COURSE OUTCOMES

- ## B.SC COMPUTER SCIENCE

SEMESTER 1

1. ### CSC1CJ101 - FUNDAMENTALS OF COMPUTERS AND COMPUTATIONAL THINKING

   - CO1: Develop foundational knowledge of computing systems, including historical milestones and significant contributors.
   - CO2: Understand and identify the hardware components and their functionalities.
   - CO3: Gain hands-on experience in basic computer assembly and hardware configuration.
   - CO4: Explore types of software and understand the installation/configuration of operating systems.
   - CO5: Cultivate problem-solving skills through computational thinking techniques.
   - CO6: Visualize solutions using algorithmic tools such as flowcharts and pseudocode.

2. ### MINOR COURSE 1 - CSC1MN101- EXPLORING COMPUTER BASICS & COMPUTATIONAL THINKING (FOR STUDENTS OPTING FOR A MINOR IN COMPUTER SCIENCE)

   - CO1: Understand basic computing concepts and the historical evolution of computing.
   - CO2: Develop computational thinking and problem-solving skills using algorithms.
   - CO3: Gain familiarity with hardware components such as CPU, RAM, and input/output devices.
   - CO4: Explore the different types of software and their role in computing.
   - CO5: Learn to create flowcharts and pseudocode for problem-solving.
   - CO6: Apply basic algorithmic techniques to simple computational problems.

3. ### MINOR COURSE 2 - CSC1MN102- PYTHON PROGRAMMING

   - CO1: Understand the basic concepts of Python programming.
   - CO2: Apply problem-solving skills using different control structures and loops.
   - CO3: Design simple Python programs to solve basic computational problems.

- CO4: Analyse the various data structures and operations on it using Python.
- CO5: Apply modular programming using functions.
- CO6: Identify the necessary Python packages in the domain and create simple programs

4. **MINOR COURSE 3 - CSC1MN103- DATA ANALYSIS USING SPREADSHEET**

- CO1: Demonstrate the ability to enter data accurately and efficiently into Excel worksheets.
- CO2: Use Excel formulas, including basic arithmetic operations and functions.
- CO3: Use Excel for data analysis, including sorting, filtering, and the creation of tables.
- CO4: Demonstrate proficiency in utilizing advanced Excel functions.
- CO5: Demonstrate collaboration skills and the ability to represent real-world data and create reports.

5. **MINOR COURSE 4- CSC1FM104 - COMPUTER ESSENTIALS WITH WORD PROCESSING & PRESENTATION**

- CO1: Gain proficiency in understanding and representing data in various forms.
- CO2: Understand the basic principles of computer architecture and organization.
- CO3: Understand the concept of software and its significance in computing.
- CO4: Understand the basic principles of document design and layout for enhanced readability.
- CO5: Understand the importance of effective communication and visual aids in presentations.
- CO6: Acquire practical skills through hands-on exercises and projects.

6. **MINOR COURSE 5- CSC1MN105 - INTRODUCTION TO IT**

- CO1: Understand basic terminology in the field of IT.
- CO2: Identify and describe essential computer hardware components.
- CO3: Comprehend the distinction between system software and application software.
- CO4: Produce documents with precision and efficiency using LaTeX.
- CO5: Understand the basics of networking and internet concepts.

7. **MINOR COURSE 6- CSC1MN106 - COMPUTER FUNDAMENTALS WITH MS EXCEL, SPSS**

- CO1: Understand fundamental concepts and skills essential for understanding and operating a computer system.
- CO2: Execute fundamental data input and manipulation tasks in MS Excel.
- CO3: Perform essential data input and manipulation activities within SPSS.
- CO4: Implement Data analysis using SPSS.
- CO5: Implement Data analysis using MS EXCEL.

8. **MINOR COURSE 7- CSC1MN107 - COMPUTER HARDWARE ASSEMBLY**

- CO1: Understand fundamental concepts and skills essential for understanding and operating a computer system.
- CO2: Execute fundamental data input and manipulation tasks in MS Excel.
- CO3: Perform essential data input and manipulation activities within SPSS.
- CO4: Implement Data analysis using SPSS.
- CO5: Implement Data analysis using MS EXCEL.

9. **VOCATIONAL MINOR COURSE 1- CSC1VN101 - COMPUTATIONAL MATHEMATICS IN DATA SCIENCE**

- CO1: Reflect the concept of matrices and determinants to streamline mathematical ideas.
- CO2: Find the inverse of square matrices and demonstrate an understanding of eigenvalues.
- CO3: Proficiency in solving linear equations and understanding geometric solutions.
- CO4: Represent vectors geometrically and algebraically.
- CO5: Apply differential and integral calculus to data science functions.
- CO6: Represent mathematical problems using algorithmic approaches.

10. **VOCATIONAL MINOR 2- CSC1VN102- STATISTICAL FOUNDATIONS FOR ARTIFICIAL INTELLIGENCE**

- CO1: Apply fundamental statistics concepts.
- CO2: Analyze data using descriptive statistics.
- CO3: Perform regression analysis.

- CO4: Apply probability and statistics in real-world situations.
- CO5: Develop critical thinking and problem-solving skills.
- CO6: Communicate statistical findings effectively.

11. MDC- CSC1FM105- DATA ANALYSIS AND VISUALISATION THROUGH SPREAD SHEETS

- **CO1:** Students will demonstrate proficiency in managing spreadsheets, including creating, formatting, and manipulating data within Excel workbooks.
- **CO2:** Learners will understand the importance of data organization and cleansing in Excel. They will be able to import, export, filter, sort, validate, and remove duplicates from datasets.
- **CO3:** Participants will acquire advanced data analysis skills like pivot tables, what-if analysis, and goal seek. They will apply various Excel functions and tools to perform complex calculations, analyze trends, and make informed decisions.
- **CO4:** Students will gain proficiency in data visualization techniques using Excel. They will create various charts, design pivot charts, and dashboards for effective data analysis.
- **CO5:** Learners will develop skills in advanced features of Excel like macros, data protection, and add-ins to enhance functionalities.

12. ENG1FA101 - ENGLISH (ABILITY ENHANCEMENT COURSE)

- **CO1:** Improve communication skills and fluency in English.
- **CO2:** Enhance reading comprehension and analytical writing abilities.
- **CO3:** Build confidence in expressing ideas through structured communication.

Semester 2

1. MAJOR COURSE - CSC2CJ101 - FUNDAMENTALS OF PROGRAMMING (C LANGUAGE)

- **CO1:** Remember the program structure of C with its syntax and semantics.
- **CO2:** Use the various constructs of a programming language viz. conditional, iteration, and recursion.

- **CO3:** Implement the algorithms in C language.
- **CO4:** Use simple data structures like arrays in solving problems.
- **CO5:** Handle pointers and memory management functions in C.
- **CO6:** Develop efficient programs for solving a problem

2. MINOR COURSE 1- CSC2MN101
FOUNDATIONS OF C PROGRAMMING
(FOR STUDENTS OPTING FOR A MINOR IN COMPUTER SCIENCE)

- **CO1:** Demonstrate a solid understanding of fundamental programming concepts.
- **CO2:** Develop effective problem-solving skills by applying algorithmic thinking and logical reasoning.
- **CO3:** Gain proficiency in writing, compiling, debugging, and executing C programs to implement algorithms.
- **CO4:** Write efficient and optimized C code, including memory management and performance tuning.
- **CO5:** Understand and apply modular programming, code documentation, and debugging techniques.
- **CO6:** Develop critical thinking by analyzing and evaluating C code for errors and inefficiencies.

3. MINOR COURSE 2- CSC2MN102-
INTRODUCTION TO DATA SCIENCE
(FOR STUDENTS OPTING FOR A
MINOR IN COMPUTER SCIENCE)

- **CO1:** Understand the types of data and the applications of data science.
- **CO2:** Analyze irregularities in the data and perform data cleaning.
- **CO3:** Implement various visualization techniques on different data types.
- **CO4:** Create prediction models using supervised techniques.
- **CO5:** Assess the similarity among the data using unsupervised techniques.
- **CO6:** Gain insights on advanced data preprocessing techniques.

4. MINOR COURSE 3- CSC2MN103- FUNDAMENTALS OF SPSS AND R PROGRAMMING
(FOR STUDENTS OPTING FOR A MINOR IN COMPUTER SCIENCE)

- **CO1:** Perform essential data input and manipulation activities within SPSS.
- **CO2:** Implement data analysis using SPSS.
- **CO3:** Compute descriptive statistics and conduct parametric and nonparametric tests in SPSS.
- **CO4:** Conduct hypothesis testing and regression analysis in R.
- **CO5:** Create effective visualizations using SPSS and R.

5. MINOR COURSE 4- CSC2MN104- WEB DESIGN TRENDS AND TECHNIQUES
(FOR STUDENTS OPTING FOR A MINOR IN COMPUTER SCIENCE)

- **CO1:** Get a general introduction to the internet.
- **CO2:** Identify and analyze the current trends in web designing.
- **CO3:** Understand basic knowledge in HTML5 and CSS3 for responsive web design.
- **CO4:** Learn how to design a simple web application.
- **CO5:** Incorporate user experience principles in web design.
- **CO6:** Become proficient in web designing through current technologies.

6. MINOR COURSE 5- CSC2MN105- EFFICIENT OFFICE DYNAMICS
(FOR STUDENTS OPTING FOR A MINOR IN COMPUTER SCIENCE)

- **CO1:** Understand basic concepts of office automation and the need for technology in the workplace.
- **CO2:** Develop proficiency in using office automation tools like word processing, spreadsheets, and presentations.
- **CO3:** Learn tools integrated with internet technologies, including cloud-based productivity suites.
- **CO4:** Understand the importance of maintaining organized and accessible document repositories.
- **CO5:** Enhance productivity skills using office automation tools through hands-on practice.

7. MINOR COURSE 6- CSC2MN106- FUNDAMENTALS OF SYSTEM SOFTWARE, NETWORKS AND DBMS
(FOR STUDENTS OPTING FOR A MINOR IN COMPUTER SCIENCE)

- **CO1:** Understand system software principles.
- **CO2:** Learn basic operating system functions.
- **CO3:** Interpret the concepts of data communications systems and their components.
- **CO4:** Acquire knowledge of database management systems and architecture.
- **CO5:** Construct basic SQL queries to retrieve and manipulate data.

8. MINOR COURSE 7- CSC2MN107- EXPLORING CYBER SECURITY IN SOCIAL MEDIA
(FOR STUDENTS OPTING FOR A MINOR IN COMPUTER SCIENCE)

- **CO1:** Understand the idea of cyber security and associated challenges.
- **CO2:** Learn about cybercrimes, their nature, and legal remedies.
- **CO3:** Apply ethical standards related to social media usage in daily life.
- **CO4:** Understand the fundamentals of computer and mobile security.
- **CO5:** Develop a cybersecurity plan for a hypothetical social media scenario.

9. VOCATIONAL MINOR 1- CSC2VN101 INTRODUCTION TO DATA SCIENCE

- **CO1:** Understand the types of data and the applications of data science.
- **CO2:** Analyze the irregularities present in the data and perform data cleaning.
- **CO3:** Implement various visualization techniques on different data types.
- **CO4:** Create prediction models using supervised techniques.
- **CO5:** Assess the similarity among the data using unsupervised techniques.
- **CO6:** Gain insights on advanced data preprocessing techniques.

10. VOCATIONAL MINOR 2- CSC2VN102- FOUNDATIONS ARTIFICIAL INTELLIGENCE

- **CO1:** Gain insight into the evolution of key ideas and technologies by exploring Artificial Intelligence history and its foundational concepts.

- **CO2:** Acquire knowledge and skills to understand, design, and implement intelligent agents that perceive, reason, and act within their environments.

- **CO3:** Demonstrate proficiency in various uninformed and informed search strategies along with constraint satisfaction problem-solving methods.

- **CO4:** Design and implement logical agents and construct ontologies that capture the semantics of a domain, facilitating knowledge representation.

- **CO5:** Understand the ethical considerations of AI and its societal impacts while analyzing emerging trends.

- **CO6:** Represent various AI problems using algorithmic approaches and enhance problem-solving skills by visualizing solutions with software tools.

11. MDC-CSC2FM106 - DIGITAL EMPOWERMENT THROUGH ETHICAL STANDARDS (MULTI-DISCIPLINARY COURSE)

- **CO1:** Analyze the challenges of the pre-digital age and the importance of the digital revolution.

- **CO2:** Gain familiarity with key digital technologies like Cloud Computing, IoT, AI, and Blockchain.

- **CO3:** Understand Digital India initiatives and Kerala's emergence as a digital society.

- **CO4:** Enhance digital literacy through tools for data sharing, online learning, and networking.

- **CO5:** Develop awareness of ethical and security considerations in the digital age.

- **CO6:** Analyze real-world digital infrastructure projects and services.

13. ENG1FA101 - ENGLISH (ABILITY ENHANCEMENT COURSE)

- **CO1:** Enhance advanced writing, speaking, and critical thinking skills in English.

- **CO2:** Develop structured arguments and analytical essays.

- **CO3:** Build confidence in presenting complex ideas fluently.

Semester 3

1. MAJOR COURSE- CSC3CJ201 - SOFTWARE PROJECT MANAGEMENT

- **CO1:** Define and explain fundamental concepts, principles, and terminologies of software project management.

- **CO2:** Master various design concepts used during project development life cycle.

- **CO3:** Understand and apply software project management techniques.

- **CO4:** Develop project plans and schedules using tools like Gantt charts and network diagrams.

- **CO5:** Understand the importance of quality in software development, including quality assurance and testing strategies.

- **CO6:** Prepare and deliver effective project presentations.

2. MAJOR/MINOR COURSE CSC3CJ202/CSC3MN200- DATA STRUCTURES AND ALGORITHM

- **CO1:** Differentiate basic data structures (arrays, linked lists, stacks, queues) and their applications.

- **CO2:** Perform operations (insertion, deletion, search) on data structures.

- **CO3:** Identify and use advanced data structures like trees and graphs.

- **CO4:** Investigate properties and applications of searching and sorting techniques.

- **CO5:** Solve computational challenges using data structures and algorithms.

- **CO6:** Implement and analyze algorithms to solve real-world problems.

3. MINOR COURSE 1 - CSC3MN101- PYTHON PROGRAMMING (FOR STUDENTS OPTING FOR A MINOR IN COMPUTER SCIENCE/DATA SCIENCE)

- **CO1:** Understand the basic concepts of Python programming.

- **CO2:** Apply problem-solving skills using different control structures and loops.

- **CO3:** Design simple Python programs to solve basic computational problems and acquire knowledge of Python's error-handling mechanisms to effectively debug programs.

- **CO4:** Analyze the various data structures and operations on them using Python.

- **CO5:** Apply modular programming using functions.

- **CO6:** Identify the necessary Python packages in the domain and create simple programs with it.

4.

5. MINOR COURSE 2 - CSC3MN102- INTRODUCTION TO AI AND MACHINE LEARNING

- **CO1:** Explain the basic concepts of Artificial Intelligence.
- **CO2:** Apply problem-solving techniques to solve standard AI problems.
- **CO3:** Master packages required for AI and machine learning applications.
- **CO4:** Gain insights into machine learning and deep learning concepts.
- **CO5:** Implement and analyze machine learning algorithms.
- **CO6:** Apply AI and machine learning concepts to real-world projects.

6. MINOR COURSE 3 - CSC3MN103- DATA VISUALISATION USING PYTHON

- **CO1:** Understand the basic concepts of Python programming.
- **CO2:** Apply problem-solving skills using control structures and loops.
- **CO3:** Design simple Python programs to solve computational problems.
- **CO4:** Analyze data structures and operations using Python.
- **CO5:** Apply modular programming using functions.
- **CO6:** Use Python packages for domain-specific visualization.

7. MINOR COURSE 4 - CSC3MN204- PROGRAMMING FUNDAMENTALS USING C

- **CO1:** Demonstrate a solid understanding of fundamental programming concepts.
- **CO2:** Develop effective problem-solving skills by applying algorithmic thinking and logical reasoning.
- **CO3:** Gain proficiency in writing, compiling, debugging, and executing C programs to implement algorithms and solve problems.
- **CO4:** Learn techniques to write efficient and optimized C code, including memory management and performance tuning.
- **CO5:** Understand and apply software development practices like modular programming, code documentation, and debugging techniques.
- **CO6:** Develop critical thinking skills by analyzing and evaluating C code, identifying errors and inefficiencies, and proposing solutions for improvement.

8. MINOR COURSE 5- CSC3MN205 - MASTERING CONTENT MANAGEMENT SYSTEMS

- **CO1:** Cultivate a robust understanding of web design fundamentals, laying a strong foundation for digital design and development.

- **CO2:** Attain comprehensive knowledge and practical proficiency in Content Management Systems (CMS).

- **CO3:** Develop expertise in Drupal, gaining understanding of its features, configuration, and installation processes.

- **CO4:** Learn website development using Drupal and explore various options within the Drupal ecosystem.

- **CO5:** Apply web design concepts to real-world scenarios by designing functional and aesthetically pleasing websites.

- **CO6:** Develop advanced website management skills, including installing and configuring modules, managing menus, and optimizing Drupal websites.

9. MINOR COURSE 6- CSC3MN206 - PYTHON PROGRAMMING

- **CO1:** Understand the basic concepts of Python programming.

- **CO2:** Implement simple Python programs to solve basic computational problems and GUI (Graphical User Interface).

- **CO3:** Apply problem-solving skills using different control structures and loops.

- **CO4:** Analyze the various data structures and operations on them using Python.

- **CO5:** Apply modular programming using functions.

- **CO6:** Identify the necessary Python packages in the domain and create simple programs with it.

10. MINOR COURSE 7- CSC3MN107 - EMERGING TRENDS IN COMPUTER SCIENCE

- **CO1:** Analyze real-world use cases and applications of emerging technologies in domains such as healthcare, finance, and smart cities.

- **CO2:** Understand the fundamental concepts of Artificial Intelligence (AI) and its applications.

- **CO3:** Identify key components of a blockchain network, such as nodes, blocks, transactions, and smart contracts.

- **CO4:** Understand fundamental concepts of computer networks and their applications.
- **CO5:** Explore the evolution of database management systems (DBMS) to modern systems.
- **CO6:** Describe features of NoSQL databases and their advantages over traditional relational databases.

11. VOCATIONAL MINOR 1- CSC8VN401 - EMERGING TRENDS IN COMPUTER SCIENCE

- **CO1:** Apply correlation and covariance analysis to assess relationships between variables.
- **CO2:** Implement linear, multiple, and polynomial regression models to predict outcomes from numerical data.
- **CO3:** Employ time series analysis techniques to identify trends and seasonal patterns.
- **CO4:** Evaluate model performance and interpret results to inform business decisions.
- **CO5:** Utilize logistic regression to classify categorical outcomes and make data-driven decisions.
- **CO6:** Acquire proficiency in building predictive models using real-world datasets.

12. VOCATIONAL MINOR 2- CSC3VN202 - AUTOMATION AND ROBOTICS

- **CO1:** Understand production systems and automation to analyze, optimize, and evaluate levels of automation.
- **CO2:** Differentiate between process industries, manufacturing industries, and control systems.
- **CO3:** Understand various forms of process control, including direct digital control, programmable logic control, and distributed control systems.
- **CO4:** Familiarize with hardware components such as sensors, actuators, and analog-digital converters used in automation.
- **CO5:** Understand developments in automation and robotics and the role of AI in enhancing these systems.
- **CO6:** Use algorithmic approaches to represent problems and solve them with software tools.

13. VAC- CSC3FV108(1) - INTRODUCTION TO CYBER LAWS

- **CO1:** Understand the concept of cyber space, cyber crimes, and cyber laws.
- **CO2:** Learn about various types of cyber crimes and criminals.
- **CO3:** Examine provisions in the IT Act 2000.
- CO4: Identify intellectual property rights and e-commerce-related issues.
- CO5: Understand cyber law enforcement mechanisms in India.
- CO6: Learn about penalties and legal implications of cyber crimes under Indian law.

Semester 4

1. ## MAJOR COURSE- CSC4CJ203 - DATABASE MANAGEMENT SYSTEM

- **CO1:** Gain a comprehensive understanding of fundamental concepts in database management systems and their applications.
- **CO2:** Understand concepts of the relational data model and normalization techniques.
- **CO3:** Apply principles of entity-relationship (ER) modelling and normalization techniques to design efficient databases.
- **CO4:** Craft and execute SQL queries for retrieval, updating, and manipulation of data.
- **CO5:** Manage transactions and implement concurrency control mechanisms to ensure consistency and reliability in databases.
- **CO6:** Explore and analyze recent trends in database management systems, including unstructured databases and NoSQL technologies.

2. ## CSC4CJ204 - PYTHON PROGRAMMING

- **CO1:** Understand the basic concepts of Python programming language.
- **CO2:** Apply problem-solving skills using the basic constructs in Python programming.
- **CO3:** Apply modular programming using functions in Python.
- **CO4:** Analyze various data structures and operations on them using Python.
- **CO5:** Apply various Python libraries/packages available for different computational needs.
- **CO6:** Use visualization tools in Python to present data effectively.

3. **CSC4CJ205 - COMPUTER NETWORKS**

- **CO1:** Understand the fundamentals of computer networks, including data communication concepts, network topologies, and reference models (OSI, TCP/IP).

- **CO2:** Gain proficiency in transmission media and multiplexing techniques.

- **CO3:** Familiarize with common networking protocols and standards.

- **CO4:** Describe, analyze, and compare various data link, network, and transport layer protocols.

- **CO5:** Design and implement basic network protocols in a simulated networking environment.

- **CO6:** Understand the importance and functionality of various application-layer protocols.

4. **VAC-CSC4FV109(2) - COMPUTER NETWORKS**

- **CO1:** Cultivate a robust understanding of web design fundamentals, providing a foundation for digital design and development.

- **CO2:** Gain knowledge and practical proficiency in Content Management Systems (CMS).

- **CO3:** Develop expertise in Drupal, a popular CMS, by understanding its features, configuration, and installation processes.

- **CO4:** Understand website development using Drupal and its ecosystem.

- **CO5:** Apply web design concepts to real-world scenarios, effectively designing functional and visually appealing websites.

- **CO6:** Develop advanced website management skills, including module installation, menu management, and optimization of websites built on the Drupal platform.

Semester 5

1. **MAJOR COURSE-CSC5CJ301 - DATA MINING**

- **CO1:** Understand the fundamental concepts and principles of data mining.

- **CO2:** Demonstrate proficiency in preprocessing techniques such as cleaning, transformation, and reduction of data.

- **CO3:** Understand popular data mining algorithms and models, such as decision trees, k-means clustering, and association rule algorithms.

- **CO4:** Evaluate and interpret the results of data mining models using appropriate performance metrics.

- **CO5:** Understand the role of data mining in extracting patterns and knowledge from large datasets.

- **CO6:** Apply data mining techniques to real-world problems and datasets, emphasizing practical applications in various domains.

2. MAJOR - CSC5CJ302 - OBJECT-ORIENTED PROGRAMMING (JAVA)

- **CO1:** Understand the concepts and features of Object-Oriented Programming (OOP).

- **CO2:** Practice programming in Java using OOP concepts.

- **CO3:** Implement exception handling mechanisms, I/O operations, and multithreading in Java.

- **CO4:** Develop Java programs to implement file operations and memory management.

- **CO5:** Integrate Java Database Connectivity (JDBC) to interact with databases.

- **CO6:** Develop Graphical User Interface (GUI) applications using Swing, layout management, and basic event handling.

3. MAJOR - CSC5CJ303 - FULL STACK WEB DEVELOPMENT

- **CO1:** Understand the concepts to create responsive web pages using HTML and CSS.

- **CO2:** Gain familiarity with client-side scripting using JavaScript.

- **CO3:** Explore Node.js and develop backend applications.

- **CO4:** Build interactive and dynamic web pages using React.js.

- **CO5:** Familiarize with SQL and NoSQL databases for effective data storage and retrieval.

- **CO6:** Explore MongoDB and develop real-world web applications using full-stack technologies.

4. ELECTIVE - CSC5EJ305A - MATHEMATICAL AND STATISTICAL FOUNDATIONS FOR DATA SCIENCE

- **CO1:** Apply vector and matrix operations to solve computational problems.

- **CO2:** Evaluate eigenvalues and eigenvectors for analyzing data transformations.

- **CO3:** Apply fundamental probability concepts to solve real-world problems.

- **CO4:** Utilize statistical techniques for data interpretation and decision-making.
- **CO5:** Apply sampling techniques and hypothesis tests to make inferences about populations.
- **CO6:** Use Principal Component Analysis (PCA) to reduce data dimensionality and interpret results.

5. **ELECTIVE - CSC5EJ306A - EXPLORATORY DATA ANALYSIS**
   - **CO1:** Understand the importance of data visualization for business intelligence and decision- making.
   - **CO2:** Use various charts and plots such as line charts, histograms, bar plots, pie charts, scatter plots, and box plots.
   - **CO3:** Learn about categories of visualization and application areas.
   - **CO4:** Familiarize with data visualization tools and techniques.
   - **CO5:** Learn Python libraries such as Matplotlib, Seaborn, Folium, and Bokeh for data visualization.
   - **CO6:** Create advanced visualizations, including geospatial data analysis and dashboards.

6. **ELECTIVE - CSC5EJ305B - MACHINE LEARNING ALGORITHMS**
   - **CO1:** Understand basic concepts of machine learning, including supervised, unsupervised, and reinforcement learning.
   - **CO2:** Analyze the mathematical foundations of machine learning algorithms, including optimization, linear algebra, and statistics.
   - **CO3:** Demonstrate proficiency in machine learning algorithms like linear regression, logistic regression, decision trees, SVMs, clustering, and neural networks.
   - **CO4:** Apply feature engineering and selection techniques to improve model performance.
   - **CO5:** Evaluate models using metrics like precision, recall, ROC curves, and confusion matrices.
   - **CO6:** Solve complex problems using machine learning approaches.

7. **ELECTIVE - CSC5EJ306B - KNOWLEDGE ENGINEERING**
   - **CO1:** Understand the basics of knowledge engineering and its applications.
   - **CO2:** Apply methodologies and models for agent design and development.

- **CO3:** Design and develop ontologies for knowledge representation.
- **CO4:** Apply reasoning with ontologies and rules to solve problems.
- **CO5:** Understand learning systems and rule-based learning methods.
- **CO6:** Develop theoretical and practical knowledge to design a knowledge-based system.

8. ELECTIVE - CSC5EJ305C - CLOUD COMPUTING

- **CO1:** Understand the fundamentals of cloud computing, its definition, and key concepts.
- **CO2:** Describe and compare different cloud service models, including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).
- **CO3:** Analyze various deployment models such as public, private, and hybrid clouds.
- **CO4:** Explore virtualization technologies, including hypervisors and containerization.
- **CO5:** Understand cloud management and orchestration technologies.
- **CO6:** Investigate and compare different cloud platforms like AWS, Microsoft Azure, and Google Cloud.

9. ELECTIVE - CSC5EJ306C - SECURITY AND PRIVACY IN CLOUD

- **CO1:** Understand the fundamental concepts of security in cloud computing, including encryption and decryption.
- **CO2:** Examine security design principles, including data protection, access control, and authentication.
- **CO3:** Analyze various threats to cloud security, such as data breaches, denial of service (DoS) attacks, and data loss.
- **CO4:** Understand security design patterns and frameworks for cloud environments.
- **CO5:** Explore various access control mechanisms and management schemes to ensure data security in the cloud.
- **CO6:** Investigate the legal, ethical, and regulatory concerns regarding privacy in cloud computing, including GDPR and data sovereignty.

10. SEC - CSC5FS112 - INTRODUCTION TO DIGITAL MARKETING

- **CO1:** Understand the concept of digital marketing and its integration with traditional marketing.
- **CO2:** Analyze customer behavior and value journey in digital contexts.

- **CO3:** Examine tactics for enhancing a website's position and ranking with search engines.

- **CO4:** Differentiate between digital marketing channels like SEO, social media, email, and content marketing.

- **CO5:** Implement basic digital marketing strategies to improve online visibility and engagement.

- **CO6:** Understand ethical considerations, privacy, and consumer trust in digital marketing.

Semester 6

1. **MAJOR- CSC6CJ304 - DIGITAL ELECTRONICS AND COMPUTER ARCHITECTURE**

   - **CO1:** Understand basic binary arithmetic techniques.

   - **CO2:** Implement logic operations using basic gates and Boolean algebra, design and optimize logic expressions using Karnaugh maps.

   - **CO3:** Understand the operation of latches and flip-flops and the design of sequential logic circuits.

   - **CO4:** Learn the basic computer organization by understanding the role of registers, buses, ALU, and control unit.

   - **CO5:** Understand how instructions are represented, addressed, and executed.

   - **CO6:** Understand concepts of memory and I/O organization, and their role in computer architecture.

2. **MAJOR - CSC6CJ305 - PRINCIPLES OF OPERATING SYSTEMS**

   - **CO1:** Summarize the history, objectives, and functions of an operating system.

   - **CO2:** Understand process management concepts: Process Control Block (PCB), states, scheduling, operations, and inter-process communication.

   - **CO3:** Evaluate various processor scheduling strategies and algorithms.

   - **CO4:** Apply process synchronization concepts for effective process management.

   - **CO5:** Analyze conditions for deadlock occurrence and methods of resolving deadlocks.

   - **CO6:** Describe memory management techniques like paging, segmentation, and virtual memory.

   - **CO7:** Develop shell scripts using Linux for process automation.

3. **CSC6CJ306 - INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

- **CO1:** Differentiate various knowledge representation methods, AI operations, and machine learning approaches.

- **CO2:** Master problem-solving techniques such as search algorithms, heuristic approaches, and informed search strategies.

- **CO3:** Investigate properties and applications of machine learning techniques, including supervised and unsupervised learning.

- **CO4:** Evaluate AI search algorithms and machine learning approaches in solving real-world problems.

- **CO5:** Implement and analyze machine learning algorithms for practical applications.

- **CO6:** Apply AI and machine learning concepts to real-world projects.

4. **ELECTIVE-CSC6EJ311A - INTRODUCTION TO DATA WAREHOUSING AND BIG DATA**

- **CO1:** Understand the concepts of data warehousing and its architecture.

- **CO2:** Analyze the differences between OLTP and OLAP operations.

- **CO3:** Explore various operations performed in the data warehouse to process the data.

- **CO4:** Understand Big Data and the role of cloud and distributed computing in its management.

- **CO5:** Learn the MapReduce concepts used for processing large datasets.

- **CO6:** Understand the Hadoop ecosystem and its role in Big Data management.

5. **ELECTIVE- CSC6EJ312A - ADVANCED PYTHON FOR DATA SCIENCE**

- **CO1:** Understand the concepts of arrays, matrices, and their transformations in Python.

- **CO2:** Create informative plots using Python packages like Matplotlib and Seaborn.

- **CO3:** Understand how to load, manipulate, and preprocess various types of data.

- **CO4:** Analyze data using Pandas and DataFrames for structured data management.

- **CO5:** Work with random tensors and generate them from various distributions using NumPy.

- **CO6:** Familiarize with TensorFlow operations for building and training machine learning models.

6. **ELECTIVE- CSC6EJ311B- SOFT COMPUTING**

- **CO1:** Understand the foundational principles of soft computing and its applications.
- **CO2:** Analyze the properties of fuzzy sets and fuzzy relations.
- **CO3:** Apply fuzzy logic concepts to real-world problems by designing fuzzy systems.
- **CO4:** Master genetic algorithms and their operations in optimization.
- **CO5:** Design solutions using fuzzy logic, neural networks, and genetic algorithms for diverse applications.
- **CO6:** Evaluate real-world problems and present solutions using soft computing techniques.

7. **ELECTIVE- CSC6EJ312B- DEEP LEARNING**

- **CO1:** Master key concepts of machine learning, especially deep learning techniques such as neural networks.
- **CO2:** Implement the backpropagation algorithm for training neural networks and update model weights.
- **CO3:** Analyze and compare different activation functions used in neural networks.
- **CO4:** Design and implement feedforward neural networks for various applications.
- **CO5:** Understand convolutional neural networks (CNNs) and their applications in computer vision.
- **CO6:** Apply deep learning techniques to real-world problems, selecting appropriate models and hyperparameters.

8. **ELECTIVE - CSC6EJ311C- STORAGE TECHNOLOGIES**

- **CO1:** Understand the fundamentals of information storage systems and their architecture.
- **CO2:** Examine features of various storage technologies such as NAS, SAN, and cloud storage.
- **CO3:** Explore the characteristics of intelligent storage systems and data redundancy techniques.
- **CO4:** Learn about backup and recovery mechanisms and their importance in storage management.
- **CO5:** Understand the security and management requirements for modern storage technologies.
- **CO6:** Evaluate and present real-world scenarios where advanced storage solutions are applied.

9. **ELECTIVE - CSC6EJ312C- VIRTUALIZATION**

- **CO1:** Understand the basics of virtualization and its components.
- **CO2:** Learn about hypervisors and how they manage virtual machines.
- **CO3:** Compare different types of virtualizations, including server, desktop, network, and storage virtualization.
- **CO4:** Understand the role of virtualization in cloud computing and its applications.
- **CO5:** Investigate the potential risks and vulnerabilities associated with virtualization.
- **CO6:** Compare and analyze various virtualization tools and platforms used in industry.

Semester 7

1. **MAJOR-CSC7CJ401 - THEORY OF COMPUTATION**

- **CO1:** Learn and understand fundamental concepts in computational theory, including computational models such as finite automata, pushdown automata, and Turing machines.
- **CO2:** Classify formal languages into regular, context-free, context-sensitive, and unrestricted languages.
- **CO3:** Design and analyze Turing machines, including their capabilities and limitations.
- **CO4:** Construct abstract machines like finite automata and pushdown automata from their associated languages and grammar.
- **CO5:** Gain insights into decidability and undecidability by studying problems like the halting problem.
- **CO6:** Solve computational problems and prove basic results in the theory of computation.

2. **MAJOR- CSC7CJ402 - SYSTEM SECURITY**

- **CO1:** Understand different types of security goals and concepts like confidentiality, integrity, and availability in information systems.
- **CO2:** Outline computer system threats and various types of system attacks (e.g., DOS, worms, Trojans).
- **CO3:** Identify issues related to system attacks, methods of attacks, and various types of attackers.

- **CO4:** Study operating system security, file protection methods, and security assurance.
- **CO5:** Understand database security and methods to protect sensitive data.
- **CO6:** Define security policies, risk analysis, and planning for system security.

3. ## MAJOR- CSC7CJ403 - ADVANCED DATA STRUCTURES AND ALGORITHMS

- **CO1:** Understand advanced data structures such as trees, graphs, and heaps.
- **CO2:** Analyze algorithmic techniques such as brute force, greedy, and divide-and-conquer strategies.
- **CO3:** Apply advanced abstract data types (ADT) and data structures to solve real-world problems.
- **CO4:** Understand asymptotic analysis, including big-O notation, time, and space complexity.
- **CO5:** Combine fundamental data structures and algorithms to build solutions for complex problems.
- **CO6:** Apply concepts of data structures in solving real-world problems.

4. ## MAJOR- CSC7CJ404 - BLOCKCHAIN TECHNOLOGY

- **CO1:** Understand the basics of cryptographic building blocks in blockchain technology.
- **CO2:** Explain the fundamental concepts of blockchain technology, including blocks, transactions, and consensus algorithms.
- **CO3:** Explore the classification of consensus algorithms used in blockchain systems.
- **CO4:** Study the first decentralized cryptocurrency, Bitcoin, and understand its underlying blockchain technology.
- **CO5:** Describe the use of smart contracts and their use cases in blockchain applications.
- **CO6:** Develop simple blockchain applications using tools like Ethereum and Hyperledger.

5. ## MAJOR- CSC7CJ405 - INTERNET OF THINGS

- **CO1:** Understand the basic concepts and architecture of the Internet of Things (IoT).
- **CO2:** Explore hardware components of IoT, including sensors, actuators, communication modules, and processing units.

- **CO3:** Explain the design principles for IoT-connected devices, focusing on system layers and standardization.

- **CO4:** Understand protocols in IoT and how they enable communication between devices.

- **CO5:** Demonstrate IoT applications by utilizing popular hardware and software platforms.

- **CO6:** Implement IoT solutions in real-time by deploying devices that collect, process, and visualize data.

Semester 8

1. ## MAJOR- CSC8CJ406 - COMPILER DESIGN

- **CO1:** Identify the different phases in the compilation process and model a lexical analyzer.

- **CO2:** Model language syntax using Context-Free Grammar (CFG) and develop parse tree representation using leftmost and rightmost derivations.

- **CO3:** Compare different types of parsers and construct parsers for given grammars.

- **CO4:** Build syntax-directed translation for a context-free grammar, compare various storage allocation strategies, and classify intermediate representations.

- **CO5:** Design and implement lexical analyzers to recognize tokens in source programs.

- **CO6:** Illustrate code optimization and code generation techniques in the compilation process.

2. ## MAJOR- CSC8CJ407 - CLIENT SERVER ARCHITECTURE

- **CO1:** Understand the basics of client-server systems and their development.

- **CO2:** Outline the architecture and classifications of client-server systems.

- **CO3:** Choose the appropriate client-server network services for different applications.

- **CO4:** Describe various management services within client-server architectures.

- **CO5:** Analyze the issues in network communication and apply appropriate strategies.

- **CO6:** Apply various network services and support protocols in client-server environments.

3. **MAJOR- CSC8CJ408 - PARALLEL COMPUTING**
   - **CO1:** Summarize the key parallel computational models used in parallel computing.
   - **CO2:** Appreciate and apply parallel and distributed algorithms in problem-solving.
   - **CO3:** Explore communication models for parallel algorithm development.
   - **CO4:** Develop parallel algorithms using the message-passing paradigm.
   - **CO5:** Formulate parallel algorithms for shared memory architectures.
   - **CO6:** Understand thread management in parallel computing environments.

4. **MAJOR- CSC8CJ489 - RESEARCH METHODOLOGY**

   - **CO1:** Understand the psychology of research and its necessity in academic and professional contexts.
   - **CO2:** Apply research methods to formulate a problem statement using various research techniques.
   - **CO3:** Explore different methods of data collection, validation, and testing.
   - **CO4:** Understand data processing and analysis techniques for research.
   - **CO5:** Analyze research outcomes using suitable statistical tools.
   - **CO6:** Write and present scientific reports, research papers, and proposals effectively.

5. **ELECTIVE- CSC8EJ401 - MICROPROCESSOR AND ITS APPLICATIONS**

   - **CO1:** Recognize the purpose, characteristics, and architecture of microprocessors like 8085 and 8086.
   - **CO2:** Identify addressing modes and comprehend how instructions work in 8086.
   - **CO3:** Write simple assembly language programs for microprocessor operations.
   - **CO4:** Identify the functions of peripheral ICs and understand how interrupts are managed.
   - **CO5:** Describe the characteristics and applications of advanced microprocessors.

6. **ELECTIVE- CSC8EJ402 - SYSTEM SOFTWARE**

   - **CO1:** Define the key concepts in system programming, such as compilers, assemblers, linkers, and loaders.
   - **CO2:** Master different types of system call and understand the role of each in system programming.

- **CO3:** Understand lexical and syntax analysis in compiler design and other system-level tasks.
- **CO4:** Analyze the debugging process, optimization techniques, and different linking/loading schemes.
- **CO5:** Implement programs using system calls for file and process management tasks.
- **CO6:** Apply compiler design principles to develop a simple compiler.

7. ELECTIVE- CSC8EJ403 - SOCIAL NETWORKS ANALYSIS

- **CO1:** Understand the basic notation and terminology used in social network analysis.
- **CO2:** Analyze the structure and connectivity patterns of social networks.
- **CO3:** Discover community structures in complex networks using statistical techniques.
- **CO4:** Apply link prediction techniques to identify new links in social networks.
- **CO5:** Study the influence in social media and perform recommendation tasks.
- **CO6:** Perform social influence analysis using appropriate techniques.

8. ELECTIVE- CSC8EJ404 - ADVANCED DISTRIBUTED COMPUTING

- **CO1:** Summarize various aspects of distributed computing models and systems.
- **CO2:** Apply distributed computing and communication design principles in problem-solving.
- **CO3:** Illustrate election algorithms, global snapshot algorithms, and termination detection algorithms.
- **CO4:** Compare token-based, non-token-based, and quorum-based mutual exclusion algorithms.
- **CO5:** Recognize the significance of deadlock detection and shared memory in distributed systems.
- **CO6:** Understand failure recovery and consensus mechanisms in distributed systems.

9. ELECTIVE- CSC8EJ405 - CYBER FORENSIC

- **CO1:** Understand the fundamental concepts and methodologies of cyber forensics.
- **CO2:** Develop skills in acquiring, preserving, and analyzing digital evidence from various sources.
- **CO3:** Use forensic tools to investigate cybercrimes, security incidents, and data breaches.

- **CO4:** Conduct forensic examinations of networks, disks, memory, and mobile devices.
- **CO5:** Evaluate ethical, legal, and privacy issues involved in cyber forensics.
- **CO6:** Apply problem-solving skills to overcome challenges in cyber forensics and cybersecurity.

10. ELECTIVE CSC8EJ406 - ETHICAL HACKING

- **CO1:** Understand the fundamentals of ethical hacking and penetration testing.
- **CO2:** Learn the process of foot printing and reconnaissance for vulnerability assessment.
- **CO3:** Apply system hacking methods to test security weaknesses.
- **CO4:** Understand and perform different types of attacks on systems and networks.
- **CO5:** Use penetration testing tools to assess network and system vulnerabilities.
- **CO6:** Apply ethical hacking techniques to secure systems and protect against malicious attacks.

11. ELECTIVE - CSC8EJ407 - EXPERT SYSTEMS AND FUZZY LOGIC

- **CO1:** Understand the fundamentals of expert systems and their components, such as knowledge base, inference engine, and user interface.
- **CO2:** Analyze the process of knowledge acquisition and representation in expert systems.
- **CO3:** Develop rule-based systems and understand the reasoning processes used in expert systems.
- **CO4:** Understand fuzzy logic and its role in decision-making and reasoning in uncertain environments.
- **CO5:** Implement fuzzy sets, fuzzy relations, and fuzzy inference systems in solving real-world problems.
- **CO6:** Apply expert systems and fuzzy logic techniques to develop intelligent systems for various applications, such as medical diagnosis and control systems.