentation on real– world use cases

Introduction to Personal Area Networks and Protocols

Overview and definition of PANs– Differences between WSN and PAN– PAN architecture and components (wearable sensors, implantable sensors)– Standards

for PANs (Bluetooth and IEEE 802.15.4 (Zigbee)– Physical and MAC layer protocols specific to PANs– Low– power communication techniques– Data collection, processing, and transmission– Network and application layer protocols

Activities:

Activity 4: Assignment on different Standards for PANs

Modern Network Trends – IoT, Cloud & Secure Networking

Healthcare monitoring systems– Fitness and wellness applications– Remote patient monitoring– Emergency response and assisted living– Energy harvesting and power management in PANs– Privacy, security, and ethical issues– Interoperability and standardization– Integration with IoT and cloud computing.

Activity 5: Case Study Topic: "Smart Health Monitoring System for Elderly Care Using Personal Area Networks and IoT"

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

References:

1. Fei Hu, "Wireless Sensor Networks: Principles and Practice" 2nd Edition, CRC Press, 2023
2. Jun Zheng, "Wireless Sensor Networks and Internet of Things: Intelligent Applications and Perspectives", Abbas Jamalipour, Wiley, 2022.
3. Ian F. Akyildiz, Mehmet Can Vuran , "Wireless Sensor Networks", Wiley, 2010.
4. Kazem Sohrawy, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks: Technology, Protocols, and Applications", Wiley, 2007.
5. William Stallings, "Wireless Communications and Networks", Pearson, 2005.

E-Resources:

1. Sensor Networks and Applications (Wikipedia)
https://en.wikipedia.org/wiki/Wireless_sensor_network
2. IEEE Xplore Digital Library – PAN Articles
<https://ieeexplore.ieee.org/Xplore/home.jsp>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, architectures, and communication technologies of wireless sensor networks and personal area networks.	--	--
CO2	Analyze wireless sensor network and personal area network protocols to understand data routing, energy efficiency, and network performance.	PO1 (3)	PSO1 (3)

CO3	Evaluate wireless sensor network and personal area network technologies to assess their suitability for different application environments and constraints.	PO3 (2)	PSO2 (2)
CO4	Design wireless sensor network and personal area network solutions by selecting appropriate network architectures, protocols, and deployment strategies for real-world applications.	PO2 (1)	PSO1 (3)

MC25013	Fog and Edge Computing	L	T	P	C
		3	0	0	3

Prerequisites:

1. Basic knowledge of computer networks, including protocols, IP addressing, and communication models.
2. Understanding of cloud computing concepts, such as virtualization, distributed systems, and service models (IaaS, PaaS, SaaS).
3. Familiarity with IoT fundamentals, including sensor networks and data flow in IoT systems.
4. Basic programming skills, especially in Python, C/C++, or Java for device-level computing.
5. Awareness of real-time systems and latency-sensitive applications.
6. Knowledge of operating systems and resource management in constrained devices (e.g., Raspberry Pi, microcontrollers).

Course Objective:

To provide a comprehensive understanding of Fog Computing as an extension of cloud services toward the edge of the network. It covers core concepts, architecture, optimization techniques, and real-time applications in domains such as healthcare, surveillance, and smart transportation. The course also addresses formal modeling, performance metrics, testing perspectives, and legal aspects, enabling learners to design, evaluate, and deploy intelligent, secure, and efficient fog-based IoT systems.

Internet of Things (IoT) and New Computing Paradigms

Introduction-Relevant Technologies –Fog and Edge Computing– Hierarchy of Fog and Edge Computing-Business Models-X as a Service- Support Service-Application Service-Opportunities and Challenges-Out-of-Box Experience-Open Platforms-System Management.

Activities:

Activity 1: Poster presentation: Hierarchy of Fog and Edge Computing.

Activity 2: Debate on Opportunities and Challenges

Challenges in Federating Edge Resources

Introduction – Networking Challenge-Methodology – Integrated C2F2T Literature by Modeling Technique – Integrated C2F2T Literature by Use – Case Scenarios – Integrated C2F2T Literature by Metrics – Threads – Standards

Activities:

Activity 3: C2F2T Use- Case Mapping Workshop

Activity 4: C2F2T Metrics and Standards Roleplay Debate

Orchestration of Network Slices in Fog, Edge, and Clouds

Introduction – Background – Network Slicing – Network Slicing in Software- Defined Clouds– Network Slicing Management in Edge and Fog – Internet of Vehicles (IoV): Architecture, Protocols and Seven-layer security model architecture for Internet of Vehicles – IoV: Network Models, Challenges and future aspects

Activities:

Activity 5: Design Your Own IoV Security Stack

Activity 6: Network Slicing Strategy Simulation.

Optimization Problems in Fog and Edge Computing

Preliminaries – The Case for Optimization in Fog Computing– Formal Modeling Framework for Fog Computing – Metrics – Further Quality Attributes – Optimization Opportunities along the Fog Architecture – Optimization Opportunities along the Service Life Cycle – Toward a Taxonomy of Optimization Problems in Fog Computing

Activities:

Activity 7: Presentation – Fog Optimization Taxonomy Builder

Activity 8: Micro Project – Metric– Based Optimization.

Applications of Fog and Edge Computing

Exploiting Fog Computing in Health Monitoring– Smart Surveillance Video Stream Processing at the Edge for Real – Time Human Objects Tracking– Fog Computing Model for Evolving Smart Transportation Applications – Testing Perspectives of Fog – Based IoT Applications – Legal Aspects of Operating IoT Applications in the Fog.

Activities:

Activity 9: Fog Application Blueprint – Sector– wise Design Challenge

Activity 10: Flipped Classroom for IoT in Fog Computing

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

References:

1. Rajkumar Buyya and Satish Narayana Srirama, "Fog and Edge computing: Principles and Paradigms", 2019, 1st Edition, John Wiley & Sons, USA.
2. Arshdeep Bahga and Vijay Madisetti, "Cloud computing: A Hands-On Approach", 2014, 2nd Edition, CreateSpace Independent Publishing Platform, USA.
3. Ovidiu Vermesan, Peter Friess, "Internet of Things –From Research and Innovation to Market Deployment", 2014, 1st Edition, River Publishers, India.
4. Jie Cao, Quan Zhang, Weisong Shi, "Edge Computing: Models, Technologies and Applications", Springer, 2020.

E-Resources:

1. Microsoft Azure – What is Edge Computing?-<https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-edge-computing/>
2. Cisco – Fog Computing Overview
<https://www.cisco.com/c/en/us/solutions/internet-of-things/fog-computing.html>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, architectures, and service models of fog and edge computing for distributed and low-latency applications.	--	--
CO2	Analyze fog and edge computing frameworks to understand data processing, latency reduction, and resource management in distributed environments.	PO1 (3)	PSO1 (3)
CO3	Evaluate fog and edge computing platforms and deployment models to assess their effectiveness for real-time and IoT-based applications.	PO3 (2)	PSO2 (2)
CO4	Design fog and edge computing solutions by selecting suitable architectures, orchestration strategies, and processing models for real-world scenarios.	PO2 (1)	PSO1 (3)

MC25014	Internet of Things	L	T	P	C
		3	0	0	3

Prerequisites:

1. Basic electronics knowledge, including sensors, actuators, and microcontrollers.
2. Understanding of computer networks, especially TCP/IP, HTTP, and MQTT protocols.
3. Familiarity with embedded systems, such as Arduino, Raspberry Pi, or ESP32.
4. Basic programming skills, preferably in C/C++, Python, or JavaScript.
5. Knowledge of cloud platforms and data handling, such as AWS IoT, Azure IoT, or ThingSpeak.
6. Introductory understanding of cybersecurity concepts for securing IoT devices.

Course Objective:

This course introduces the fundamentals of the Internet of Things (IoT), including architecture, communication protocols, and hardware platforms. Students will gain practical experience in designing and developing IoT systems using sensors, actuators, and embedded boards with real-time data communication and cloud integration.

Introduction to IoT

Definition– characteristics, and scope of IoT. Evolution of IoT– applications in various domains (smart home, healthcare, agriculture). IoT ecosystem and enabling technologies– IoT Architecture: Perception layer– Network layer– Application layer. Edge computing and Cloud computing in IoT.

Activities:

Activity 1: Seminar: Evolution and current trends in IoT

Activity 2: Quiz on IoT layers and architecture

IoT Communication and Networking

IoT Communication Models and APIs– Protocols: MQTT– CoAP– AMQP– HTTP. Wireless Technologies: Wi– Fi– Bluetooth– Zigbee– LoRa– NFC– 5G. IP addressing: IPv4 and IPv6– addressing schemes in IoT. Sensor Networks– data acquisition and transmission models.

Activities:

Activity 3: Poster presentation: IoT protocols comparison

Activity 4: Hands– on: Simulate device– to– device communication using MQTT

IoT Hardware and Devices

Overview of 8051 microcontroller-Arduino– Raspberry Pi. Interfacing of sensors and actuators (temperature, humidity, motion, light, etc.). Real– time data acquisition and processing– Analog and digital sensor handling– Basics of embedded C.

Activities:

Activity 5: Mini project: Build a temperature monitoring system using Arduino and IoT cloud

Activity 6: Project– based Learning: Design an IoT– based Smart Parking prototype

Data Management and Cloud Platforms

IoT data storage and analytics– Open source IoT platforms: ThingsBoard – NodE-RED– Cloud integration: AWS IoT– Azure IoT Hub– Google Cloud IoT– Data visualization tools and dashboards. Security and privacy in IoT systems.

Activities:

Activity 7: Mini project: Send sensor data to ThingsBoard and display on dashboard.

Activity 8: Video demo + discussion: Setting up IoT cloud dashboards (AWS/GCP).

IoT Applications and Trends

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare. Challenges in deployment and scalability– Research directions and opportunities in IoT.

Activities:

Activity 9: Project expo: Build a mini smart system (e.g., Smart Dustbin, Home Temp Monitor).

Activity 10: Research paper review: Emerging trends like Edge AI or Digital Twins.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20).

References:

1. Arshdeep Bahga and Vijay Madiseti, “Internet of Things: A Hands– On Approach”, 2nd Edition, VPT, 2021.
2. Pethuru Raj, Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press, 2020.
3. Sunil Cheruvu et al., “Demystifying Internet of Things Security: Successful IoT Device/Edge and Platform Security Deployment”, Apress, 2020.
4. Shweta Jaiswal, “Internet of Things (IoT): Architecture, Technology, and Applications”, Wiley, 2022.
5. Yashavant Kanetkar, “Exploring C for IoT Development”, BPB Publications, 2022.

E-Resources:

1. NPTEL: <https://nptel.ac.in/courses/106105166>
2. Cisco IoT Learning Path: <https://www.netacad.com/courses/iot>
3. IoT Development on ThingsBoard: <https://thingsboard.io/docs>
4. Arduino Official: <https://www.arduino.cc>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, architectures, and enabling technologies of the Internet of Things for connecting smart devices and systems.	--	--
CO2	Analyze Internet of Things communication protocols and system architectures to understand data flow, interoperability, and performance.	PO1 (3)	PSO1 (3)
CO3	Evaluate Internet of Things platforms, security mechanisms, and application models to assess their suitability for diverse real-world scenarios.	PO3 (2)	PSO2 (2)
CO4	Design Internet of Things solutions by selecting appropriate sensing, communication, and data processing strategies for practical applications.	PO2 (1)	PSO1 (3)

MC25015	Deep Learning Techniques	L	T	P	C
		3	0	2	4

Prerequisites:

1. Strong foundation in linear algebra and calculus (e.g., matrices, vectors, gradients).
2. Understanding of probability and statistics, especially for modeling uncertainty and distributions.
3. Basic machine learning knowledge, including supervised/unsupervised learning and common algorithms.
4. Proficiency in Python programming, especially with libraries like NumPy, Pandas, and Matplotlib.
5. Familiarity with neural networks, activation functions, and backpropagation.
6. Hands-on experience with ML frameworks like TensorFlow or PyTorch (basic level)..

Course Objective:

This course introduces the foundational and advanced concepts of neural networks and deep learning. It covers the architecture, training, and optimization of various neural models including CNNs, RNNs, and LSTMs. Students will gain hands-on experience with deep learning techniques such as transfer learning and generative models. The objective is to enable students to build, train, and evaluate intelligent systems for real-world applications

Fundamentals of Neural Networks

Introduction to artificial neurons – McCulloch-Pitts model, perceptron, and activation functions.

Learning paradigms – supervised, unsupervised, and reinforcement learning. Architecture of neural networks – single-layer, multi-layer, and feedforward networks. Training of neural networks – error correction, backpropagation, and gradient descent.

Practical:

1. Implement a perceptron model to classify linearly separable data using supervised learning.
2. Build a multi-layer feedforward neural network and train it using the backpropagation algorithm.

Deep Neural Networks

Introduction to deep learning – concepts, need, and advantages over shallow networks. Deep neural network architectures – input, hidden, and output layers; role of activation functions. Backpropagation in deep networks – forward pass, backward pass, and weight updates. Challenges in deep learning – vanishing gradients, overfitting, and strategies to overcome them.

Practical:

1. Visualize various activation functions and analyze their behavior and impact on learning.
2. Train a deep neural network on a standard dataset and evaluate its performance.

Convolutional Neural Network (CNN) Architectures

Introduction to CNNs – motivation, basic structure, and comparison with fully connected networks. Convolutional layers, pooling layers, activation functions, and flattening – their roles and functions. Popular CNN architectures – LeNet, AlexNet, GoogLeNet (overview and Comparison). Training CNNs – parameter tuning, transfer learning, and use of pretrained models.

Practical:

1. Design and implement a Convolutional Neural Network (CNN) for basic image classification.
2. Perform image classification using pre-trained CNN architectures through transfer learning.

Transfer Learning and RNN

Introduction to transfer learning – concept, benefits, and use of pretrained models. Fine-tuning and feature extraction using popular models like VGG, ResNet, and BERT. Introduction to RNNs – architecture, sequential data processing, and vanishing gradient problem.

Variants of RNN – LSTM and GRU; applications in text, speech, and time-series data.

Practical :

1. Build a basic Recurrent Neural Network (RNN) to handle sequential data such as text or time series.
2. Implement LSTM and GRU networks to solve long-term dependency problems in sequential datasets.

Generative Models

Introduction to generative models – concepts, applications, and types (explicit vs. implicit).

Autoencoders and Variational Autoencoders (VAE) – architecture and latent space learning. Generative Adversarial Networks (GANs) – components, training process, and challenges. Applications of generative models in image synthesis, data augmentation, and creative AI.

Practical :

1. Develop an autoencoder to perform dimensionality reduction and reconstruct input data.
2. Train a simple Generative Adversarial Network (GAN) to generate synthetic images and visualize the results.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20)

REFERENCES:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.
2. Simon Haykin, “Neural networks and Learning Machines”, Third Edition, Pearson, 2016.
3. François Chollet, “Deep Learning with Python”, Manning, 2nd Edition, 2021.
4. Josh Patterson & Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O’Reilly, 2017.
5. A. Géron, “Hands– On Machine Learning with Scikit– Learn, Keras, and TensorFlow”, O’Reilly, 3rd Edition, 2022.
6. Charu Aggarwal, “Neural Networks and Deep Learning”, Springer, 2018.

E-RESOURCES:

1. <https://www.tensorflow.org/tutorials>
2. https://onlinecourses.nptel.ac.in/noc21_cs76/preview
3. https://www.youtube.com/playlist?list=PLZHQObOWTQDNU6R1_67000Dx_ZCJB-3pi
4. <https://keras.io>
5. Edutech:<https://www.edutechlearning.com/coursedescript/computer-science/lab-courses/deep-learning-lab-course>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, models, and learning mechanisms of deep learning techniques used in modern intelligent systems.	--	--
CO2	Analyze deep learning algorithms and network architectures to understand training dynamics, performance metrics, and optimization challenges.	PO1 (3)	PSO1 (3)
CO3	Evaluate deep learning techniques and models to assess their effectiveness for various data-driven applications.	PO3 (2)	PSO2 (2)
CO4	Design deep learning solutions by selecting appropriate architectures, training strategies, and hyperparameter tuning methods for real-world problems.	PO2 (1)	PSO1 (3)

MC25016	Artificial Intelligence	L	T	P	C
		3	0	2	4

Prerequisites:

1. Proficient understanding of discrete mathematics, especially in logical inference, set theory, and probability distributions.
2. Strong foundation in data structures and algorithm design, including recursion, graphs, and search strategies.
3. Ability to implement algorithmic solutions using Python or a comparable high-level programming language, with exposure to libraries relevant to AI (e.g., NumPy, scikit-learn).

Course Objective:

To impart foundational knowledge of Artificial Intelligence (AI), including its principles, techniques, and historical evolution. It enables learners to assess the applicability, strengths, and limitations of various knowledge representation schemes, problem-solving strategies, and learning methods in addressing real-world engineering problems. Furthermore, the course focuses on developing intelligent systems by integrating appropriate AI techniques to solve concrete computational challenges

Foundations of Artificial Intelligence

AI – history, definition, and scope; AI as the study of intelligent agents. The state of the art – applications, current trends, and research challenges. Rational agents – structure, performance measures, and PEAS descriptions. Environment types – fully/partially observable, deterministic/stochastic, episodic/sequential.

Practical:

1. Design an intelligent agent that makes decisions based on performance measures and environmental conditions.

Problem Solving based on Searching

Introduction to Problem Solving by searching Methods– State Space Search- Uninformed Search Methods – Uniform Cost Search, Breadth First Search– Depth First Search– Depth– limited search, Iterative deepening depth first, Bidirectional Search-Informed Search Methods– Best First Search-A*, SMA* Search.

Practical :

1. Implement basic uninformed search algorithms such as BFS, DFS, and Uniform Cost Search for problem-solving tasks.
2. Apply informed search techniques like Best-First Search and A* to navigate through heuristic-based problems.
3. Simulate iterative deepening and bidirectional search algorithms and compare their efficiencies.

Local Search and Adversarial Search

Local Search algorithms – Hill– climbing search-Simulated annealing- Genetic Algorithm-Adversarial Search-Game Trees and Minimax Evaluation- Elementary two-player game, tic– tac– toe-Minimax with Alpha– Beta Pruning.

Practical :

1. Solve constraint satisfaction or optimization problems using local search methods like hill climbing and simulated annealing.
2. Create a two-player game using the Minimax algorithm with Alpha–Beta pruning to demonstrate adversarial search.

Logical Reasoning

Introduction to propositional and predicate logic – logical connectives, truth tables, and normal forms. Rules of inference – direct and indirect proofs, contradiction, and logical equivalence. Automated reasoning – resolution, unification, forward and backward chaining. Applications in AI – knowledge representation, monotonic and non-monotonic reasoning.

Practical:

1. Construct truth tables and use propositional logic to verify logical equivalence and infer conclusions.
2. Use predicate logic and resolution techniques for automated reasoning in a knowledge-based system.

Reasoning Under Uncertainty in AI

Introduction to uncertainty – sources of uncertainty, need for probabilistic reasoning. Bayesian networks – structure, conditional probability, inference in Bayesian networks. Probabilistic reasoning over time – hidden Markov models, dynamic Bayesian networks. Decision making under uncertainty – utility theory, value of information, and decision networks.

Practical:

1. Build a Bayesian network for probabilistic reasoning and perform inference based on given evidence.
2. Model and evaluate decisions under uncertainty using utility theory and decision networks.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20)

REFERENCES:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 4th Edition, Pearson, 2021.
2. Elaine Rich, Kevin Knight, Shivashankar B. Nair, “Artificial Intelligence”, 3rd Edition, Tata McGraw– Hill, 2017.
3. Deepak Khemani, “A First Course in Artificial Intelligence”, McGraw– Hill Education, 2013.

E-RESOURCES:

1. NPTEL Course: Artificial Intelligence by Prof. Mausam (IIT Delhi) – nptel.ac.in/courses/106102220.

2. AI Open-Source Tools & Datasets: <https://www.kaggle.com/>
3. Google AI Blog: <https://ai.googleblog.com>
4. Edutech: <https://www.edutechai.net/>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, principles, and applications of artificial intelligence in solving real-world problems.	--	--
CO2	Analyze artificial intelligence techniques and models to understand problem-solving strategies, learning mechanisms, and system performance.	PO1 (3)	PSO1 (3)
CO3	Evaluate artificial intelligence approaches, algorithms, and applications to assess their effectiveness and limitations in practical scenarios.	PO3 (2)	PSO2 (2)
CO4	Design artificial intelligence–based solutions by selecting appropriate models, algorithms, and reasoning techniques for real-world applications.	PO2 (1)	PSO1 (3)

MC25017	DevOps	L	T	P	C
		3	0	2	4

Prerequisites:

1. Proficiency in at least one programming language (e.g., Python, Java, or C++) to follow scripting and automation tasks.
2. Exposure to Linux/Unix commands and file systems, as many DevOps tools operate in Linux environments.
3. Prior knowledge of software development stages and lifecycle models like Waterfall and Agile.
4. Familiarity with version control concepts (e.g., Git, repositories, commits, branches) to effectively engage in collaborative development and CI workflows.
5. Awareness of cloud service models (IaaS, PaaS, SaaS) and platforms (AWS, Azure, GCP) is beneficial for infrastructure and DevSecOps components.

Course Objective:

To equip students with comprehensive knowledge and practical skills in DevOps practices, including version control, CI/CD pipelines, infrastructure as code, containerization, monitoring, and security integration into DevOps pipelines using real-world tools and cloud platforms.

Introduction to DevOps

Introduction to DevOps: Overview of Software Development Lifecycle (SDLC) – Traditional vs. Agile vs. DevOps – DevOps: Definition, Need, and Benefits – DevOps Principles and Practices – DevOps Lifecycle and Workflow – DevOps Tools Landscape Overview – Culture, Collaboration & Communication in DevOps – Key Roles in a DevOps Team.

Practical:

1. Compare Traditional vs Agile vs DevOps workflows using a sample project timeline.
2. Map a real-world use case to the DevOps lifecycle (with stages like Plan → Code → Build → Test → Release → Deploy → Monitor).
3. Create a DevOps workflow diagram using draw.io or Lucid chart and explain each stage.

Version Control and Continuous Integration

Introduction to Version Control Systems (VCS) – Git Basics: Repositories, Branches, Merges – GitHub/GitLab/Bitbucket Overview – Introduction to CI (Continuous Integration) – CI Concepts and Best Practices – Jenkins: Installation and Configuration – Creating and Managing Jenkins Jobs – Integration of Git with Jenkins – CI Pipeline Design and Implementation.

Practical:

1. Push a local repository to GitHub/GitLab. Perform pull requests and branch merging.
2. Create a Jenkins pipeline (Declarative/Scripted) to build and test a simple Java/Python app.
3. Integrate GitHub repository with Jenkins CI. Automate build triggers on code push.

Configuration Management and Containerization

Infrastructure as Code – Concept and Benefits – Configuration Management Tools Overview - Ansible, Chef, Puppet – Introduction to Docker – Docker Architecture and Components – Docker Images, Containers, Volumes, and Networks – Docker file: Writing and Building Custom Images – Docker Compose for Multi- container Applications – Container Orchestration Introduction- Kubernetes Basics.

Practical:

1. Write a basic Ansible playbook to install Apache/Nginx on a remote server (localhost via SSH).
2. Install Docker and run basic commands: docker run, docker ps, docker exec, docker stop
3. Build a Docker image using a custom Docker file and run the container.

Continuous Delivery, Deployment, and Monitoring

Continuous Delivery vs Continuous Deployment – CD Pipeline Setup and Implementation – Introduction to GitOps – Deployment Strategies: Blue- Green, Canary, Rolling Updates – Introduction to Monitoring and Logging – Tools: Prometheus, Grafana, ELK Stack – Alerts and Dashboards – Incident Management and Feedback Loop.

Practical:

1. Setup a full CI/CD pipeline using Jenkins with a deploy step (use a dummy deployment to a folder or local server).
2. Demonstrate blue- green or canary deployment using two versions of a simple web app (manual simulation or scripted).

Cloud Platforms and DevSecOps

Overview of Cloud Computing Models - IaaS, PaaS, SaaS– Introduction to AWS/Azure/GCP Basics – Setting Up Infrastructure Using Terraform (IaC) – Serverless and Cloud- Native DevOps – Introduction to DevSecOps – Need and Concepts – Security Practices in CI/CD Pipelines – Secrets Management and Vulnerability Scanning – Final Case Study: End- to- End DevOps Implementation.

Practical:

1. Write a basic Terraform script to provision AWS/GCP/Azure EC2 instance (can simulate with local provider if cloud not available).
2. Final Mini Project: Build a full DevOps pipeline for a sample app (Code → Git → Jenkins → Docker → Deploy → Monitor) simulating real- time workflow

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20)

References:

1. Kim, G., Humble, J., Debois, P., & Willis, J., “The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations”, 2nd Edition, IT Revolution Press, 2021.

2. Krief, M., “Learning DevOps: Continuously Deliver Better Software”, Packt Publishing, 2020.
3. Poulton, N., “Docker Deep Dive”, 2025 Edition, Shelter Island, 2025.
4. Forsgren, N., Humble, J., & Kim, G., “Accelerate: The Science of Lean Software and DevOps”, IT Revolution Press, 2018.
5. Brikman, Y., “Terraform: Up and Running – Writing Infrastructure as Code”, 2nd Edition, O’Reilly Media, 2019.

E– Resources:

1. NPTEL: DevOps by Prof. Rajkumar Buyya.
2. AWS Free Tier Labs.
3. Docker Playground (<https://labs.play-with-docker.com>).
4. Kubernetes Bootcamp by Google.
5. GitOps Practices by Weaveworks.

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, principles, and practices of DevOps and their role in modern software development and operations.	--	--
CO2	Analyze DevOps tools, pipelines, and automation practices to understand continuous integration, delivery, and deployment workflows.	PO1 (3)	PSO1 (3)
CO3	Evaluate DevOps methodologies, monitoring strategies, and collaboration models to assess their effectiveness in improving software quality and reliability.	PO3 (2)	PSO2 (2)
CO4	Design DevOps pipelines by selecting appropriate tools, automation frameworks, and deployment strategies for real-world software systems.	PO2 (1)	PSO1 (3)

MC25018	Ethical Hacking and Penetration Testing	L	T	P	C
		3	0	2	4
Prerequisites:					
<ol style="list-style-type: none"> 1. Exposure to computer networks and TCP/IP fundamentals 2. Working knowledge of Linux/Windows OS 3. Familiarity with cyber security fundamentals 4. Programming/scripting knowledge (e.g., Python, Bash) is desirable 					
Course Objective					
<p>This course aims to provide a foundational understanding of information security, cyber threats, attacks, and web security. It introduces various hacking tools, penetration testing phases, and methodologies.</p>					
Ethical Hacking Fundamentals					
<p>Ethical Hacking - TCP/IP - IP Addressing - Numbering Systems - Network and Computer Attacks: Malicious Software - Protecting Against Malware Attacks - Intruder Attacks on Networks and Computers - Addressing Physical Security</p>					
Practical:					
<ol style="list-style-type: none"> 1. Use Wireshark to capture and analyze packets; identify TCP 3-way handshake. 2. Create a Malware Defense Policy for a sample organization. 					
Foot Printing and Social Engineering					
<p>Footprinting and Social Engineering: Using Web Tools for Footprinting - Conducting Competitive Intelligence - Using Domain Name System Zone Transfers - Social Engineering - Port Scanning- Port Scanning - Using Port-Scanning Tools - Conducting Ping Sweeps - Understanding Scripting</p>					
Practical:					
<ol style="list-style-type: none"> 1. Write a basic shell or Python script to automate Nmap scans and log output. 2. Write a Python script to perform DNS lookups and log the results. 					
Penetration Testing And Reconnaissance					
<p>Penetration Testing: Setting the Stage - Kali and Backtrack Linux - Working with Your Attack Machine - The Use and Creation of a Hacking Lab - Phases of A Penetration Test – Reconnaissance - Httrack: Website Copier - Google Directives - The Harvester – Whois – Netcraft – Host - Extracting Information from DNS - Nslookup – Dig – Fierce - Extracting Information from E-Mail Servers – Metagoofil - Threatagent - Social Engineering - Sifting Through the Intel to Find Attackable Targets</p>					
Practical:					
<ol style="list-style-type: none"> 1. Set up of Kali Linux in a Virtual machine with attacker and victims 2. Write a Python script to extract hyperlinks from a webpage (web reconnaissance). 					
Network Scanning Techniques					
<p>Scanning: Pings And Ping Sweeps - Port Scanning - The Three-Way Handshake - Using Nmap To Perform A TCP Connect Scan - Using Nmap To Perform An Syn Scan - Using Nmap To Perform UDP Scans - Using Nmap To Perform An Xmas Scan - Using Nmap To Perform Null Scans - The Nmap Scripting Engine - Port Scanning Wrap Up -</p>					

Vulnerability Scanning – Exploitation- Social Engineering

Practical:

1. Write a Python script to scan TCP ports and log open ports.
2. Perform network scanning using Nmap with various scans to identify open ports and vulnerabilities

System Hacking And Password Cracking

System Hacking Concepts: Understanding Goals of System Hacking – Gaining Access, Escalating Privileges, Maintaining Access, and Clearing Tracks. Password Cracking Techniques: Dictionary Attacks, Brute Force Attacks, Hybrid Attacks. Password Cracking Tools: John the Ripper, Hydra, Cain & Abel, L0phtCrack. Privilege Escalation Techniques. Keylogging and Spyware: Types, Tools, and Countermeasures. Covering Tracks: Clearing Logs, Disabling Auditing, Stealth Techniques. Rootkits and Trojans: Identification, Detection, and Prevention. Real-World Scenarios: Case studies on breaches via weak credentials and poor access controls.

Practical:

1. Use John the Ripper or Hydra to crack user passwords from a password-protected file or login system.
2. Write a Python script to simulate brute-force attack logic (educational, non-malicious).
3. Simulate a log-clearing operation in Linux and explain its forensic implications.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20)

References

1. Simpson, M. T., Backman, K., & Corley, J., Hands-On Ethical Hacking and Network Defense, 2nd Edition, Cengage Learning (Course Technology PTR), 2010
2. Engebretson, P., The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy, 2nd Edition, Syngress (Elsevier), August 1, 2013
3. Kim, P., The Hacker Playbook 3: Practical Guide to Penetration Testing, 3rd Edition, Secure Planet, 2025.
4. Weidman, G., “Penetration Testing: A Hands-on Introduction to Hacking”, 2nd Edition, No Starch Press, forthcoming (in progress) — the 2nd edition is currently being worked on, but the 1st Edition (2014).
5. Stallings, W.,” Network Security Essentials: Applications and Standards”, 6th Edition, Pearson, July 2021.
6. Stuttard, D. & Pinto, M., “The Web Application Hacker’s Handbook: Finding and Exploiting Security Flaws”, 2nd Edition, Wiley, 2011 (latest available revised edition)

E–Resources:

1. OWASP (Open Web Application Security Project)- <https://owasp.org>
2. Kali Linux Documentation- <https://www.kali.org/docs>

CO PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, principles, and methodologies of ethical hacking and penetration testing used to assess system security.	--	--
CO2	Analyze system vulnerabilities and attack vectors to understand security risks, threat models, and exploitation techniques.	PO1 (3)	PSO1 (3)
CO3	Evaluate penetration testing tools, techniques, and security assessment reports to determine system robustness and compliance.	PO3 (2)	PSO2 (2)
CO4	Design ethical hacking and penetration testing strategies by selecting appropriate tools, methodologies, and mitigation measures for real-world systems.	PO2 (1)	PSO1 (3)

MC25019	E-Commerce Technologies	L	T	P	C
		3	0	2	4
<p>Prerequisites:</p> <ol style="list-style-type: none"> 1. Basic knowledge of web technologies, including HTML, CSS, and JavaScript. 2. Familiarity with internet and networking fundamentals, such as HTTP, IP, and domain systems. 3. Introductory knowledge of databases and SQL for handling E-commerce data. 4. Basic programming skills, preferably in languages like PHP, Python, or Java. 5. Grasp of business and marketing principles, including online payment systems and customer interaction. 6. Awareness of cybersecurity basics, especially in the context of data privacy and secure transactions. 					
<p>Course Objective:</p> <p>To provide a comprehensive understanding of E- business systems, covering their evolution, marketing strategies, security mechanisms, and payment solutions. It emphasizes the integration of ERP, CRM, SCM, mobile commerce, and knowledge management to streamline business processes. Students will also explore enabling technologies, real- time E- commerce strategies, and regulatory frameworks like the IT Act 2000.</p>					
<p>Evolution of E-Commerce History – Early Business Information Interchange Efforts – Emergence of internet– WWW. E- Commerce – Advantages– Disadvantages – BAM Models – Transition to E- Commerce in India– E- Transmission Challenges– The Information Technology Act 2000 – Business Models – Enabling Technologies of WWW.Social Networks– Auctions– Portals: Social networks and online communities – Online auctions – E- commerce portals.</p> <p>Practical:</p> <ol style="list-style-type: none"> 1. Create a Timeline of EDI and E-Commerce Evolution 2. Simulate B2B, B2C, and C2C BAM Models through Roleplay <p>Electronic Marketing, Security and Payment Traditional Marketing – Web Presence Goal – Browsing Behavior Model – Online Marketing– E- Advertising– Trends– E- branding– Strategies. E- Security – Internet Security– E- business Risk Management Issues– Information Security Environment in India. E- Payment – Concerns in Internet Banking– Digital Payment Requirements– Token Based E- Payment Classification– E- Cash– Cheque Payment– Risk and E- Payment.</p> <p>Practical:</p> <ol style="list-style-type: none"> 1. Design a Digital Marketing Strategy for an Online Business 2. Compare Token-Based vs Traditional Payment Methods via Simulation <p>CRM – SCM & SKM E- CRM Solutions – Business Touch Points – Case Studies. Supply Chain – The new way–</p>					

E- logistics– Fulfilling Customer's Needs– Smart Chains Smarter Gains. Real Time Benefits and Strategies – Advantages. Knowledge as Key Business Asset– Changes in – Global Business Economy– Technology. Knowledge – Definition– Management – Knowledge Management– Data Warehousing and Data Mining. Virtual value chain – 7 Dimensions – E- Commerce Strategy – planning E- Commerce Project.

Practical:

1. Develop a Java EE Servlet for File Upload to Server Directory.
2. Map Customer Touchpoints in E-CRM using a Case Study.

Mobile Commerce and Technologies

E- Business Portals. What? – Issues – Wireless– Cellular– Wireless Spectrum. – Success Stories. Technologies – mobile commerce- WAP Wireless Generations. Portals – Different Types– benefits– features. Requirements for Intel.

Practical :

1. Design a Mock UI for a Mobile-Friendly E-Commerce Portal
2. Simulate ERP Process Mapping from Problem to Process Flow

ERP & EDI

Introduction – ERP and E2RP – Business Problems– New Paradigm– Drivers – Business processes and supporting processes. Architecture- Implementation– ERP Processes. ERP – Cloud and Open Sources. EDI– Concepts and Technology.

Practical :

1. Create a Flow Diagram for EDI and ERP System Integration
2. Conduct a Wireless Technology Scavenger Hunt with Case Study Discussion

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Assignments (15), Quiz (10), Virtual Demo (20), Flipped Class Room (10), Review of Gate and IES Questions (25), Project (20)

References:

1. P. T. Joseph S.J, “E Commerce – An Indian Perspective”, 7th Edition, PHI Learning Private Limited, 2023
2. Kenneth C. Laudon & Carol Guercio Traver, “E Commerce: Business – Technology – Society”, 17th Edition, Pearson, 2021
3. Sandeep Desai & Abhishek Srivastava, “ERP to E2RP – A Case Study Approach”, 1st Edition (Eastern Economy), PHI Learning Private Limited, 2013
4. Kamallesh K. Bajaj & Debjani Nag, “E Commerce – The Cutting Edge of Business”, 2nd Edition, McGraw Hill Education (India), 2005.
5. Elder Moraes, “Java EE 8 Cookbook: Build reliable applications with the most robust and mature technology for enterprise development”, 1st Edition, Packt Publishing, April 2018.

E-Resources:

1. NPTEL Course on E-Business – <https://nptel.ac.in/courses/110/105/110105083>
2. NPTEL Digital Marketing – <https://nptel.ac.in/courses/110/105/110105150>
3. Java EE Tutorials – <https://youtube.com/@JavaBrainsChannel>
4. W3Schools Java Servlet Guide – https://www.w3schools.com/java/java_servlets.asp
5. SWAYAM Portal – <https://swayam.gov.in>

CO-PO Mapping:

CO	Description of CO	PO	PSO
CO1	Describe the fundamental concepts, architectures, and technologies of e-commerce systems used for online business transactions.	--	--
CO2	Analyze e-commerce platforms and transaction models to understand system functionality, security, and performance.	PO1 (3)	PSO1 (3)
CO3	Evaluate e-commerce technologies, payment systems, and security mechanisms to assess their effectiveness in real-world business environments.	PO3 (2)	PSO2 (2)
CO4	Design e-commerce solutions by selecting appropriate technologies, architectures, and security strategies for scalable online applications.	PO2 (1)	PSO1 (3)