

**Program Outcome (PO's): Master of Computer Application (MCA 2 Year degree Course), Affiliated from RGPV, Bhopal (MP)**

**PO1: Computing Knowledge - Apply knowledge of computing fundamentals, mathematical foundations, and domain-specific specialization to solve complex computing problems.**

**PO2: Problem Analysis - Identify, formulate, and analyze computing problems by reviewing research and using foundational principles of mathematics and computer science.**

**PO3: Design & Development of Solutions - Design and implement solutions for complex computing problems, developing software and system components that meet specified requirements with consideration for security, performance, and usability.**

**PO4: Research-Based Investigation - Use research-based knowledge, including experiment design, data analysis, and synthesis of information, to investigate and provide solutions to advanced computing problems.**

**PO5: Modern Tools Usage - Select and apply modern software tools, technologies, and resources, including modeling and simulation, with an understanding of their limitations in various computing tasks.**

**PO6: Social and Professional Awareness - Assess and understand societal, health, safety, and ethical issues in the context of professional computing practice, taking responsibility for impacts on society.**

**PO7: Environment & Sustainability - Recognize the impact of computing solutions on the environment and promote sustainable practices within the industry.**

**PO8: Ethics - Apply ethical principles, commit to professional ethics, and follow regulatory standards and norms in computing practice.**

**PO9: Individual & Teamwork - Work effectively as both an individual contributor and a team leader in diverse, multidisciplinary settings.**

**PO10: Communication - Communicate effectively in professional contexts, including writing technical reports, preparing design documentation, making presentations, and collaborating with stakeholders.**

## Mapping of Course Outcomes with Program Outcomes

### MCA 1<sup>st</sup> Semester

Subject Code	Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5
MCA 101	CO1(a): Ability to understand and define the concepts of C programming with its basic concepts.	3	2	3	1	2
	CO1(b): Analyze the concepts of arrays and pointers and implement types of arrays along with pointers using C programming.	3	3	2	1	2
	CO2: Implement different types of data structures using programming techniques and analyze the concepts of algorithm evaluation to find time and space complexities for searching and sorting algorithms.	2	2	2	1	2
	CO3: Apply and analyze linked lists with their types.	3	2	2	1	2
	CO4: Analyze various tree traversal techniques and implement them using linked list representation.	2	2	2	1	2
MCA 102	CO1(a): Understand the concept of matrices and their applications to solve linear equations and eigenvalue problems as well.	3	2	2	2	1
	CO1(b): Demonstrate the knowledge of limits, functions, differentiability, partial derivatives, and beta-gamma functions with their applications.	3	3	2	2	1
	CO2: Understand the concept of hypothesis testing and applications of distributions (normal, student's t, Chi-square, and F-distributions) for testing mean, variance, and proportions, as well as tests for independence of attributes and goodness of fit.	3	3	2	2	1
	CO3: Understand the concept of probability and probability distributions, including laws of probability, conditional probability, probability mass and density functions, binomial, Poisson, and normal distributions, and their properties.	3	2	2	2	1
	CO4: Understand the concept of discrete mathematics, including set theory, countability, induction methods, basic propositional logic, basic data structures, and their properties.	3	3	2	2	1
MCA 103	CO1(a): Able to identify the basic structure of a processor, memory, and instructions to analyze the working of a system.	3	2	2	1	1
	CO1(b): Understand and apply the basic knowledge of operating systems like kernel, shell, and types of operating systems.	3	2	2	1	2
	CO2: Analyze various synchronization and process scheduling algorithms (FCFS, SJF, RR, SRTF) based on turnaround time and waiting time.	3	3	3	2	2
	CO3: Apply page replacement algorithms (LRU, FIFO, Optimal) to resolve issues in virtual memory and understand various memory management techniques.	3	2	3	1	2

	CO4: Design the concept of disk management and analyze different disk scheduling algorithms (FCFS, SSTF, SCAN, etc.) for better utilization of external memory and apply file management operations.	3	3	3	2	2
MCA 104	CO1(a): Learn the fundamentals of wireless communication in the modern world.	3	2	2	1	2
	CO1(b): Classify various security algorithms and understand their concepts and applications.	3	3	2	2	2
	CO2: Understand the fundamental concepts of Artificial Intelligence and its applications across different domains.	3	3	3	2	3
	CO3: Understand the working of Smart Systems and their integration with IoT to create intelligent and automated environments.	3	2	3	2	3
	CO4: Explain the concept of cloud computing and its importance in modern IT infrastructure and services.	3	2	2	1	3
MCA 105	CO1(a): Develop active listening skills by understanding barriers, approaches, and techniques to improve listening, and demonstrate effective speaking skills including paralanguage, stress, intonation, and public speaking.	2	3	2	1	2
	CO2(b): Demonstrate effective reading strategies to enhance comprehension, overcome reading difficulties, and apply these strategies to diverse reading materials. Apply structured writing skills in various formats, such as paragraphs, essays, reports, letters, articles, notices, and formal documents.	3	3	2	1	2
	CO2: Understand and apply principles of communication, including modes of communication, identifying and overcoming communication barriers, and enhancing interpersonal and non-verbal communication skills.	3	2	2	1	2
	CO3: Develop and demonstrate group dynamic skills, including group discussion, team building, leadership, decision-making, creativity, and management of time and stress.	2	3	3	1	2
	CO4: Prepare for different types of interviews by creating an effective CV, understanding interview structures, practicing through mock interviews, and employing techniques to succeed in professional interviews.	3	2	3	1	2
MCA 106	CO1a: Ability to understand & define the concepts of C programming with its basic concepts	3	2	3	1	2
	CO1b: Analyze the concepts of arrays and pointers, and implement types of arrays along with pointers using C programming	3	3	2	1	2
	CO2: Implement different types of data structures using programming techniques and analyze algorithm evaluation to determine time and space complexities for searching and sorting algorithms	2	3	3	2	3
	CO3: Apply and analyze linked lists and their types	3	2	2	1	2
	CO4: Analyze various tree traversal techniques and implement them	2	2	3	1	2

	using linked list representation					
MCA 107	CO1a: Develop and implement various CPU scheduling algorithms such as FCFS, SJF, Priority, and Round Robin. Understand the workings and applications of each algorithm in process scheduling.	3	3	3	1	2
	CO1b: Implement solutions to classical inter-process communication problems.	3	3	3	1	2
	CO2: Develop and compare various page replacement algorithms to understand their efficiency in managing virtual memory. evaluation and find Best fit, first fit and worst fit for algorithms.	3	3	3	2	2
	CO3: Implement and compare different disk and drum scheduling algorithms	3	3	3	2	2

### MCA 2<sup>nd</sup> Semester

Subject Code	Course Outcomes (COs)	P01	P02	P03	P04	P05
MCA 201	CO1A: Understand database concepts, architectures, and analyze database requirements using ER modeling	3	2	1	-	1
	CO1B: Apply relational database concepts and write complex SQL queries including PL/SQL programming	3	2	3	1	2
	CO2: Implement database design principles using normalization techniques and functional dependencies	3	3	2	2	1
	CO3: Analyze transaction management, concurrency control, and recovery mechanisms in database systems	3	2	2	2	2
	CO4: Evaluate emerging database technologies including object-oriented databases, data warehousing, and multimedia databases	2	2	1	3	3
MCA 202	CO1A: Understand fundamental concepts of computer networks, network architecture, and transmission protocols	3	2	1	1	2
	CO1B: Analyze data security mechanisms and implement various error detection and correction techniques	3	3	2	2	2
	CO2: Evaluate different types of Local Area Networks and their interconnection methods	2	3	2	2	2
	CO3: Apply routing algorithms and understand TCP/IP protocols in Wide Area Networks	3	3	3	2	2
	CO4: Analyze wireless broadband technologies, standards, and protocols for modern communication systems	2	2	2	3	3
MCA 203	CO1A: Understand software engineering concepts and implement various software development life cycle models	3	2	3	1	2
	CO1B: Apply software design principles and create efficient software architectures	2	3	3	2	2
	CO2: Evaluate software metrics and implement software quality assurance techniques	2	3	2	3	2

	CO3: Implement various software testing strategies and maintain software systems effectively	2	2	3	2	2
	CO4: Design and develop system models using UML diagrams and apply them in real-world applications	2	2	3	2	3
MCA 204	CO1A: Implement and analyze various linear data structures and their applications	3	3	2	1	1
	CO1B: Apply non-linear data structures and evaluate different searching and sorting techniques	3	3	2	2	1
	CO2: Analyze graph algorithms and implement various tree structures for efficient data organization	3	3	2	2	1
	CO3: Design algorithms using different paradigms and analyze their time complexity	3	3	3	2	2
	CO4: Evaluate advanced algorithm design techniques and understand complexity classes	3	3	2	3	2
MCA 205	CO1A: Apply object-oriented programming concepts and develop Java applications	3	2	3	1	2
	CO1B: Implement multithreading and exception handling mechanisms in Java programs	3	2	3	1	2
	CO2: Develop applications using Java I/O, JDBC, and Collections framework	3	2	3	2	3
	CO3: Create graphical user interfaces using AWT and Swing components	2	2	3	1	3
	CO4: Design and develop web applications using Servlets, JSP, and Struts framework	2	2	3	2	3

### MCA 3<sup>rd</sup> Semester

Subject Code	Course Outcomes (COs)	P01	P02	P03	P04	P05
MCA 301	CO1A: Understand fundamental concepts of data mining, its functionalities, and analyze different types of data and data mining systems	3	2	-	1	1
	CO1B: Comprehend data warehouse architecture, OLAP technology, and multidimensional data models for effective data analysis	3	2	1	2	2
	CO2: Apply various data preprocessing techniques including cleaning, integration, transformation, and reduction methods	2	3	2	2	2
	CO3: Implement association rule mining algorithms and analyze market basket analysis using Apriori algorithm	2	3	3	2	2
	CO4: Evaluate different classification, prediction, and clustering methods along with their applications in real-world scenarios	2	3	3	3	2

MCA 302	CO1A: Understand core concepts of AI, its characteristics, and implement basic LISP programming concepts	3	2	1	-	2
	CO1B: Apply various problem-solving strategies including forward/backward chaining and heuristic search techniques	2	3	2	1	2
	CO2: Implement different knowledge representation techniques using predicate logic, semantic networks, and frames	3	2	3	2	2
	CO3: Analyze natural language processing techniques and develop game playing strategies using minimax algorithm	2	3	3	2	2
	CO4: Apply probabilistic reasoning, understand expert systems, and implement various learning mechanisms	2	3	3	3	2
MCA 303-1	CO1A: Understand Python fundamentals including data types, variables, expressions, and basic programming constructs	3	2	-	1	1
	CO1B: Implement control structures, functions, and string manipulation techniques in Python programs	3	1	1	-	1
	CO2: Design programs using lists, tuples, dictionaries, and advanced list processing techniques	3	2	2	-	2
	CO3: Apply object-oriented programming concepts including classes, inheritance, and methods in Python	2	2	3	1	2
	CO4: Implement file handling, exception handling, and develop modular programs using packages	2	2	3	1	2
MCA 303-2	CO1A: Understand internet fundamentals, client-server model, and principles of effective web design	3	1	1	-	2
	CO1B: Develop web pages using HTML and enhance their appearance using CSS	2	2	3	-	2
	CO2: Create interactive web pages using JavaScript and implement client-side form validations	2	2	3	1	2
	CO3: Design and develop XML documents with DTD, Schema, and implement XML transformations using XSLT	2	2	3	2	2
	CO4: Implement AJAX applications and understand web services architecture and its benefits	2	2	3	2	3
MCA 303-3	CO1A: Understand fundamentals of data science, big data concepts, and statistical analysis techniques	3	2	1	2	1
	CO1B: Apply various data analysis techniques using R programming for univariate and multivariate analysis	2	3	2	2	2
	CO2: Implement data modeling techniques including Bayesian modeling and work with NoSQL databases	2	3	2	2	2
	CO3: Utilize various data analytical frameworks including Hadoop, MapReduce, and Spark	2	2	3	2	3
	CO4: Analyze streaming data and implement various stream analytics techniques	2	2	3	3	3

MCA 304-1	CO1A: Understand machine learning fundamentals, data preprocessing techniques, and types of learning	3	2	1	2	1
	CO1B: Implement neural networks with different activation functions and optimization techniques	2	3	2	2	2
	CO2: Design and develop convolutional neural networks for various applications	2	3	3	2	3
	CO3: Apply recurrent neural networks and reinforcement learning algorithms	2	3	3	2	3
	CO4: Implement support vector machines and develop applications in computer vision and NLP	2	3	3	3	3
MCA304-2	CO1A: Understand soft computing concepts and artificial neural network architectures	3	2	1	2	1
	CO1B: Implement supervised learning algorithms including backpropagation and Hopfield networks	2	3	2	2	2
	CO2: Apply unsupervised learning techniques including Hebbian learning and Kohonen networks	2	3	3	2	2
	CO3: Design fuzzy logic systems and implement fuzzy logic controllers	2	3	3	2	2
	CO4: Apply genetic algorithms for optimization problems and understand genetic programming	2	3	3	3	2
MCA304-3	CO1A: Understand IoT fundamentals, characteristics, and architectural frameworks	3	1	1	1	2
	CO1B: Apply M2M communication concepts and implement IoT cloud-based services	2	2	2	1	3
	CO2: Implement web communication protocols and understand internet connectivity principles for IoT	2	2	3	1	3
	CO3: Work with various sensor technologies and communication protocols in IoT	2	2	3	2	3
	CO4: Design IoT solutions considering security aspects and implement using Raspberry Pi/Arduino	2	2	3	2	3
MCA305-1	CO1A: Understand fundamental concepts of ethics and their importance in IT profession	3	1	1	1	-
	CO1B: Analyze computer security incidents and implement privacy protection measures	2	2	2	1	2
	CO2: Evaluate intellectual property rights and freedom of expression in digital context	2	2	2	2	1
	CO3: Understand software development ethics and impact of IT on productivity	2	2	2	2	1
	CO4: Analyze ethical issues in social networking and organizational IT practices	2	2	2	2	2

MCA 305-2	CO1A: Implement object-oriented and object-relational database concepts	3	2	2	1	2
	CO1B: Design and develop deductive, parallel, and distributed databases	2	2	3	2	2
	CO2: Apply advanced transaction processing models and concepts	2	3	3	2	2
	CO3: Implement active database concepts and real-time database systems	2	3	3	2	2
	CO4: Design and develop multimedia databases and web databases	2	3	3	2	3
MCA 305-3	CO1A: Understand distributed systems concepts and implement client-server models	3	2	2	1	2
	CO1B: Apply process synchronization techniques in distributed systems	2	3	2	1	2
	CO2: Implement consistency models and security mechanisms in distributed systems	2	3	3	2	2
	CO3: Design and develop distributed object-based and file systems	2	2	3	2	2
	CO4: Implement distributed shared memory systems and coordinate-based systems	2	2	3	2	3

#### MCA 4<sup>th</sup> Semester

Subject Code	Course Outcomes (COs)	P01	P02	P03	P04	P05
MCA 401-1	CO1A: Understand fundamental Python programming concepts including data types, functions, and control structures while developing programs using IDE.	3	2	2	-	2
	CO1B: Apply Object-Oriented Programming concepts in Python by implementing classes, inheritance, polymorphism, and handling exceptions.	3	2	3	-	2
	CO2: Implement file handling operations and error handling mechanisms in Python applications.	2	2	3	-	2
	CO3: Develop database applications using Python with SQL integration and create basic GUI applications.	3	2	3	-	3
	CO4: Apply Python libraries (NumPy, Pandas, Matplotlib, Scikit-learn) for data analysis, visualization, and machine learning implementations.	3	3	3	2	3
MCA 401-2	CO1A: Design responsive web applications using Bootstrap framework components and plugins.	3	2	3	-	3
	CO1B: Develop XML applications with proper structure and apply XSLT transformations.	3	2	3	-	2



	CO2: Create dynamic web applications using AJAX and integrate with PHP for server-side processing.	3	2	3	-	3
	CO3: Handle XML data using PHP and AJAX, and implement web services using different protocols.	3	2	3	1	3
	CO4: Develop interactive web applications using jQuery for DOM manipulation, events handling, and AJAX integration.	3	2	3	-	3
MCA 401-3	CO1A: Understand Big Data characteristics, architecture, and implement MapReduce programming model.	3	2	2	2	3
	CO1B: Apply clustering and classification techniques for data analysis using various algorithms.	3	3	2	3	3
	CO2: Implement association rules and recommendation systems for data mining applications.	3	3	3	3	3
	CO3: Analyze streaming data and implement real-time analytics applications.	3	3	3	3	3
	CO4: Work with NoSQL databases and visualization tools for big data management and analysis.	3	2	3	2	3
MCA 402-1	CO1A: Implement neural networks using various learning algorithms and TensorFlow framework.	3	3	3	2	3
	CO1B: Design and develop Convolutional Neural Networks for image processing applications.	3	3	3	2	3
	CO2: Apply deep learning concepts and understand the differences between deep and shallow networks.	3	3	2	3	3
	CO3: Optimize deep neural networks using various techniques and implement recurrent neural networks.	3	3	3	2	3
	CO4: Develop applications using deep reinforcement learning algorithms and techniques.	3	3	3	3	3
MCA 402-2	CO1A: Understand cloud computing fundamentals, architectures, and various service providers.	3	2	-	2	3
	CO1B: Compare different types of cloud models and their applications in various scenarios.	3	3	2	2	2
	CO2: Analyze different cloud services and implement applications using various service providers.	3	2	3	2	3
	CO3: Apply virtualization concepts and techniques in cloud computing environments.	3	2	3	-	3
	CO4: Implement security measures and identify security challenges in cloud computing.	3	3	3	2	3
MCA 402-3	CO1A: Understand digital marketing fundamentals and implement SEO strategies.	2	2	2	1	3
	CO1B: Apply on-page and off-page optimization techniques for website ranking.	2	2	3	1	3

	CO2: Create and manage search engine marketing campaigns using various platforms.	2	2	3	2	3
	CO3: Implement content marketing strategies and social media marketing campaigns.	2	2	3	2	3
	CO4: Design remarketing campaigns and analyze digital marketing performance using various tools	2	3	3	2	3
MCA 403-1	CO1A: Understand information security fundamentals and implement security in SDLC.	3	3	3	2	2
	CO1B: Analyze security threats and implement access control mechanisms.	3	3	3	2	2
	CO2: Apply risk management techniques and implement information flow control.	3	3	3	2	2
	CO3: Design security architectures following various security standards and models.	3	2	3	2	3
	CO4: Implement physical security measures and use various security technologies.	3	2	3	1	3
MCA 403-2	CO1A: Understand blockchain fundamentals and implement various consensus mechanisms.	3	2	2	2	3
	CO1B: Analyze cryptocurrency systems and implement Ethereum-based applications.	3	2	3	2	3
	CO2: Work with various digital tokens and implement smart contracts.	3	2	3	1	3
	CO3: Develop applications using Solidity and Hyperledger platforms.	3	2	3	2	3
	CO4: Compare different blockchain platforms and implement blockchain frameworks.	3	3	3	2	3
MCA 403-3	CO1A: Understand mobile computing fundamentals and wireless communication technologies.	3	2	-	2	3
	CO1B: Analyze telecommunication systems and implement GSM-based applications.	3	2	2	2	3
	CO2: Implement mobile network layer protocols and wireless LAN applications.	3	2	3	1	3
	CO3: Design and develop mobile ad-hoc network applications.	3	3	3	2	3
	CO4: Create mobile applications for different platforms and implement mobile payment systems.	3	2	3	1	3