## Master of Computer Application [Integrated] Course Outcome (CO)

SEMESTER – I		
Course Code	Course Title	Course Outcome (CO)
CA 1.1	Computer Essentials	<ul> <li>CO1: To understand basics of computer System.</li> <li>CO2: To Understand Data Representation and Basic of Algorithm.</li> <li>CO3: To understand concept and functioning of Operating System</li> <li>CO4: To acquire knowledge of Software &amp; Computer Viruses.</li> <li>CO5: To understand Fundamental of Internet &amp; Advanced Application of Computer System in Real Life.</li> </ul>
CA1.2	Professional Communication	<ul> <li>CO1: To demonstrate his verbal and non-verbal communication ability</li> <li>CO2: To demonstrate his/her ability to write error free while making an optimum use of correct Business Vocabulary &amp; Grammar.</li> <li>CO3: To distinguish among various levels of organizational communication and communication barriers while developing an understanding of Communication as a process in an organization.</li> <li>CO4: To draft effective business correspondence with brevity and clarity.</li> <li>CO5: To stimulate their Critical thinking by designing and developing clean and lucid writing skills.</li> </ul>
CA1.3	Mathematical foundation of Comp. Science –I	<ul> <li>CO1: Apply mathematical logic to solve problems</li> <li>CO2: Understand sets; apply operations on sets and algebraic structures.</li> <li>CO3: Model and solve real world problems using graphs and trees.</li> <li>CO4: Use mathematical concepts such as relations and functions.</li> <li>CO5: Analyze and understand the mathematical operations on vectors.</li> </ul>
CA1.4	C programming	<ul> <li>CO1: Gain basic knowledge of C language.</li> <li>CO2: Develop logics which will help them to create programs, applications in C programming.</li> <li>CO3: Learn the decision-making ability to construct the C Programs.</li> <li>CO4: Apply user defined functions for solving the problem.</li> <li>CO5: Understand the use of structure and union to solve the complex problem.</li> <li>CO6: Analyze problems in different applications and develop</li> </ul>

		logic to implement their solutions.
CA1.5	Lab on Professional Communication	<ul> <li>CO1: To demonstrate his verbal and non-verbal communication ability</li> <li>CO2: To demonstrate his/her ability to write error free while making an optimum use of correct Business Vocabulary &amp; Grammar.</li> <li>CO3: To distinguish among various levels of organizational communication and communication barriers while developing an understanding of Communication as process in an organization.</li> <li>CO4: To draft effective business correspondence with brevity and clarity.</li> <li>CO5: To stimulate their Critical thinking by designing and developing clean and lucid writing skills.</li> </ul>
CA1.6	Problem solving & Algorithmic Thinking -I	<ul> <li>CO1: Apply and practice logical ability to solve the problems on matrices.</li> <li>CO2: Apply and practice different operations on sets.</li> <li>CO3: Demonstrate the use of Strings and string handling functions.</li> <li>CO4: Demonstrate the use of graphs and trees.</li> </ul>
CA1.7	Lab on C Programming	<ul> <li>CO1: Learn Simple C Program.</li> <li>CO2: Read, understand and trace the execution of programs written in C language</li> <li>CO3: Use the decision-making ability for writing a C code for a given Problem.</li> <li>CO4: Develop detail understanding of pointers, functions, string functions, arrays, structure, union and file handling.</li> <li>CO5: Learn to develop complex C Programs.</li> </ul>
	•	SEMESTER –II
CA2.1	Comp. Organization & Architecture	<ul> <li>CO1: Describe the fundamental organization of a computer system.</li> <li>CO2: Understand the basics of instructions sets and their impact on processor design. CO3: Perform computer arithmetic operations and control unit operations.</li> <li>CO4: Understanding of the addressing modes, instruction formats and program control statements. CO5: Measure the performance of CPU, memory and I/O operations.</li> </ul>
CA2.2	Web Designing	<ul> <li>CO1: Design the web Pages using HTML / HTML 5 Tags.</li> <li>CO2: Use Hyperlink, Tables in web page.</li> <li>CO3: Use CSS to apply effect to webpage text / Controls.</li> </ul>
CA2.3	Mathematical foundation of Computer Science –	• CO1: Solve applications involving permutations and combinations.

	Π	<ul> <li>CO2: Analyze statistical data using measures of central tendency, dispersion and location. CO3: Organize, manage and present data using statistics.</li> <li>CO4: Develop and apply problem-solving techniques needed to accurately calculate probabilities</li> <li>CO5: Provide the students with a fundamental understanding of probabilistic methods</li> </ul>
CA2.4	C++ Programming	<ul> <li>CO1: Solve applications involving permutations and combinations.</li> <li>CO2: Analyze statistical data using measures of central tendency, dispersion and location. CO3: Organize, manage and present data using statistics.</li> <li>CO4: Develop and apply problem-solving techniques needed to accurately calculate probabilities</li> <li>CO5: Provide the students with a fundamental understanding of probabilistic methods</li> </ul>
CA2.5	Lab on Web Designing	<ul> <li>CO1: Design the web Pages using HTML / HTML 5 Tags.</li> <li>CO2: Use Hyperlink, Tables in web page.</li> <li>CO3: Use CSS to apply effect to webpage text / Controls</li> </ul>
CA2.6	Problem solving & Algorithmic Thinking -II	<ul> <li>CO1: Apply and demonstrate the concept of Permutation and Combination.</li> <li>CO2: Apply and demonstrate the measure of Central Tendency</li> <li>CO3: Apply and demonstrate the concepts of probability</li> </ul>
CA2.7	Lab on C++ Programming	<ul> <li>CO1: To describe the advantages of a high-level language like C++, the programming process, and the compilation process.</li> <li>CO2: To describe and use software tools in the programming process.</li> <li>CO3: To apply good programming principles to the design and implementation of C++ programs. CO4: To design, implement, debug and test programs using the fundamental elements of C++.</li> <li>CO5: To demonstrate an understanding of primitive data types, values, operators and expressions in C++</li> </ul>
		SEMESTER –III
CA 3.1	Operating System	<ul> <li>CO1: Recall the basic concept of operating system</li> <li>CO2: Summarize fundamental concepts of computer system architecture</li> <li>CO3: Understand the theory of processes, resource control, physical and virtual memory, scheduling and system calls</li> <li>CO4: Recall the basic concept of memory management, processes and file system</li> <li>CO5: Understand the concept of page replacement algorithms</li> </ul>

		Mass Storage,
CA3.2	C# Programming Language	<ul> <li>CO1: Describe the C# language components</li> <li>CO2: Explain Object Oriented Programming in C#</li> <li>CO3: Explain Advanced Features in C# &amp; Exception Handling</li> <li>CO4: Understand the concept of .Net Framework and C# language fundamentals</li> <li>CO5: Develop the console and GUI applications using C# .Net</li> </ul>
CA3.3	Data Structure & Algorithms	<ul> <li>CO1: Recall the concept of abstract data types and types of data structures</li> <li>CO2: Apply the different linear data structures like array, stack and queue to various computing problems.</li> <li>CO3: Illustrate the various types of linked list structures with their applications including representations and operations.</li> <li>CO4: Students will be able to develop Linear and Non-Linear data structures such as Trees, Graphs etc.</li> <li>CO5: Students compare various important concepts of sorting and searching techniques</li> </ul>
CA3.4	Object oriented programming using Java	<ul> <li>CO1: Recall basic programming skills in object-oriented programming</li> <li>CO2: Summarize Fundamental concepts of object oriented programming using Java technology.</li> <li>CO3: Apply the concepts of Exception handling to develop efficient and error free codes</li> <li>CO4: Analyze the concept of Array, String and Vector.</li> <li>CO5: Justify Why swing component is better than Awt component ?.</li> </ul>
CA3.5	Lab on C# programming Language	<ul> <li>CO1: Demonstrate the concept of boxing and unboxing</li> <li>CO2: Demonstrate the use of Timer control in C#</li> <li>CO3: Demonstrate Simple Database Connectivity using wizard.</li> <li>CO4: Demonstrate a C# application using PictureBox, ScrollBar control</li> <li>CO5: Develop the console and GUI applications using C# .Net</li> </ul>
CA3.6	Lab on Data Structure & Algorithms	<ul> <li>CO1: Recall the concept of abstract data types and types of data structures</li> <li>CO2: Apply the different linear data structures like array, stack and queue to various computing problems.</li> <li>CO3: Illustrate the various types of linked list structures with their applications including representations and operations.</li> <li>CO4: Students will be able to develop Linear and Non-Linear data structures such as Trees, Graphs etc.</li> </ul>

		CO5: Students compare various important concepts of
		sorting and searching techniques
CA3.7	Lab on Object oriented programming using Java	<ul> <li>CO2: To demonstrate his/her ability to write error free while making an optimum use of correct Business Vocabulary &amp; Grammar.</li> <li>CO3: To distinguish among various levels of organizational communication and communication barriers while developing an understanding of Communication as a process in an organization.</li> <li>CO4: To draft effective business correspondence with brevity and clarity.</li> <li>CO5: To stimulate their Critical thinking by designing and developing clean and lucid writing skills.</li> </ul>
		SEMESTER – IV
CA4.1	Principals of Management & Accounting	<ul> <li>CO1: To familiarize the students with the basic Management concept.</li> <li>CO2: To provide a basis of understanding with reference to working of business management.</li> <li>CO3: To develop the foundation in the field of accounting.</li> <li>CO4: To study the fundamental accounting concepts and terms</li> <li>CO5: To learn the process of recording of financial transactions in the books of Accounts.</li> </ul>
CA4.2	Data Base Management System	<ul> <li>CO1: To recall knowledge of fundamentals of DBMS, database design and normal forms</li> <li>CO2: To define various normal forms</li> <li>CO3: To describe basics of SQL for retrieval and management of data</li> <li>CO4: To discuss basics of transaction processing and concurrency control</li> <li>CO5: To Classify database access techniques</li> </ul>
CA4.3	PHP Programming	<ul> <li>CO1: Students can define structure and syntax of php</li> <li>CO2: Students can recall arrays</li> <li>CO3: Students can use php function</li> <li>CO4: Students can compare \$_GET and \$_POST</li> </ul>
CA4.4	Advanced Java	<ul> <li>CO1: Explain advanced java technology</li> <li>CO2: Apply knowledge of servlet to create server side programs</li> <li>CO3: Evaluate the performance of JSP over servlet</li> <li>CO4: To develop programs using java script and java beans.</li> </ul>
CA4.5	Lab on DBMS	• CO1: To recall knowledge of fundamentals of DBMS, database design and normal forms

		<ul> <li>CO2: To define various normal forms</li> <li>CO3: To describe basics of SQL for retrieval and management of data</li> <li>CO4: To discuss basics of transaction processing and concurrency control</li> <li>CO5: To Classify database access techniques</li> </ul>	
CA4.6	Lab on PHP Programming	<ul> <li>CO1: Students can define structure and syntax of php</li> <li>CO2: Students can recall arrays</li> <li>CO3: Students can use php function</li> <li>CO4: Students can compare \$_GET and \$_POST</li> </ul>	
CA4.7	Lab on Advanced Java	<ul> <li>CO1: Explain advanced java technology</li> <li>CO2: Apply knowledge of servlet to create server side programs</li> <li>CO3: Evaluate the performance of JSP over servlet</li> <li>CO4: To develop programs using java script and java beans.</li> </ul>	
SEMESTER – V			
CA5.1	Computer Networks	<ul> <li>CO1: To understand the concepts of data communications</li> <li>CO2: To study the functions of different layers.</li> <li>CO3: To Understand the different protocols and network components.</li> <li>CO4: Describe the client/server model and key application layer protocols.</li> </ul>	
CA5.2	Design and Analysis of Algorithms	<ul> <li>CO1: To understand data representation and basic of Algorithm.</li> <li>CO2: To understand concept and functioning and operation of elementary data structures.</li> <li>CO3: Analyze the asymptotic performance of algorithms and write rigorous correctness proofs for algorithms.</li> <li>CO4: Design and analyze divide-and-conquer, greedy and dynamic-programming based algorithms.</li> <li>CO5: Model problems using backtracking, classify nondeterministic polynomial time algorithms</li> </ul>	
CA5.3	Python Programming	• CO1: Understand the basic concept of Python Programming. CO2: Understand lists, tuples, dictionaries, strings and files efficiently for solving real world problems. CO3: Recall the concepts of object-oriented programming using python. CO4: Understand modules, packages and GUI based programming for web. CO5: Understand the Database connectivity steps.	
CA5.4	A) Web Development Technologies I	<ul> <li>CO1: To Understand the HTML and CSS features with different layouts as per need of applications.</li> <li>CO2: Describe the concepts of CSS and the requirements of effective web design.</li> </ul>	

	B) Data Analytics I	<ul> <li>CO3: Use the JavaScript to develop the dynamic web pages.</li> <li>CO4: Use various React features including components and forms.</li> <li>CO1: Understanding the Role of data Analyst.</li> <li>CO2: Understanding the basic concept of data management and data mining techniques.</li> <li>CO3: To understand the basic concept of machine learning</li> <li>CO4: To understand the application of business analysis.</li> <li>CO5: Understanding the basic concept of Advanced Excel.</li> </ul>
	C) Computer Graphics	<ul> <li>CO1: Recall basic concept of computer graphics</li> <li>CO2: Explain the Graphical display Devices &amp; its Application</li> <li>CO3: Apply various scan conversion and filling technique</li> <li>CO4: Explain 2D and 3D transformation and matrix representation technique</li> <li>CO5: Implement various curve representation technique</li> </ul>
CA5.5	Lab on DAA	<ul> <li>CO1: Construct logic for the algorithms designed using designing techniques.</li> <li>CO2: Posterior analysis of the algorithms.</li> <li>CO3: Debug, test and profile the algorithms, modify to improve performance of the algorithms.</li> </ul>
CA5.6	Lab on Python programming Language	<ul> <li>CO1: Demonstrate use and working of various data types, control structures, files, exceptional handling etc.</li> <li>CO2: Create, configure and make use of modules.</li> <li>CO3. Develop console based and GUI applications (both procedural/object oriented) to solve different problems using python programming.</li> </ul>
CA5.7	A) - Lab On Web Development Technology-I	<ul> <li>CO1: Create interactive websites using HTML, CSS &amp; JavaScript.</li> <li>CO2: To gain knowledge on designing static and dynamic web pages.</li> <li>CO3: Able to validate web pages at client-side.</li> <li>CO4: Gain knowledge on server-side scripting.</li> <li>CO5: Create components, routing and forms validations etc.</li> </ul>
	B) – Lab on Data Analytics – I	<ul> <li>CO1: To develop pivot tables and understand the validating &amp; auditing techniques.</li> <li>CO2: To understand different formatting techniques in MS Excel.</li> <li>CO3: To give an overview of the capabilities of popular statistical software packages.</li> <li>CO4: To give hands on experience about the practical approach of Advanced Excel.</li> </ul>

	C) Lab on	• CO1: Apply the algorithms for drawing 2D transformation
	Computer Graphics	• CO2: Discuss various algorithms for scan conversion and
		filling
		• CO3: Develop program for 3D transformation
		• CO4: Implement various clipping algorithms
		• CO5: Develop program to create curve using algorithm
		SEMESTER -VI
		<ul> <li>CO1. Define and use common System Analysis and Design fundamental terminology.</li> <li>CO2. Utilize current Analysis and Design tools to</li> </ul>
		graphically characterize processes and flows in a business
CA6.1	System Analysis & Designing	<ul> <li>CO3. Design and create effective Input/output including Web pages/forms.</li> </ul>
		• CO4. Design Logical Databases.
		• CO5. Demonstrate the technical and communication skills required for developing a Systems Proposal.
		• CO1: Understand the history and benefits of Linux.
		• CO2: Navigate and manage the Linux file system.
		• CO3: Create and manage user accounts, groups, and
CA6.2	Linux Operation	permissions
CA0.2	System	• CO4: Use command-line tools for file manipulation and
		maintenance.
		• CO5: Modify system configuration files and schedule tasks.
		CO1: Describe different .NET technologies
		• CO2: Explain Web services & HTTP Application
	Ase Not	CO3: Explain ASP.NET Control and Master Pages
CA6.3	Asp .Net Programming	• CO4: Understand the concept of .Net Framework
	Tiogramming	• CO5: Develop the console and GUI applications using ASP
		.Net
		• CO1: To Understand the concept HTML, CSS and
		JavaScript.
		• CO2: To understand the Angular Forms, inputs, Components
	A) Web	and Directives
	Development	CO3: Demonstrate how to Design Responsive Websites
CA6.4	Technologies II	Using Bootstrap.
		• CO4: Understanding of MongoDB and NoSQL data model.
		• CO5: Understanding of MongoDB Architecture and Shell.
		• CO1: To introduce the software R and how to write
	D) Date Analytics	elementary programs
	B) Data Analytics	• CO2: To demonstrate how statistical models are
	11	implemented and applied.
		• CO3: To import, manage and structure data files.

		• CO4: To write simple program scripts for data analysis produce illustrative data plots and carry out statistical tests
	C) User Interface Designing	<ul> <li>CO1: Recall the basic concept of HTML and CSS.</li> <li>CO2: To Describe Node JS and traditional web server</li> <li>CO3: To Define control statements including conditionals, loops and arrays</li> <li>CO4: To Describe how to Use npm and manage node packages</li> </ul>
CA6.5	Mini Project Development	<ul> <li>CO1: Students will be able to apply their theoretical knowledge to practical problems and will be able to develop hands-on experience in software development.</li> <li>CO2: Students will understand how to apply programming knowledge for a real-world problem.</li> <li>CO3: Students will understand the documentation process regarding the Software Requirements Specification (SRS).</li> </ul>
CA6.6	Lab on ASP .Net Programming and Linux OS	<ul> <li>CO1: Understand the concept of Profiles/Themes using skin files</li> <li>CO2: Understands using different ASP.Net controls.</li> <li>CO3: Understand the concept of master page and navigation controls</li> <li>CO4: Understand the concept of use of ADO .NET</li> <li>CO5: Understand Linux startup and shutdown procedures.</li> <li>CO6: Navigate, manage, and maintain the Linux file system.</li> <li>CO7: Configure Linux environment variables and system files.</li> </ul>
CA6.7	A) - Lab on Web Development Technology-II	<ul> <li>CO1: Develop Angular programs using basic features.</li> <li>CO2: Develop dynamic Web applications using Angular modules</li> <li>CO3: Make use of form validations and controls for interactive applications</li> <li>CO4: Understand the designing library like Bootstrap</li> <li>CO5: Develop highly scalable and cost-efficient applications with MongoDB.</li> </ul>
	B) – Lab on Data Analytics – II	<ul> <li>CO1: To provide basic knowledge of R Syntax.</li> <li>CO2: To provide practical experience of Data analysis using R.</li> <li>CO3: To provide practical insight of using R to calculate descriptive statistics</li> </ul>
	C) Lab on User Interface Designing	<ul> <li>CO1: Demonstration of hands-on experience on Typescript and Node js.</li> <li>CO2: Recall the tag of HTML5 and CSS3</li> <li>CO3: To implement Build in Modules and User Define Module in Node Js</li> </ul>

		• CO4: To Implement Node js with different File System		
		module		
	SEMESTER –VII			
CA7.1	Software Engineering	<ul> <li>CO1: Understand the Fundamentals of Software Engineerins</li> <li>CO2: Analyze and Specify Software Requirements</li> <li>CO3: Design Software Systems Using Appropriate Methodologies</li> <li>CO4: Implement Software Testing, Quality Assurance, and Maintenance</li> </ul>		
CA7.2	Android Application Development	<ul> <li>CO1: Understand the fundamental concepts of mobile application development and gain insight into handheld devices, mobile operating systems, and Android platform architecture.</li> <li>CO2: Set up the Android development environment and demonstrate the ability to create simple Android applications, utilizing Android components like Activities, Services, Broadcast Receivers, and Content Providers.</li> <li>CO3: Design and develop interactive Android User Interfaces using various UI components, layouts, event handling techniques, and menus to ensure an intuitive user experience.</li> <li>CO4: Implement advanced Android features such as drag-and-drop, notifications, location-based services, and integration of email, SMS, and phone functionalities within an Android application.</li> <li>CO5: Design and manage databases in Android applications using SQLite to store, retrieve, and manage data, and integrate databases effectively within the application's flow.</li> </ul>		
CA7.3	Artificial Intelligence	<ul> <li>CO1: Define the basic concepts of Artificial Intelligence and its related terminology.</li> <li>CO2: Explain different types of AI problems, problem spaces, and search strategies.</li> <li>CO3: Apply heuristic search techniques like Hill Climbing, Best-First Search, and Means-Ends Analysis.</li> <li>CO4: Analyze various approaches to knowledge representation and their challenges.</li> </ul>		
CA7.4	A) Web Development Technologies III	<ul> <li>CO1: Build scalable web apps using advanced frontend tools and build pipelines.</li> <li>CO2: Work with cloud-based services and APIs to enrich user experiences.</li> <li>CO3: Apply containerization, CI/CD, and DevOps tools in web app deployment.</li> <li>CO4: Implement real-time web applications and progressive web apps (PWAs).</li> </ul>		
	B) Data Analytics	• CO1:To introduce students to modern BI tools: Power BI		

	III	<ul> <li>and Tableau</li> <li>CO2:To enable data cleaning, modeling, visualization, and storytelling</li> <li>CO3:To equip students with dashboard design skills using real data</li> <li>CO4:To provide a foundation for analytics careers or further study</li> </ul>
	C) Digital Image Processing	<ul> <li>CO1: Understand the Basics of Digital Image Processing</li> <li>CO2: Apply Image Enhancement Techniques</li> <li>CO3: Analyze and Implement Image Restoration Techniques</li> <li>CO4: Evaluate and Implement Image Segmentation Methods</li> </ul>
CA7.5	Lab on Android Application Development	<ul> <li>CO1: Install and configure the Android development environment using Android Studio, SDK tools, and cross- platform IDEs, and set up a C compiler in a virtual environment using VirtualBox.</li> <li>CO2: Design and develop Android user interfaces using layouts, views, widgets (e.g., DatePicker, Spinner, RadioButtons), and demonstrate event handling with various UI components.</li> <li>CO3: Implement core Android components such as Activities, Intents (Implicit and Explicit), Dialogs, and Menus to build interactive mobile applications and manage navigation and communication between components.</li> <li>CO4: Apply data persistence in Android applications by using SQLite databases and content providers to perform insert, update, delete, and retrieve operations effectively.</li> </ul>
CA7.6	Lab on Artificial Intelligence using Python	<ul> <li>CO1: Understand basic AI concepts and terminology using Python.</li> <li>CO2: Solve AI problems using search techniques and heuristics.</li> <li>CO3: Apply logical reasoning using rule-based systems and inference.</li> <li>CO4: Simulate uncertainty using probabilistic and fuzzy logic methods.</li> <li>CO5; Represent and use knowledge effectively in intelligent systems.</li> </ul>
CA7.7	(A) Web Development Technologies III	<ul> <li>CO1:Master Component Communication in Angular</li> <li>CO2: Build Forms and Validate User Input</li> <li>CO3: Develop and Connect to RESTful APIs with Databases</li> <li>CO4: Integrate Frontend with Backend</li> <li>CO5: Use Modern Development Tools and Real-Time Technologies.</li> <li>CO1: Import and clean data using Power BI tools</li> <li>CO2: Develop and model relationships in data, and use basic</li> </ul>

	<ul> <li>(B) Data Analytics III</li> <li>(C) Digital Image Processing</li> </ul>	<ul> <li>DAX expressions</li> <li>CO3: Create insightful visualizations using charts, cards, and tables</li> <li>CO4: Design interactive dashboards with slicers and filters in Power BI and Tableau</li> <li>CO5: Create Tableau dashboards and stories for business analysis and performance tracking.</li> <li>CO1: Develop scientific and strategic approach to solve complex problems in the domain of Computer Graphics and Digital Image Processing;</li> <li>CO2: Implement various algorithms for scan conversion, filling objects, 2-D and 3-D geometric transformations, viewing and clipping on graphical objects;</li> <li>CO3: Make use of MATLAB and Image Processing Toolbox to implement image transformation, image enhancement in spatial and frequency domain.</li> </ul>
		SEMESTER – VIII
CA8.1	Software Project Management	<ul> <li>CO1: Understand the activities during the project scheduling of any software application.</li> <li>CO2: Understand about risk management activities and the resource allocation for the projects</li> <li>CO3: Acquire knowledge and skills needed for the construction of highly reliable software project.</li> <li>CO4: Apply different techniques of project monitoring, control and review.</li> <li>CO5: Explain various project management scheduling techniques.</li> </ul>
CA8.2	Advanced DBMS	<ul> <li>CO1: Understand the basic concepts of databases, how they are structured, and how data is stored and managed.</li> <li>CO2: Understand how to protect databases using security methods like access control and encryption.</li> <li>CO3: Create and use different database objects like views, indexes, sequences, cursors, procedures, functions, and triggers.</li> <li>CO4: Learn how parallel and distributed databases work, and how they handle data and transactions.</li> <li>CO5: Get introduced to advanced database topics like object databases and XML, and understand their uses</li> </ul>
CA8.3	Machine Learning	<ul> <li>CO1: Understand and implement the supervised learning algorithms.</li> <li>CO2: Analyze and apply the machine learning concepts for different</li> <li>problems.</li> <li>CO3: Apply the clustering algorithms for various problems.</li> </ul>

		<ul> <li>CO4: Evaluate and test the performance of the learning algorithms.</li> <li>CO5: Design and create a learning model for real time applications.</li> </ul>
CA8.4	A) Information Security (Information, Cyber & Network)	<ul> <li>CO1: Identify key concepts related to information security, including confidentiality, integrity, and availability.</li> <li>CO2: Describe fundamental principles and practices of network security.</li> <li>CO3: Apply vulnerability scanning tools and penetration testing techniques to assess security in a controlled environment.</li> <li>CO4: Analyze firewall rules and configurations to identify potential weaknesses.</li> </ul>
	B) Internet of Things	<ul> <li>CO1: Recall fundamental concepts and understanding basic principles related to IoT security.</li> <li>CO2: To understand essentials of IoT Security.</li> <li>CO3: Implement interfacing of various sensors, actuators to the development boards.</li> <li>CO4: Implementing IoT systems using standard communication protocols and analyzing their</li> <li>effectiveness for interoperability and data exchange.</li> <li>CO5: Compare various IoT communication technologies and Design various IoT applications.</li> </ul>
	C) Current Computing Trends	<ul> <li>CO1: Recognize the characteristics, applications of big data that make it useful to real world problems.</li> <li>CO2: Discuss the challenges and their solutions in Big Data</li> <li>CO3: Understand and work on Hadoop Framework and eco systems.</li> <li>CO4: Explain and analyze the Big Data using Map-reduce programming in Hadoop</li> </ul>
CA8.5	Lab on Advanced DBMS	<ul> <li>CO1: Apply DDL and DML commands to create and manipulate relational database structures.</li> <li>CO2: Understand and implement normalization techniques to design efficient database schemas.</li> <li>CO3: Apply view creation, store procedure, function, cursor in SQL queries to modularize logic.</li> <li>CO4: Apply database connectivity concepts to integrate SQL operations with front-end</li> <li>Applications.</li> </ul>
CA8.6	Lab on Machine Learning	<ul> <li>CO1: Apply preprocessing, feature engineering, and model training in ML applications.</li> <li>CO2: Evaluate supervised learning models (regression, k-NN, SVM, Decision Trees, Naive Bayes) using performance metrics.</li> <li>CO3: Implement unsupervised learning (k-Means,</li> </ul>

		<ul> <li>Hierarchical Clustering) and dimensionality reduction (PCA).</li> <li>CO4: Develop artificial neural networks with backpropagation for classification tasks.</li> <li>CO5: Use basic NLP techniques (tokenization, stemming, lemmatization) with Python.</li> </ul>
	(A) Information Security (Information, Cyber & Network)	<ul> <li>CO1: Identify the basic structure and components of the DES encryption algorithm.</li> <li>CO2: Describe the AES encryption and decryption processes, including key sizes and block modes.</li> <li>CO3: Implement a digital signature scheme in a program and test it for signing and verifying data.</li> </ul>
CA8.7	(B) Internet of Things	<ul> <li>CO1: Recall the steps involved in installing operating systems on the Raspberry Pi</li> <li>CO2: Describe how each type of sensor works and its applications.</li> <li>CO3: Apply Wire IR sensors to a Raspberry Pi or Arduino board and ensure proper</li> <li>connections and functionality.</li> </ul>
	(C) Current Computing Trends	<ul> <li>CO1: Apply HDFS commands to manage file systems in a distributed environment</li> <li>CO2: Develop Java applications for interacting with HDFS to perform file operations.</li> <li>CO3:Utilize Hadoop's built-in commands for efficient file and directory management.</li> <li>CO4: Design and implement a pipeline of multiple MapReduce jobs for complex data workflows</li> <li>CO5:Formulate and execute HiveQL queries to retrieve and manipulate data stored in Hive.</li> </ul>