# Kurukshetra University, Kurukshetra

(Established by the State Legislature Act-XII of 1956)
("A++" Grade, NAAC Accredited)

## Syllabus
**for**

## Post Graduate Programme

## M.Sc. Computer Science (Software)

**(First and Second Semester)**
**as per NEP-2020**
**Curriculum and Credit Framework for Postgraduate Programme**

**With Multiple Entry-Exit, Internship and CBCS-LOCF**
**With effect from the session 2024-25**

DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS
FACULTY OF SCIENCES

KURUKSHETRA UNIVERSITY, KURUKSHETRA -136119

| With effect from Session: 2024-25 | | | |
|---|---|---|---|
| **Part A - Introduction** | | | |
| Name of the Programme | M. Sc. Computer Science (Software) | | |
| Semester | 2nd | | |
| Name of the Course | Advanced Web Technologies | | |
| Course Code | M24-CSE-201 | | |
| Course Type | CC-5 | | |
| Level of the course (As per Annexure-I | 400-499 | | |
| Pre-requisite for the course (if any) | - | | |
| Course Objectives | This course aims to provide a solid foundation in front-end development, covering web development principles, JavaScript basics, and event handling, along with an introduction to React for building dynamic user interfaces using components, state management, and JSX. It further introduces Node.js, explaining its process model, event-driven architecture, and modules while teaching students to create web servers and handle HTTP requests. The course also focuses on Express.js for designing RESTful APIs, implementing routing and middleware, and securing applications with JWT-based authentication. By integrating tools and technologies from the MERN stack, students will gain the skills to develop efficient and scalable web applications. | | |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to: | **CLO-1:** Students will be able to understand the basics of front-end development, including JavaScript programming, object manipulation, and event handling, and gain familiarity with tools used in the MERN stack.<br>**CLO-2:** Students will develop skills in building dynamic user interfaces using React, mastering components, state management, lifecycle methods, and form handling.<br>**CLO-3:** Students will learn to use Node.js for server-side development, create HTTP servers, handle HTTP requests and responses, and work with events and modules efficiently.<br>**CLO-4:** Students will be able to design RESTful APIs using Express.js, implement routing and middleware, and secure web applications with JWT-based user authentication. | | |
| Credits | Theory | Practical | Total |
| | 4 | 0 | 4 |
| Teaching Hours per week | 4 | 0 | 4 |
| Internal Assessment Marks | 30 | 0 | 30 |
| End Term Exam Marks | 70 | 0 | 70 |
| Max. Marks | 100 | 0 | 100 |
| Examination Time | 3 hours | | |

**Part B- Contents of the Course**

**Instructions for Paper- Setter:** The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

| Unit | Topics | Contact Hours |
|---|---|---|
| I | Basics of Front End Development: Overview of web development (Front End vs. Back End), Understanding the MERN stack and its components, Tools and environments (text editors, browsers, version control with Git). Basics of JavaScript: Introduction to JavaScript, Variables, data types, and operators, Control structures (if, else, switch, loops); Functions and Scope: Defining and invoking functions, Function expressions and arrow functions, Scope and closures; Objects and Arrays: Creating and manipulating objects, Array methods and iteration; Event handling | 15 |
| II | Introduction to React: Overview and advantages of React, Setting up a React development environment (using Create React App); JSX (JavaScript XML): Understanding JSX syntax, Embedding expressions in JS, JSX best practices; Components and Props: Functional and class components, Props and | 15 |

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|---|---|---|
| | component communication, Prop types and default props.; State and Lifecycle: Understanding state in React, State management in class components, Lifecycle methods (componentDidMount, componentDidUpdate, componentWillUnmount); Event Handling and Forms | |
| III | Introduction to Node JS: Node JS process model, Advantages, Traditional web server model. Setup Install Node.js on windows, REPL, Node JS console, Node JS modules, Events: Event Emitter class, inheriting events, Node Package Manager, Building Web Servers: Creating a basic HTTP server, Handling HTTP requests and responses, Understanding request methods (GET, POST, PUT, DELETE). | 15 |
| IV | Express.js Basics: Introduction to Express.js, Setting up Express projects, Understanding routing and middleware. Using template engines (e.g., EJS) for server-side rendering, Designing RESTful APIs, CRUD operations, Structuring API routes. Built-in middleware (e.g., body-parser), Creating custom middleware, Error handling middleware.User authentication using JWT (JSON Web Tokens) and sessions. | 15 |
| | **Total Contact Hours** | 60 |

**Suggested Evaluation Methods**

| **Internal Assessment: 30** | | **End Term Examination: 70** | |
|---|---|---|---|
| ➢ **Theory** | **30** | ➢ **Theory** | **70** |
| • Class Participation: | 5 | Written Examination | |
| • Seminar/presentation/assignment/quiz/class test etc.: | 10 | | |
| • Mid-Term Exam: | 15 | | |

**Part C-Learning Resources**

**Reference Books:**


1) Flanagan, D. (2020). JavaScript: The Definitive Guide. O'Reilly Media.
2) "Node.js Design Patterns" by Mario Casciaro and Luciano Mammino
3) "Learning Node.js Development" by Andrew Mead
4) "Express in Action" by Evan M. Hahn
5) "REST API Development with Node.js" by Fernando Doglio

| With effect from Session: 2024-25 | | | |
|---|---|---|---|
| **Part A - Introduction** | | | |
| Name of the Programme | M. Sc. Computer Science (Software) | | |
| Semester | 2nd | | |
| Name of the Course | Data Communication | | |
| Course Code | M24-CSE-202 | | |
| Course Type | CC-6 | | |
| Level of the course (As per Annexure-I | 400-499 | | |
| Pre-requisite for the course (if any) | - | | |
| Course Objectives | The course aims to provide a foundational understanding of computer networks, focusing on architectures, protocols, and services across layered models like OSI and TCP/IP. It covers network applications, devices, media, and data communication concepts, emphasizing performance metrics, encoding techniques, and switching methods. The curriculum includes detailed study of data link, network, and transport layers, exploring protocols, addressing, routing, VLANs, and emerging technologies like SDN and IoT networking. Practical aspects like network management tools, SNMP, and real-world applications such as WAN technologies and Internet services are also included, fostering a comprehensive grasp of modern networking principles. | | |
| Course Learning Outcomes (CLO) After completing this course, the learner will be able to: | **CLO-1:** Students will be able to explain the foundational concepts of computer networks, including architectures, layered models, protocols, and the role of network applications and devices in real-world scenarios.<br>**CLO-2:** Students will be able to analyze data communication principles, evaluate network performance metrics, and apply encoding and switching techniques to optimize network bandwidth and utilization.<br>**CLO-3:** Students will be able to implement data link and network layer functionalities, including framing, error correction, logical addressing, routing, and VLAN configurations, for efficient network operations.<br>**CLO-4:** Students will be able to demonstrate the operation of transport layer protocols, utilize network management tools, and evaluate emerging network technologies like SDN and IoT in contemporary networking environments. | | |
| Credits | Theory | Practical | Total |
| | 4 | 0 | 4 |
| Teaching Hours per week | 4 | 0 | 4 |
| Internal Assessment Marks | 30 | 0 | 30 |
| End Term Exam Marks | 70 | 0 | 70 |
| Max. Marks | 100 | 0 | 100 |
| Examination Time | 3 hours | | |

**Part B- Contents of the Course**

**Instructions for Paper- Setter:** The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

| Unit | Topics | Contact Hours |
|---|---|---|
| I | **Introduction to Networks:** Overview of computer networks, network architectures (layered model, OSI model, TCP/IP model), network protocols and services.<br>**Network Applications:** File sharing (client-server, peer-to-peer), web services (HTTP, web servers, caching), content delivery networks (CDNs), distributed applications.<br>**Network Devices:** Network Interface Cards (NICs), hubs, switches, routers, gateways, firewalls, modems, wireless access points.<br>**Network Media:** Guided media (coaxial cable, twisted-pair, fiber optic), wireless media (radio waves, Wi-Fi, cellular networks). | 15 |

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|---|---|---|
| II | **Data Communication Concepts:** digital and analog signals. asynchronous and synchronous transmission in real-world scenarios;<br>**Network Performance:** Metrics (bandwidth, latency, throughput, packet loss), factors affecting performance (bottlenecks, congestion, network impairments), quality of service (QoS).; Command-Line Tools to measure network performance;<br>**Data Encoding & Modulation Techniques:** NRZ, NRZ-I, Manchester and Differential Manchester encoding; 4B/5B ; Pulse Code Modulation & Delta Modulation; Digital to Analog encoding;<br>**Switching and Bandwidth Utilization:** circuit vs. packet switching and their application in real-world networks (voice calls vs. data transfer)<br>**Wired Networks and the Local Loop:** wired technologies (ADSL, Cable) used for internet access ; Fiber-to-the-Home Broadband; | 15 |
| III | **Data Link Layer:** Concepts (framing, error detection and correction, flow control), Media Access Control (MAC) protocols (CSMA/CD, CSMA/CA), Ethernet (frame format, addressing), IEEE 802.11 Wi-Fi standards.<br>**Network Layer:** Logical addressing (IP addresses, subnetting, CIDR), routing protocols (distance vector, link state, hierarchical, Multicast Routing, Routing for mobile hosts),<br>**IPv4 and IPv6:** Structure and addressing schemes of IPv4 and IPv6;<br>**Virtual LANs (VLANs):** Concept, configurations, benefits for network management and security. | 15 |
| IV | **Transport Layer:** Protocols (TCP, UDP), connection-oriented vs. connectionless services, port numbers, reliable data transfer with TCP (three-way handshake, flow control, congestion control).<br>**Network Management:** Simple Network Management Protocol (SNMP), network monitoring tools.<br>**Emerging Network Technologies:** Software-Defined Networking (SDN), Internet of Things (IoT) networking, network function virtualization (NFV).<br>**Introduction to Example Networks:** The Internet - conceptual framework and common services; Wide Area Networks (WAN) Technologies: X.25, Frame Relay, Asynchronous Transfer Mode (ATM), MPLS. | 15 |
| | **Total Contact Hours** | 60 |

**Suggested Evaluation Methods**

| **Internal Assessment: 30** | | **End Term Examination: 70** | |
|---|---|---|---|
| ➢ **Theory** | **30** | ➢ **Theory** | **70** |
| • Class Participation: | 5 | Written Examination | |
| • Seminar/presentation/assignment/quiz/class test etc.: | 10 | | |
| • Mid-Term Exam: | 15 | | |

**Part C-Learning Resources**

**Reference Books:**


1) Andrew S. Tanenbaum, Computer Networks, 4th Edition - PHI.
2) Behrouz A Forouzan, Data Communications and Networking, 5th Edition- Mc-Graw Hill Education.
3) Michael A. Gallo, William M. Hancock, Computer Communications and Networking Technologies – CENGAGE learning.
4) William Stallings, Data and Computer Communications, 5th Edition – PHI.

| With effect from the Session: 2024-25 | | | |
|---|---|---|---|
| **Part A - Introduction** | | | |
| Name of the Programme | M.Sc. Computer Science (Software) | | |
| Semester | 2nd | | |
| Name of the Course | Advanced Database Systems | | |
| Course Code | M24-CSE-203 | | |
| Course Type | CC-7 | | |
| Level of the course (As per Annexure-I | 400-499 | | |
| Pre-requisite for the course (if any) | - | | |
| Course Objectives | The course aims to provide a comprehensive understanding of database systems, covering foundational concepts, architecture, and the entity-relationship model for designing databases. It delves into SQL and PL/SQL, emphasizing data definition, manipulation, constraints, and relational database design through normalization. Advanced topics include query optimization, transaction processing, concurrency control, and recovery techniques. The course also explores emerging database applications like distributed, parallel, temporal, spatial, multimedia, and mobile databases, alongside concepts like OLAP and XML-based databases. | | |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to: | **CLO-1:** Understand the fundamental concepts of database systems, including DBMS architecture, E-R and EER models, and their role in designing robust database schemas.<br>**CLO-2:** Demonstrate proficiency in SQL and PL/SQL for database management, constraints, triggers, and relational database design through normalization techniques up to 5NF and DKNF.<br>**CLO-3:** Analyze query processing, optimize transactions, and apply concurrency control techniques while ensuring reliable database backup and recovery.<br>**CLO-4:** Evaluate advanced database architectures and applications, including distributed, parallel, temporal, spatial, multimedia, and mobile databases, as well as XML and OLAP concepts. | | |
| Credits | Theory | Practical | Total |
| | 4 | 0 | 4 |
| Teaching Hours per week | 4 | 0 | 4 |
| Internal Assessment Marks | 30 | 0 | 30 |
| End Term Exam Marks | 70 | 0 | 70 |
| Max. Marks | 100 | 0 | 100 |
| Examination Time | 3 hours | | |

**Part B- Contents of the Course**

**Instructions for Paper- Setter:** The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

| Unit | Topics | Contact Hours |
|---|---|---|
| I | Database Systems Concepts and Architecture: DBMS architecture and Data Independence, Entity Relationship Model: Entity Types, Entity Sets, Attributes & keys, Relationships Types & Instances, E-R Diagrams, Design of an E-R Database Schema. The Enhanced Entity-Relationship (EER) Model: Subclasses, Super classes, Inheritance, Specialization and Generalization. | 15 |
| II | SQL: Data Definition and Data Types, DDL, DML, and DCL, Views & Queries in SQL, Specifying Constraints & Indexes in SQL. PL/SQL: Architecture of PL/SQL, Basic Elements of PL/SQL, PL/SQL Transactions, Cursors and Triggers.<br>Relational Database Design: Functional Dependencies, Normal Forms Based on Primary Keys- (1NF, 2NF, 3NF, BCNF), Multi-valued Dependencies, 4 NF, Join dependencies, 5 NF, Domain Key Normal Form. | 15 |

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|---|---|---|
| III | Query Processing and Optimization, Transaction Processing: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Concurrency Control Techniques: Two-Phase Locking Techniques, Timestamp Ordering, Serializability. Database Backup and Recovery: Recovery facilities, Recovery Techniques. | 15 |
| IV | Databases for Advance Applications: Architecture for Parallel Database and Distributed Database, Active Database Concept and Triggers, Temporal Databases Concepts, Spatial and Multimedia Databases, Deductive Databases, Geographical Information System, Mobile Databases, Web Databases, XML Schema, Object- Based Databases, OLTP Vs OLAP. | 15 |
| | **Total Contact Hours** | 60 |

**Suggested Evaluation Methods**

| **Internal Assessment: 30** | | **End Term Examination: 70** | |
|---|---|---|---|
| ➢ **Theory** | **30** | ➢ **Theory** | **70** |
| ➢ Class Participation: | 5 | Written Examination | |
| ➢ Seminar/presentation/assignment/quiz/class test etc.: | 10 | | |
| ➢ Mid-Term Exam: | 15 | | |

**Part C-Learning Resources**

**Reference Books:**


1) Date C.J., An Introduction to Database Systems, Pearson Education.
2) Hector G.M., Ullman J.D., Widom J., Database Systems: The Complete Book, Pearson Education.
3) Silberschatz A., Korth H., Sudarshan S., Database System Concepts, McGraw Hill.

| With effect from the Session: 2024-25 | | | |
|---|---|---|---|
| **Part A - Introduction** | | | |
| Name of the Programme | M.Sc. Computer Science (Software) | | |
| Semester | 2nd | | |
| Name of the Course | Distributed Operating System | | |
| Course Code | M24-CSE-204 | | |
| Course Type | CC-8 | | |
| Level of the course (As per Annexure-I | 400-499 | | |
| Pre-requisite for the course (if any) | - | | |
| Course Objectives | The course aims to provide a comprehensive understanding of distributed systems, including their design, architecture, and communication mechanisms. It explores synchronization, coordination, and transaction management techniques essential for distributed environments. The course also covers resource management strategies such as scheduling, load balancing, and fault tolerance, with a focus on distributed file systems. Students will gain the ability to analyze and design solutions for challenges in distributed computing systems. | | |
| Course Learning Outcomes (CLO) After completing this course, the learner will be able to: | **CLO-1:** Understand the fundamentals of distributed systems, including their design issues, types, and the architectural styles along with the system architectures.<br>**CLO-2:** Analyze the layered protocols, communication mechanisms such as RPC, RMI, and message-oriented communication and the synchronization in distributed systems.<br>**CLO-3:** Evaluate coordination mechanisms, including election algorithms, deadlock handling, and distributed transaction processing.<br>**CLO-4:** Develop effective scheduling and load-balancing strategies in distributed environments and demonstrate the fault recovery & tolerance techniques. | | |
| Credits | Theory | Practical | Total |
| | 4 | 0 | 4 |
| Teaching Hours per week | 4 | 0 | 4 |
| Internal Assessment Marks | 30 | 0 | 30 |
| End Term Exam Marks | 70 | 0 | 70 |
| Max. Marks | 100 | 0 | 100 |
| Examination Time | 3 hours | | |

**Part B- Contents of the Course**

**Instructions for Paper- Setter:** The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

| Unit | Topics | Contact Hours |
|---|---|---|
| I | **Introduction to Distributed Systems:** Definition and Characteristics. Design Goals - Resource Sharing, Transparency, Openness, Scalability. Types of Distributed Systems - High performance distributed computing systems (Cluster Computing, Grid Computing, Cloud Computing), Distributed information systems (Distributed transaction processing, Enterprise application integration), Distributed systems for pervasive computing (ubiquitous computing systems, mobile systems, and sensor networks).<br>**Architectural Models: Architectural Styles –** Layered architecture, Object-Based & Service-oriented architecture, Resource-based architecture, Publish-subscribe architecture. System Architectures: Client-Server architecture, Multi-Tiered architecture, Peer-to-Peer systems. Middleware and System Models. | 15 |

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|---|---|---|
| II | **Communication in Distributed Systems:** Layered protocols, Types of Communication, Remote Procedure Call (RPC) – Basic RPC operation, Parameter passing. Remote Method Invocation (RMI), Message-oriented communication.<br>**Synchronization in Distributed Systems:** Clock Synchronization – Need for synchronization, Cristian's algorithm, Berkeley algorithm, Network time protocol. Logical Clocks - Lamport's timestamps and vector clocks. Mutual Exclusion – Centralized algorithm, Ricart-Agrawala algorithm, Token-based algorithm. | 15 |
| III | **Coordination:** Election Algorithms: Bully algorithm, Ring algorithm, applications in leader selection. Deadlock Handling: Characteristics of deadlocks in distributed systems, prevention, avoidance, detection and recovery.<br>**Distributed Transaction Processing:** ACID properties, concurrency control techniques (locking, timestamp ordering). Commit Protocols: Two-phase commit (2PC), three-phase commit (3PC), performance and failure recovery considerations. | 15 |
| IV | **Distributed Scheduling and Load Balancing:** Scheduling Strategies - Static vs dynamic scheduling, Issues in load distributing, Components of load distributing algorithm, Load distributing algorithms – Sender-Initiated algorithms, Receiver-Initiated algorithms, Symmetrically Initiated algorithms, Adaptive algorithms. Task migration, Issues in Task migration.<br>**Failure Recovery and Fault Tolerance:** Classification of failures, Backward and Forward Error Recovery, Approaches of Backward-Error Recovery – Operation-Based approach, State-based approach. Recovery in Concurrent systems, Synchronous and Asynchronous check-pointing and Recovery. Fault Tolerance: Issues, Commit protocols, Nonblocking Commit protocols, Voting protocols. | 15 |
| | **Total Contact Hours** | 60 |

**Suggested Evaluation Methods**

| **Internal Assessment: 30** | | **End Term Examination: 70** | |
|---|---|---|---|
| ➢ **Theory** | **30** | ➢ **Theory** | **70** |
| ➢ Class Participation: | 5 | Written Examination | |
| ➢ Seminar/presentation/assignment/quiz/class test etc.: | 10 | | |
| ➢ Mid-Term Exam: | 15 | | |

**Part C-Learning Resources**

**Reference Books:**


1) Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems: Principles and Paradigms, 3rd Edition, Pearson, 2017.
2) Mukesh Singhal and Niranjan G. Shivaratri, Advanced Concepts in Operating Systems, McGraw Hill, 1994.
3) Pradeep K. Sinha, Distributed Operating Systems: Concepts and Design, PHI, 2002.
4) Gaurav Sharma and Bhushan Trivedi, Distributed Operating Systems, University Science Press, 2020.

| With effect from Session: 2024-25 | | | |
|---|---|---|---|
| **Part A - Introduction** | | | |
| Name of the Programme | M. Sc. Computer Science (Software) | | |
| Semester | 2nd | | |
| Name of the Course | Practical-3 | | |
| Course Code | M24-CSE-205 | | |
| Course Type | PC-3 | | |
| Level of the course | 400-499 | | |
| Pre-requisite for the course (if any) | | | |
| Course objectives | The course is designed to introduce students to full-stack web development, focusing on both front-end and back-end technologies. It covers the essentials of JavaScript, React, Node.js, and Express.js, emphasizing practical implementation of dynamic web applications. Students will gain hands-on experience in building and managing web applications using the MERN stack, while also learning to handle user inputs, manage state, and create RESTful APIs. Additionally, the course will teach how to work with event-driven programming, server-side operations, authentication, and dynamic content rendering. | | |
| Course Learning Outcomes (CLO) After completing this course, the learner will be able to: | **CLO-1:** Students will be able to create basic web pages and understand the distinctions between front-end and back-end technologies, showcasing their knowledge of the MERN stack.<br>**CLO-2:** Students will gain proficiency in JavaScript by implementing various functions and event-driven programs and demonstrate an understanding of React by developing dynamic applications with state management and lifecycle methods.<br>**CLO-3:** Students will learn to use Node.js for server-side programming, create HTTP servers, manage file operations, and build REST APIs to handle CRUD operations and authentication systems.<br>**CLO-4:** Students will develop and manage full-stack applications using Express.js, leveraging middleware for request validation, setting up authentication, and rendering dynamic content with template engines like EJS. | | |
| Credits | Theory | Practical | Total |
| | 0 | 4 | 4 |
| Teaching Hours per week | 0 | 8 | 8 |
| Internal Assessment Marks | 0 | 30 | 30 |
| End Term Exam Marks | 0 | 70 | 70 |
| Max. Marks | 0 | 100 | 100 |
| Examination Time | 0 | 4 hours | |
| **Part B- Contents of the Course** | | | |
| **Practicals** | | | **Contact Hours** |
| Practical course will consist of two components Part-A and Part-B. The examiner will set 5 questions at the time of practical examination asking 2 questions from the Part-A and 3 questions from the Part-B by taking course learning outcomes (CLO) into consideration. The examinee will be required to solve one problem from the Part-A and to write and execute 2 programs from the Part-B. | | | 120 |
| **Part-A**<br>Problems based on the theory courses M24-CSE-201 and M24-CSE-202 will be solved in this part and their record will be maintained in the Practical Note Book. Direct results and questions will not be asked in this section rather exercises or applied problems based on the theory parts will be done, as identified or given by the teacher concerned. | | | 30 |
| **Part-B**<br>1) Create a simple webpage that differentiates between front-end and back-end technologies, showcasing the role of the MERN stack.<br>2) Write JavaScript code to validate a user registration form with input fields for name, email, and password using control structures. | | | 90 (Lab hours include instructions for writing programs and |

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|---|---|
| 3) Implement a JavaScript function to calculate the factorial of a number using recursion and test it with various inputs.<br>4) Develop a dynamic to-do list application using objects and arrays, allowing users to add, remove, and mark tasks as completed.<br>5) Build an event-driven program that changes the background color of a webpage when a button is clicked.<br>6) Set up a React development environment using Create React App and create a "Hello World" application.<br>7) Create a React application that displays a user's profile information using functional components and props.<br>8) Implement a React component to manage a counter with "Increment" and "Decrement" buttons, showcasing state management.<br>9) Develop a React form to collect user details, validating the inputs using event handling and form control techniques.<br>10) Create a React application that uses lifecycle methods to fetch and display data from a mock API.<br>11) Install Node.js and use REPL to perform basic JavaScript operations.<br>12) Create a Node.js program to read from and write to a file asynchronously.<br>13) Develop a basic HTTP server in Node.js that responds with "Hello World" to incoming requests.<br>14) Build a Node.js application that handles different HTTP request methods (GET, POST, PUT, DELETE) for a sample REST API.<br>15) Create an event-driven program using Node's `EventEmitter` to handle custom events.<br>16) Set up an Express.js project and create routes for a blog application (e.g., `/home`, `/about`, `/posts/:id`).<br>17) Design a RESTful API using Express.js for managing a library database with CRUD operations on books (add, view, update, delete).<br>18) Implement middleware in an Express.js application to log request details and validate incoming data.<br>19) Develop an authentication system in Express.js using JWT to secure API endpoints.<br>20) Use a template engine like EJS to render dynamic content, such as displaying a list of products from a database. | demonstration by a teacher and for running the programs on computer by students.) |

**Suggested Evaluation Methods**

| **Internal Assessment: 30** | | **End Term Examination: 70** | |
|---|---|---|---|
| ➢ **Practicum** | **30** | ➢ **Practicum** | **70** |
| • Class Participation: | 5 | Lab record, Viva-Voce, write-up and execution of the programs | |
| • Seminar/Demonstration/Viva-voce/Lab records etc.: | 10 | | |
| • Mid-Term Examination: | 15 | | |

**Part C-Learning Resources**

**Recommended Books:**


1) Flanagan, D. (2020). JavaScript: The Definitive Guide. O'Reilly Media.
2) "Node.js Design Patterns" by Mario Casciaro and Luciano Mammino
3) "Learning Node.js Development" by Andrew Mead
4) "Express in Action" by Evan M. Hahn
5) "REST API Development with Node.js" by Fernando Doglio

| With effect from Session: 2024-25 | | | |
|---|---|---|---|
| **Part A - Introduction** | | | |
| Name of the Programme | M. Sc. Computer Science (Software) | | |
| Semester | 2nd | | |
| Name of the Course | Practical-4 | | |
| Course Code | M24-CSE-206 | | |
| Course Type | PC-4 | | |
| Level of the course | 400-499 | | |
| Pre-requisite for the course (if any) | | | |
| Course objectives | The course aims to provide a comprehensive understanding of database design, modeling, and implementation using relational databases. It emphasizes SQL and PL/SQL programming for creating, querying, and managing databases efficiently. The course also focuses on advanced database concepts like normalization, functional dependencies, and schema optimization to ensure data integrity and reduce redundancy. Additionally, it introduces distributed systems concepts through practical implementations such as leader election algorithms and database transaction management in distributed environments. | | |
| Course Learning Outcomes (CLO) After completing this course, the learner will be able to: | **CLO-1:** Develop the ability to design and model databases using Entity-Relationship (ER) diagrams, convert them into relational schemas, and implement integrity constraints such as primary and foreign keys to ensure data consistency.<br>**CLO-2:** Gain hands-on experience in creating and managing database schemas using SQL, writing complex queries with advanced features like `JOIN`, `GROUP BY`, and subqueries, and implementing CRUD operations for real-world database applications.<br>**CLO-3:** Acquire skills to write efficient PL/SQL programs for transaction management, implement triggers for automated database updates, and design recursive queries for hierarchical data handling.<br>**CLO-4:** Learn to analyze unnormalized relations, identify functional dependencies, and apply normalization techniques (1NF to BCNF) to design optimized and efficient database schemas that minimize redundancy and ensure data integrity. | | |
| Credits | Theory | Practical | Total |
| | 0 | 4 | 4 |
| Teaching Hours per week | 0 | 8 | 8 |
| Internal Assessment Marks | 0 | 30 | 30 |
| End Term Exam Marks | 0 | 70 | 70 |
| Max. Marks | 0 | 100 | 100 |
| Examination Time | 0 | 4 hours | |

| **Part B- Contents of the Course** | |
|---|---|
| **Practicals** | **Contact Hours** |
| Practical course will consist of two components Part-A and Part-B. The examiner will set 5 questions at the time of practical examination asking 2 questions from the Part-A and 3 questions from the Part-B by taking course learning outcomes (CLO) into consideration. The examinee will be required to solve one problem from the Part-A and to write and execute 2 programs from the Part-B. | 120 |
| **Part-A**<br>Problems based on the theory courses M24-CSE-203 and M24-CSE-204 will be solved in this part and their record will be maintained in the Practical Note Book. Direct results and questions will not be asked in this section rather exercises or applied problems based on the theory parts will be done, as identified or given by the teacher concerned. | 30 |
| **Part-B**<br>1) Design an ER model for a university database. Convert the ER diagram into relational schemas, including constraints like primary and foreign keys.<br>2) Write SQL queries to create tables for a hospital database, defining data types, constraints (e.g., NOT NULL, UNIQUE, CHECK), and indexes. | 90 (Lab hours include instructions for writing |

| | |
|---|---|
| 3) Develop SQL queries to demonstrate CRUD operations (Create, Read, Update, Delete) on a library database. Include advanced queries with `JOIN`, `GROUP BY`, `HAVING`, and subqueries.<br>4) Create and manage views in SQL for a company database. Demonstrate how to specify and enforce constraints like foreign keys and default values.<br>5) Write a PL/SQL program to handle a banking system's transactions with features like deposit, withdrawal, and balance inquiry using cursors.<br>6) Develop a trigger to automatically log changes in a student database whenever marks are updated.<br>7) Given an unnormalized relation for an employee database, perform step-by-step normalization to convert it into 1NF, 2NF, 3NF, BCNF, and 4NF.<br>8) Identify functional dependencies in a given sales database and use them to determine if the schema satisfies BCNF.<br>9) Write SQL recursive queries to retrieve hierarchical data from an organizational chart database.<br>10) Implement a PL/SQL program to manage inventory for an e-commerce platform. Include triggers for automatic stock updates and procedures for order processing.<br>11) Write a program to simulate the Bully algorithm or Ring algorithm for leader election in a distributed system.<br>12) Write a program to implement vector clocks to maintain causal ordering of events in a distributed system. | programs and demonstration by a teacher and for running the programs on computer by students.) |

**Suggested Evaluation Methods**

| **Internal Assessment: 30** | | **End Term Examination: 70** | |
|---|---|---|---|
| ➢ **Practicum** | **30** | ➢ **Practicum** | **70** |
| • Class Participation: | 5 | Lab record, Viva-Voce, write-up and execution of the programs | |
| • Seminar/Demonstration/Viva-voce/Lab records etc.: | 10 | | |
| • Mid-Term Examination: | 15 | | |

**Part C-Learning Resources**

**Recommended Books:**


1) Date C.J., An Introduction to Database Systems, Pearson Education.
2) Hector G.M., Ullman J.D., Widom J., Database Systems: The Complete Book, Pearson Education.
3) Silberschatz A., Korth H., Sudarshan S., Database System Concepts, McGraw Hill.
4) Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems: Principles and Paradigms, 3rd Edition, Pearson, 2017.
5) Mukesh Singhal and Niranjan G. Shivaratri, Advanced Concepts in Operating Systems, McGraw Hill, 1994.

| Session: 2024-25 | | | |
|---|---|---|---|
| **Part A - Introduction** | | | |
| Name of Programme | M. Sc. Computer Science (Software) | | |
| Semester | 2nd | | |
| Name of the Course | Constitutional, Human and Moral Values, and IPR | | |
| Course Code | M24-CHM-201 | | |
| Course Type | CHM | | |
| Level of the course | 400-499 | | |
| Pre-requisite for the course (if an ) | | | |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to: | CLO 1: Learn the different Constitutional Values, Fundamental rights and duties enshrined in the Indian Constitution.<br>CLO 2: Understand humanism, human virtues and values, and ide of International peace.<br>CLO 3: Grasp the basic concepts of Moral Values and Professional Conduct which are required to become a part of the civil society and for developing professionalism.<br>CLO 4: Understand concepts of Intellectual Property Rights, Copyright, Patent, Trademark etc., and about threats of Plagiarism. | | |
| Credits | Theory | Tutorial | Total |
| | 2 | | 2 |
| Teaching Hours per week | 2 | | 2 |
| Internal Assessment Marks | 15 | | 15 |
| End Term Exam Marks | 35 | | 35 |
| Max. Marks | 50 | | 50 |
| Examination Time | 3 | | 3 |

**Part B- Contents of the Course**

**Instructions for Paper- Setter:** The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

| Unit | Topics | Contact Hours |
|---|---|---|
| I | **Constitutional Values:** Historical Perspective of Indian Constitution; Basic Values enshrined in the Preamble of the Indian Constitution; Concept of Constitutional Morality; Patriotic Values and Ingredients of Nation Building; Fundamental Rights and Duties ; Directive Principles of the State Policy. | 8 |
| II | **Humanistic Values:** Humanism, Human Virtues and Civic Sense; Social Responsibilities of Human Beings; Ethical ways to deal with human aspirations; Harmony with society and nature; Idea of International Peace and Brotherhood (Vasudhaiv Kutumbkam). | 7 |
| III | **Moral Values and Professional Conduct:** Understanding Morality and Moral Values; Moral Education and Character Building; Ethics of Relations: Personal, Social and Professional; Introduction to Gender Sensitization; Affirmative approach towards Weaker Sections (SCs, STs, OBCs, EWS & DAs); Ethical Conduct in Higher Education Institutions; Professional Ethics. | 8 |
| IV | **Intellectual Property Rights:** Meaning, Origins and Nature of Intellectual Property Rights (IPRs);Different Kinds of IPRs – Copyright, Patent, Trademark, Trade Secret/Dress, Design, Traditional Knowledge; Infringement and Offences of IPRs – Remedies and Penalties; Basics of Plagiarism policy of UGC. | 7 |
| | **Note: Scope of the syllabus shall be restricted to generic and introductory level of mentioned topics.** | |
| **Total Contact Hour** | | **30** |

| Suggested Evaluation Methods | | | |
|---|---|---|---|
| **Internal Assessment: 15** | | **End Term Examination: 35** | |
| ➢ **Theory** | **15** | ➢ **Theory:** | **35** |
| ➢ Class Participation: | 4 | Written Examination | |
| ➢ Seminar/presentation/assignment/quiz/class test etc.: | 4 | | |
| ➢ Mid-Term Exam: | 7 | | |

**Part C-Learning Resources**

**Recommended Books/e-resources/LMS:**


1) Ahuja, V K. (2017). Law relating to Intellectual Property Rights, India, IN: Lexis Nexis. Bajpai, B. L., Indian Ethos and Modern Management, New Royal Book Co., Lucknow, 2004.
2) Basu, D.D., Introduction to the Constitution of India (Students Edition) Prentice Hall of India Pvt. Ltd., New Delhi, 20th ed., 2008.
3) Dhar, P.L. & R.R. Gaur, Science and Humanism, Commonwealth Publishers, New Delhi, 1990. George, Sussan, How the Other Half Dies, Penguin Press, 1976.
4) Govindarajan, M., S. Natarajan, V.S. Sendilkumar (eds.), Engineering Ethics (Including Human Values), Prentice Hall of India Private Ltd, New Delhi, 2004.
5) Harries, Charles E., Michael S. Pritchard & Michael J. Robins, Engineering Ethics, Thompson Asia, New Delhi, 2003.
6) Illich, Ivan, Energy & Equity, Trinity Press, Worcester, 1974.
7) Meadows, Donella H., Dennis L. Meadows, Jorgen Randers & William W. Behrens, Limits to Growth: Club of Rome's Report, Universe Books, 1972.
8) Myneni, S.R, Law of Intellectual Property, Asian Law House. Narayanan, P, IPRs.
9) Neeraj, P., &Khusdeep, D. (2014). Intellectual Property Rights, India, IN: PHI learning Private Limited. Nithyananda, K V. (2019). Intellectual Property Rights: Protectionand Management. India, IN: Cengage Learning India PrivateLimited.
10) Palekar, Subhas, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati, 2000.
11) Phaneesh, K.R., Constitution of India and Professional Ethics, New Delhi.
12) Pylee, M.V., An Introduction to Constitution of India, Vikas Publishing, New Delhi, 2002. Raman, B.S., Constitution of India, New Delhi, 2002.
13) Reddy, B., Intellectual Property Rights and the Law, Gogia Law Agency.
14) Reddy, N.H., SantoshAjmera, Ethics, Integrity and Aptitude, McGraw Hill, New Delhi. Sharma, Brij Kishore, Introduction to the Constitution of India, New Delhi,