Master of Computer Application

Program Outcomes (POs):

1. **Scholarship of Knowledge**: Through rigorous coursework, research endeavors, and specialized study, students delve into the intricacies of their subject area, gaining a nuanced understanding that extends beyond foundational principles. Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.

2. **Critical Thinking and Analytical Skill**: Students emerge with the ability to systematically evaluate information, discern patterns, and synthesize complex concepts. This skill set empowers them to approach challenges with a discerning eye, fostering innovative problem-solving. Through rigorous coursework and practical applications, students hone their analytical prowess, enabling them to dissect problems, make informed decisions, and contribute meaningfully to their respective fields. This program outcome not only equips graduates for success in diverse professional environments but also underscores their capacity to navigate complexity, adapt to change, and contribute thoughtfully to the advancement of knowledge and practice in their chosen domains.

3. **Problem Analysis and Solving:** Students acquire the ability to methodically assess complex challenges, identifying root causes and potential solutions. Through practical applications and case studies, they refine their problem-solving techniques, fostering adaptability and resilience. This outcome not only equips graduates with the capacity to navigate diverse issues within their respective fields but also underscores their commitment to implementing effective, innovative solutions. As adept problem solvers, they contribute valuable insights and drive positive change, positioning themselves as resourceful and impactful professionals in a variety of industries and contexts.

4. **Research and Innovation:** the emphasis on innovation encourages the development of creative problem-solving and the translation of research findings into practical applications. This dual focus prepares graduates to be dynamic contributors in academia, industry, or other sectors, where they can actively participate in advancing their respective fields through the generation of new ideas, technologies, and methodologies. Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyse and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains.

5. **Collaborative and Multidisciplinary work:** Possess knowledge and understanding of group dynamics, recognise opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as

well as others. The student must be skilled to abridge the industry academia gap while studying. To develop proper corporate working environment in education.

6. **Ethical Practices and Social Responsibility:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

7. **Teamwork:** To transform a group into an effective, cohesive and collaborative unit. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. Enable learns to understand the stages of team development- Forming stage, Storming stage, Norming stage, Performing stage, and Adjourning stage. To set team norms set a standard for behaviour, attitude, and performance that all the learning group team members are expected to follow.

8. **Project Management and Finance:** Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.

9. **Lifelong Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. To incubate the culture of lifelong learning that is, self-initiated education focused on personal development. As natural learners to inculcate natural drive to explore natural curiosity, learn and grow and encourage us improve quality of life and sense of self-worth by paying attention to the contemporary ideas and goals. Encourage learners to self-learn giving rise to Renewed self-motivation, Recognition of personal interests and goals, Improvement in other personal and professional skills, Improved self-confidence, Stronger soft skills, Better cognitive health, Confidence, Networking opportunities.

10. **Entrepreneurship & Startupreneurship:** Practice process of planning, starting and operating a business venture. Making learners to get educated from the knowledge & skills perspectives, awareness and culture for entrepreneurship. This includes - training & education, business mentoring & coaching, financing (debt or equity), networking initiatives, framework conditions and policies. Inculcate startupreneurship to create and launch innovative products or services, Building a sustainable business model for long-term success.

Program Specific Outcomes (PSOs):

1. Design, develop and implement interdisciplinary application software projects to meet the demands of industry requirements using modern tools and technologies.
2. Analyze the societal needs to provide novel solutions through technological based research.
3. Understand and apply knowledge on analysis, design and development of applications in the computing discipline.
4. To gain critical understanding of hardware and software tools catering to the contemporary needs of IT industry.
5. Inculcate the knowledge of Engineering and Management principles to manage projects effectively and create innovative career path.
6. Enumerate technical skills in computer application fields.
7. Develop ability to utilize modern computer technologies, environments, and platforms in creating innovative career paths to be an entrepreneur, and contribution towards society.

Course Outcomes (COs):

Semester-I

Course Code/ Name	Course Outcomes
	Student will be able to:
MCA 101 Programming in C and data Structure	• Write, compile, and execute C programs with variable and functions. • Understand the relationship between arrays and pointers. • Analyse algorithms and algorithm correctness and to describe stack and queues. • Describe linked list operation with different searching and sorting techniques. • Have knowledge of treeand graphs concepts and traversal techniques.
MCA 102 Statistical Mathematics	• Understand fundamental concepts of statistics, including matrices and linear equations • Understand the concept of limits, continuity, and differentiability and partial derivatives to functions of multiple variables. • Perform hypothesis tests using Normal, Student's t, Chi-square, and F distributions. • Understand and apply the axioms of probability and its distribution. • Understand sets, subsets, power sets and apply basic proof techniques such as induction and proof by contradiction. • Understand basic data structures: stacks, queues, graphs, arrays, hash tables, trees.
MCA 103 Operating System and Architecture	• Understand the concept of buses and data movement among registers and processors. • Define various types of operating systems (Multitasking, Timesharing, Multithreading, Multiprogramming, Real-time). • Explore memory management without or with swapping or paging and segmentation. • Understand the need for inter-process synchronization and deadlock detection. • Understand file systems, directories, and file system implementation.
MCA 104 Information Technology	• Understand basic concept of modern communication and technology and its types. • Understand concept of information technology and its applications. • Understand artificial intelligence and neural network. • Define the concept and applications of IoT.
MCA 105 Communication Skills	• Demonstrate improvement through listening exercises for public speaking. • Demonstrate effective writing in various formats such as paragraphs, essays, reports, letters, articles, notices, agenda, and minutes. • Demonstrate understanding of etiquettes in verbal and non-verbal communication. • Participate effectively in group discussions. • Identify and understand different types of interviews.
MCA 106 C and DS Lab	• write programs that demonstrate the use of control structures and different loops.

	• write programs to manipulate arrays and strings. • design and implement a program that uses pointers to create and manipulate a queue, stack, trees, lists etc. • write programs to manipulate files. • Understand the concepts of dynamic memory allocation.
MCA 107 Operating System Lab	• Write programs of CPU scheduling and disk scheduling with their algorithms. • Write programs of memory allocation strategies and techniques • Write program of deadlock management, semaphores and dining philosopher problems.

Semester-II

Course Code/ Name	Course Outcomes
	Student will be able to:
MCA 201 Data Base Management System	• Describe the fundamental elements of relational database management systems with data models, database languages, transaction management, and overall system architecture. • Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL. • Design ER-models to represent simple database application scenarios • Improve the database design by normalization. • Familiar with basic database storage structures and access techniques • Understand file and page organizations, indexing methods including B tree, and hashing.
MCA 202 Computer Network	• Review the ISO-OSI model and layered network architecture and its protocols. • Understand error detection techniques such as parity checking, cyclic redundancy checks (CRC), and Hamming code. • Explore LAN technologies such as Ethernet (802.3 IEEE standard), Token Ring (802.5 IEEE standard), Token Bus (802.4 IEEE standard), FDDI protocol, and DQDB protocol. • Introduction to WANs, network routing, and routing tables. • Overview of wireless broadband networks technology.
MCA 203 Software Engineering and UML	• Understand different software engineering paradigms and all types of software lifecycle models. • Understand abstraction, modularity, and software architecture. • Comprehend the importance of software quality assurance. • Understand software testing fundamentals. • Understand the basics of UML and create Use Case Diagrams, Class Diagrams, State Diagrams, Sequence Diagrams, and Activity Diagrams.
MCA 204 Algorithm Design	• Understand the concept of abstract data types (ADT) like stack, queue, lists trees etc. • Understand binary trees and expression trees and perform binary tree traversals. • Understand the concepts of searching, sorting and hashing. • Represent graphs and perform depth-first and breadth-first traversals. • Apply divide and conquer principles in algorithms like merge sort, quicksort, binary search and other algorithms. • Apply backtracking to solve problems like the N-Queen's Problem etc.
MCA 205 Object oriented Programming with JAVA	• Understand basic OOPS concepts and data abstraction, encapsulation, inheritance in Java programming language. • Know the concepts of multithreading and exceptional handling. • Understand JDBC, the JDBC-ODBC bridge, connectivity models, resultset objects, and connecting to remote databases and understand concepts of Input Output streams. • Design webpages using HTML and JSP.
MCA 206	• Use an integrated development environment to write, compile, run, and

Java and OOPS Lab	test simple object-oriented Java programs. • Read and make elementary modifications to Java programs that solve real-world problems. • Validate input in a Java program. • Identify and fix defects and common security issues in code. • Document a Java program using Javadoc. • Use a version control system to track source code in a project.
MCA 207 Data Base Management System Lab	• Apply the basic concepts of Database Systems and Applications. • Use the basics of SQL and construct queries using SQL in database creation and interaction. • Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system. • Analyze and Select storage and recovery techniques of database system.

Semester-III

Course Code/ Name	Course Outcomes
	Student will be able to:
MCA 301 Data Mining	• Understand the motivation and importance of data mining in various domains. • Understand data warehouse architecture, implementation, and technology for data mining applications. • Demonstrate proficiency in data preprocessing techniques, including data cleaning, integration, transformation, reduction, discretization, and concept hierarchy generation. • Understand association rule mining concepts, with a focus on market basket analysis. • Explore applications and trends in data mining, including currently available tools.
MCA 302 Artificial Intelligence	• Understand the fundamental AI problems and the scope of AI applications. • Analyze general problem-solving methods and production systems. • Implement knowledge representation techniques using horn's clauses, semantic networks, frame systems, value inheritance, scripts, and conceptual dependency. • Implement game-playing algorithms such as the minimax search procedure, alpha-beta cutoffs, and additional refinements. • Understand probability theory, Bayes' theorem, and Bayesian networks in probabilistic reasoning.
MCA 303 Elective–I Web Technology	• Understand the Client/Server model and the fundamental concepts of the Internet, including IP, URL, ISP, DNS. • Know basic knowledge of HTML and CSS. • Implement Javascript inside HTML code. • Knowledge of XML. • Implement AJAX in HTML codes
MCA 303 Elective–I Python	• Demonstrate the use of variables, expressions, and statements in Python. • Understand conditionals in Python, including boolean values, operators, and various conditional structures and loop structures. • Work with tuples, including tuple assignment and using tuples as return values. • Understand Object-Oriented Programming (OOP) concepts in Python. • Learn file handling in Python, including reading and writing text files, and using the format operator.
MCA 303 Elective–I Introduction Data Science and Big Data	• Understand the fundamentals of Data Science and the Data Science process. • Understand multivariate analysis and create graphical representations using R, including bar plots, histograms, box plots, line plots, scatter plots, lattice plots, regression lines, and two-way cross-tabulation. • Explore Bayesian modeling, support vector and kernel methods, neuro-fuzzy modeling, and principal component analysis. • Provide an overview of Hadoop, comparing it to RDBMS and understanding HDFS components and block replication. • Understand concepts related to stream data model and architecture.
MCA 304	• Understand the concept of Soft Computing and distinguish it from Hard

Elective-II Soft Computing	Computing. • Explain the concept of supervised learning in Artificial Neural Networks. • Explore unsupervised learning in Artificial Neural Networks. • Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory. • Introduce basic concepts of Genetic Algorithms (GA), including encoding, fitness function, and reproduction.
MCA 304 Elective-II Machine Learning	• Develop a comprehensive understanding of fundamental machine learning concepts, including supervised learning, unsupervised learning, reinforcement learning, and various types of neural networks. • Gain practical skills in data preprocessing, which includes data cleaning, normalization, and feature selection or engineering to prepare data for machine learning algorithms. • Learn how to choose appropriate machine learning algorithms and models for different types of tasks, and develop proficiency in evaluating model performance using relevant metrics. • Acquire programming skills in popular machine learning libraries and frameworks such as Python's scikit-learn and TensorFlow, and implement machine learning algorithms from scratch. • Apply machine learning techniques to real-world problems and datasets, demonstrating the ability to solve practical challenges in various domains, such as image recognition, natural language processing, or recommendation systems. • Complete a machine learning project from start to finish, including problem formulation, data collection and preprocessing, model selection and training, and the presentation of results, to showcase practical experience in machine learning applications.
MCA 304 Elective-II Internet Of Things	• Understand the conceptual framework of IoT and its architectural view. • Explore data storage solutions for IoT and cloud-based services for IoT applications. • Discuss design principles for web connectivity in IoT. • Gain a deep understanding of the foundational concepts and principles of IoT, including the architecture, components, and the role of sensors, actuators, and communication protocols. • Learn about the security challenges and solutions in IoT, including encryption, authentication, and access control, and the importance of privacy considerations in IoT applications.
MCA 305 Elective-III Distributed Systems	• Understand the goals of Distributed Systems and the concepts of hardware and software in distributed environments. • Explore the concepts of threads, clients, and servers in distributed systems. • Explore object replication and different consistency models in distributed systems. • Examine types of distributed file systems, including Sun Network File System (NFS). • Implement Object-Oriented Programming in a distributed environment using technologies like Java RMI, OLE, ActiveX, Orbix, Visbrokes, and Object-oriented Programming with SOM.
MCA 305 Elective-III Computer	• Develop an awareness of ethical issues and dilemmas in the field of computer science and technology, including issues related to privacy, security, intellectual property, and social impact.

Ethics	• Build the ability to engage in ethical reasoning and critical thinking when confronted with ethical dilemmas, enabling students to analyze and evaluate potential courses of action. • Understand the legal and regulatory frameworks that govern technology and computer science, including copyright laws, data protection regulations, and cyber security standards. • Recognize the ethical responsibilities and obligations of technology professionals, including the importance of honesty, transparency, and accountability in their work. • Explore the social, cultural, and global implications of technology and how it can impact individuals, communities, and society as a whole. • Apply ethical theories and principles to analyze real-world case studies and engage in discussions to evaluate the ethical dimensions of various technological advancements and applications.
MCA 305 Elective-III Advanced Database	• Analyze the architecture of Object-Oriented and Object-Relational databases, including persistent programming languages and cache coherence. • Explore distributed query processing, optimization, distributed transaction modeling, concurrency control, deadlock, commit protocols, and design of parallel databases. • Discuss transaction processing monitors and shared disk systems. • Explore triggers in SQL and Event-Condition-Action (ECA) rules. • Study multimedia data formats, video data models, audio and handwritten data, and Geographic Information Systems (GIS). • Discuss commercial systems such as Oracle XXI and DB2 in the context of web database access.
MCA 306 Minor Project	• knowledge within the chosen area of technology for project development • Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach • Reproduce, improve and refine technical aspects for engineering projects • Work as an individual or in a team in development of technical projects • Report project related activities effectively to peers and mentors
MCA 307P Elective–I Web Technology	• Create web pages using XHTML and Cascading Style Sheets. • Build dynamic web pages using JavaScript (Client side programming). • Create XML documents and Schemas. • Understand, appreciate and effectively explain the underlying concepts of database technologies • Design and implement a database schema for a given problem-domain • Normalize a database • Populate and query a database using SQL DML/DDL commands.

Semester-IV

Course Code/ Name	Course Outcomes
	Student will be able to:

MCA 401 Elective–IV Advanced Web Technology	• Understand and implement responsive web design principles. • Use XSLT for transforming XML documents. • Integrate PHP and AJAX for sending data from a web application to a server. • Extract data from XML using JavaScript properties. • Integrate jQuery with AJAX for asynchronous data retrieval and updates.
MCA 401 Elective–IV Advanced Python	• Develop programs using an Integrated Development Environment (IDE). • Master advanced object-oriented programming (OOP) concepts in Python, including metaclasses, decorators, and abstract base classes (ABCs), and understand how to design and implement complex Python classes and hierarchies. • Understand the concepts of input/output in Python. • Write SQL statements for data manipulation. • Develop proficiency in using Python libraries and frameworks for specific domains, such as data science (e.g., NumPy, Pandas, Matplotlib, scikit-learn), web development (e.g., Django, Flask), or scientific computing (e.g., SciPy).
MCA 401 Elective–IV Big Data and Analytics	• Understand the evolution of Big Data. • Apply the K-means clustering method. • Understand advanced analytical theory and methods for association rules. • Introduction to stream concepts and stream data model. • Explore key-value stores, document stores, tabular stores, object data stores, and graph databases.
MCA 402 Elective-V Cloud Computing Technologies	• Define Cloud Computing and understand its fundamental concepts. • Distinguish between Cluster Computing and Grid Computing. • Examine major Cloud service providers, including Google App Engine, Amazon EC2, Microsoft Azure, Salesforce, and Clarizen. • Grasp the basics of virtualization and its types. • Provide an overview of security in Cloud Computing.
MCA 402 Elective-V Deep Learning	• Implement neural networks using TensorFlow. • Develop an in-depth understanding of neural networks, including feedforward neural networks, convolution neural networks (CNNs), recurrent neural networks (RNNs), and advanced architectures like transformers. • Apply batch normalization in deep networks. • Understand optimization techniques in deep learning. • Learn how to apply deep learning techniques to various real-world applications, such as computer vision, natural language processing (NLP), speech recognition, and reinforcement learning.
MCA 402 Elective-V Digital Marketing	• Gain a comprehensive understanding of the core concepts and principles of digital marketing, including the digital marketing landscape, channels, and strategies. • Learn how to optimize websites and online content for search engines, improve organic search rankings, and increase website traffic through keyword research and on-page and off-page SEO strategies. • Introduce SEM and paid platforms. • Develop proficiency in creating and executing social media marketing campaigns on platforms like Facebook, Instagram, Twitter, LinkedIn, and TikTok, including content creation, audience targeting, and engagement.

	• Understand the principles of paid advertising, including Google Ads (formerly AdWords), Bing Ads, and social media advertising, and learn how to create and manage PPC campaigns effectively.
MCA 403 Elective-VI Information Security	• Define Information Security and its critical characteristics. • Explore various threats, attacks, and legal, ethical, and professional issues in Information Security. • Identify and assess risks associated with systems and implement risk control measures. • Explore international security standards such as ISO 17799/BS7799 and NIST Models. • Explore security technologies, including Intrusion Detection Systems (IDS) and scanning tools.
MCA 403 Elective-VI Block Chain and Crypto-currency	• Gain a comprehensive understanding of block-chain technology, including its fundamental concepts, components, and how it enables secure, decentralized data storage and transactions. • Learn the basics of crypto-currencies, including their history, functioning, and the principles behind cryptographic security, digital wallets, and block-chain networks like Bitcoin. • Introduce Hyperledger and its importance. • Introduce Hyperledger Fabric, compare it with Ethereum, and discuss Hyperledger Iroha and its features. • Discuss the evolving landscape of Blockchain technology and its potential applications in various domains.
MCA 403 Elective-VI Mobile Computing	• Understand the basics of Mobile Computing and Wireless Computing. • Understand GSM protocols, connection establishment, frequency allocation, routing, mobility management, security, and GPRS architecture. • Study Mobile IP and its protocols. • Explore the characteristics, applications, and design issues of Ad-hoc networks(MANET). • Introduce Software Development Kits (SDKs) for mobile platforms.
MCA 404 Major Project	• Practice acquired knowledge within the chosen area of technology for project development • Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach • Reproduce, improve and refine technical aspects for engineering projects • Work as an individual or in a team in development of technical projects • Report project related activities effectively to peers and mentors
MCA 405P Elective-VI Advanced Web Technology	• Create web pages using XHTML and Cascading Style Sheets. • Build dynamic web pages using JavaScript (Client side programming). • Create XML documents and Schemas. • Understand, appreciate and effectively explain the underlying concepts of database technologies • Design and implement a database schema for a given problem-domain • Normalize a database • Populate and query a database using SQL DML/DDL commands.
MCA 405P Elective-VI Cloud Computing	• Understand the fundamental principles of cloud computing. • Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing. • Analyze the performance of Cloud Computing.

Technologies	• Understand the concept of Cloud Security. • Learn the Concept of Cloud Infrastructure Model.
MCA 405P Elective-VI Information Security	• Develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications. • Gain familiarity with prevalent network and distributed system attacks, defences against them, and forensics to investigate the aftermath. • Develop a basic understanding of cryptography, how it has evolved, and some key encryption techniques used today. • Develop an understanding of security policies (such as authentication, integrity and confidentiality), as well as protocols to implement such policies in the form of message exchanges. • Determine appropriate mechanisms for protecting information systems ranging from operating systems to database management systems and to applications.