Teerthanker Mahaveer University
College of Computing Sciences & IT

MCA (Master of Computer Applications)

Programme Outcome

PO-1	:	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO-2	:	Problem analysis& Solving: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-3	:	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO-4	:	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO-5	:	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO-6	:	Social Interaction & effective citizenship: 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.
PO-7	:	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	:	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO-9	:	Attitude (Individual and team work): Function effectively as an individual, and as member or leader in diverse teams, and in multidisciplinary settings.
PO-10	:	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clean instructions.
PO-11	:	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO-12	:	Life-long 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.

Programme Specific Outcome

PSO-1	:	Understanding of the fundamentals of computer applications to establish themselves as computer and IT professionals in the IT and IT Enabled Service industry
PSO-2	:	Applying analytical and technical skills for a continued life-long learning, teaching and research. and will be prepared to be accepted to complete advanced degree programs such as M.Tech/M.S./M.Phil./Ph.D.
PSO-3	:	Analyzing developed industry software projects for various technical or application areas and production & maintenance of computer systems.
PSO-4	:	Developing software projects for industries and physical systems. In addition, Developing communication & soft skills to deal with IT/ corporate environment.

Course Outcomes

MCA116	CO-1	Understanding about various operating systems and the functions and services provided by the operating system.
	CO-2	Understanding the process management, process concepts and how process synchronized.
	CO-3	Understanding the detailed operation deadlock and deadlock characterization.
	CO-4	Understand different memory management techniques like paging segmentation etc.
	CO-5	Analyzing the working and functions various operating systems.
MCA 117	CO-1	Understanding the basic concept of algorithm analysis, complexity, growth function, and sorting in polynomial time & in linear time.
	CO-2	Understanding the concept of graph algorithms as well as shortest path computation.
	CO-3	Understanding the concept of advanced design and analysis techniques like dynamic programming, matrix chain multiplication etc.
	CO-4	Understanding the concept of advanced data structure like RB tree, Fibonacci heap etc.
	CO-5	Understanding randomized string matching algorithms like Naïve algorithm, string matching with finite automata, and NP hard & NP complete problems.
MCA 118	CO-1	Understanding the basics of data base systems, structure and architecture.
	CO-2	Understanding the relational data model and its different important terms like integrity and constraints.
	CO-3	Understanding the anomalies of database and removal of these anomalies using different normalization techniques.
	CO-4	Understanding different transaction processing concepts and serialization techniques.
	CO-5	Understanding different database recovery like shadow paging, deferred/ immediate updates and concurrency control techniques.
MCA 119	CO-1	Understanding of the basic structure and operation of a digital computer
	CO-2	Understanding the basics of hardwired and micro-programmed control of

			the CPU.
	CO-3		Understanding the concepts of processor organization, various I/O devices and the I/O interface.
	CO-4		Applying binary arithmetic to perform various arithmetic operations using complement methods.
	CO-5		Applying concepts of memory control and I/O functions in the design of microprocessor chip.
MCA120	CO-1		Understanding the basics of English language, grammar and communication.
	CO-2		Understanding comprehension skills, business correspondence and presentation strategies.
	CO-3		Applying non-verbal means of communication in presentation.
	CO-4		Analyzing the different types of communication, report writing and interviews.
	CO-5		Analyzing the different types of sentence construction and the different modes of speech delivery.
MCA155	CO-1		Applying linear and polynomial time sorting algorithm to sort the elements.
	CO-2		Applying graph algorithms to find the shortest path in the graph.
	CO-3		Applying advanced design and analysis techniques like dynamic programming, matrix chain multiplication, greedy algorithm etc. to solve the real life problems.
	CO-4		Developing algorithms for real life problems.
	CO-5		Developing randomized string matching algorithms like Naïve algorithm, Rabin Karp algorithm etc.
MCA156	CO-1		Applying the concepts of DML operation to database table to complete different queries on database.
	CO-2		Applying the concepts of PL/SQL for creating functions and procedure.
	CO-3		Applying the concepts of PL/SQL for creating different triggers.
	CO-4		Developing the database for application software.
	CO-5		Developing the queries to access and update the database
MCA121	CO-1		Understanding types of computers and generations of computers.
	CO-2		Understanding the basic components of a computer system
	CO-3		Understanding the importance of input /output devices and memory.
	CO-4		Understanding the basics of application and system software.
	CO-5		Understanding the basics of number system.
MCA122	CO-1		Understanding the concept of C/ C++ programming.
	CO-2		Understanding the importance of data types and tokens used in C/ C++.
	CO-3		Understanding the importance of object oriented features.
	CO-4		Understanding the use of object and class in C++.
	CO-5		Understanding the use of constructor and destructor in C++.
MCA123	CO-1		Understanding the basic concept of human value and ethics.
	CO-2		Understanding the basics of relationship and physical facilities.
	CO-3		Understanding the importance of human value and ethics.
	CO-4		Understanding the needs of Self ('I') and 'Body'
	CO-5		Understanding harmony in the Family

TMUPS-101	**CO-1**	Utilizing effective verbal and non-verbal communication techniques in formal and informal settings	
	CO-2	Understanding and analyzing self and devising a strategy for self growth and development.	
	CO-3	Adapting a positive mindset conducive for growth through optimism and constructive thinking	
	CO-4	Utilizing time in the most effective manner and avoiding procrastination.	
	CO-5	Making appropriate and responsible decisions through various techniques like SWOT, Simulation and Decision Tree.	
	CO-6.	Formulating strategies of avoiding time wasters and preparing to-do list to manage priorities and achieve SMART goals.	
MCA224	**CO-1**	Understanding the basic concepts of software development life cycle and various process models of software development.	
	CO-2	Understanding the concepts of agile software development and the basics of requirements engineering using case study.	
	CO-3	Understanding the concepts of software design and to apply software design techniques with the help of flow charts, ERD and DFD.	
	CO-4	Understanding the concepts of coding approach, software testing, and software maintenance & software reliability.	
	CO-5	Analyzing various tools and techniques of coding approach, software testing, and software maintenance & software reliability.	
MCA225	**CO-1**	Understanding the concepts of network fundamentals and terminology.	
	CO-2	Understanding the principles of LAN design such as topology and configuration depending on types of users accessing the network.	
	CO-3	Understanding different type of network interfaces and their uses by identifying and using basic Network components, choosing appropriate network type and media.	
	CO-4	Understanding network industry standards such as the OSI model.,	
	CO-5	Analyzing routing Protocols and reverse address resolution protocols.	
MCA225	**CO-1**	Understanding the concepts of network fundamentals and terminology.	
	CO-2	Understanding the principles of LAN design such as topology and configuration depending on types of users accessing the network	
	CO-3	Understanding different type of network interfaces and their uses by identifying and using basic Network components, choosing appropriate network type and media.	
	CO-4	A understanding network industry standards such as the OSI model.,	
	CO-5	Analyzing routing Protocols and reverse address resolution protocols.	
MCA226	**CO-1**	Understanding the fundamentals of Computational theory and basic terminology used.	
	CO-2	Understanding basics of various machines used for computations like FSM, PDA, TM.	
	CO-3	Understanding the grammar, language, formation of regular expression in FA, minimization of FA and CFG.	
	CO-4	Applying the concepts to design various machines like FSM, PDA etc.	
	CO-5	Analyzing the efficiency of various machines based upon their functionality and limitations.	
MCA227	**CO-1**	Understanding the basic concept of object oriented programming.	

	CO-2	Understanding the detail concept of java in real life. Properties of hydrocarbons & quality improvements.
	CO-3	Understanding the concept of data types and conditional statement used in java.
	CO-4	Understanding application of java and its modules.
	CO-5	Analyzing the relationship between java and Data Analysis.
MCA228	CO-1	Understanding the concept of server-side web-based programming and the CGI environment.
	CO-2	Understanding the basics of web-based scripting languages, their advantages and problems.
	CO-3	Understanding the concept of searching and pattern matching using regular expressions.
	CO-4	Understanding the concept of implementation of a small web-based server-side application.
	CO-5	Understanding the some current technical and research issues in this field.
MCA257	CO-1	Understanding the execution of java in real life.
	CO-2	Analyzing the data from different datasets with different modules.
	CO-3	Developing different functions to search pattern in the files.
	CO-4	Developing the different modules to predict data.
	CO-5	Developing console application in Java
MCA258	CO-1	Understanding the structure and organization of computer networks; as well as relationships between the layers.
	CO-2	Analyzing various models of client/server and peer to peer models.
	CO-3	Analyzing transport layer protocols to design the network.
	CO-4	Developing data link frame to transfer data from one node to another node.
	CO-5	Developing error detection methods to detect the error during transmission of data from one node to another node
MCA259	CO-1	Developing server-side web-based program modules.
	CO-2	Developing program modules to solve the real life problems using web-based scripting languages.
	CO-3	Developing searching and pattern matching programming problems using regular expressions.
	CO-4	Developing a small web-based server-side application programming problems.
	CO-5	Developing the websites using HTML and java script
TMUPA-202	CO-1	Operationalizing the inter-related concept of Percentage in Profit Loss and Discount, Si/CI and Mixture/Allegation.
	CO-2	Employing the techniques of Percentage; Ratios and Average in inter related concepts of Time and Work
	CO-3	Applying the arithmetical concepts of Average, Mixture and Allegation.
	CO-4	Evaluating the different possibilities of various reasoning based problems in series, Blood relation, Direction and Puzzle Problems
	CO-5	Correlating the various arithmetic concepts to check sufficiency of data.
TMUPS-201	CO-1	Communicating effectively in a variety of public and interpersonal settings

	CO-2	Applying concepts of change management for growth and development by understanding inertia of change and mastering the Laws of Change.
	CO-3	Analyzing scenarios, synthesizing alternatives and thinking critically to negotiate, resolve conflicts and develop cordial interpersonal relationships
	CO-4	Functioning in a team and enabling other people to act while encouraging growth and creating mutual respect and trust.
	CO-5	Handling difficult situations with grace, style, and professionalism.
MCA332	CO-1	Understanding the basic concept of python programming language.
	CO-2	Understanding the object oriented programming concepts using Python
	CO-3	Understanding the important aspects related with string, lists and dictionary in python
	CO-4	Understanding various modules used in python
	CO-5	Applying the technical skill for designing user defined functions in python
MCA333	CO-1	Understanding the basics of Dot Net Framework with C#
	CO-2	Understanding the meaning and basic components of a Dot Net Framework with C#
	CO-3	Understanding the hands-on use of Dot Net Framework with C# applications in Web, Window and Console Application
	CO-4	Understanding the categories of programs, Web, Window and Console Application.
	CO-5	Understanding the use of the Dot Net Framework with C# programs to create professional, academic, and business software projects
MCA334	CO-1	Understanding the concepts of Internet of Things.
	CO-2	Understanding the building blocks of Internet of Things and characteristics
	CO-3	Understanding the application areas of IOT.
	CO-4	Understanding design, development, and security challenges of IoT.
	CO-5	Developing Internet of Things based applications in different domain
MCA361	CO-1	Applying the core python programming concepts like loop, if statement and other concept to create python program.
	CO-2	Applying the different collections such as list, tupple, dictionaries used in python to create python program.
	CO-3	Applying various functions used in python to create python program.
	CO-4	Developing the python programs by using the concept of class, inheritance and operator overloading
	CO-5	Developing the applications by using python programming concepts.
MCA362	CO-1	Applying the dot net framework with C# applications in web, window and console application.
	CO-2	Applying the dot net framework features to create personal, academic and business documents.
	CO-3	Developing the C# programs by using C# programming concept.
	CO-4	Developing the various business applications using dot net framework with C#

	CO-5	Developing the real life applications using dot net framework features.
MCA363	CO-1	Understanding the various stages of project development by Synopsis ,SRS and Project document
	CO-2	Understanding the basic concept of project by ER diagrams and DFDs.
	CO-3	Applying the test cases in the various modules of the project.
	CO-4	Developing the real life small projects by using the technical skills.
	CO-5	Developing the database design database queries for real life small projects.
MCA364	CO-1	Understanding the working environment of IT industries.
	CO-2	Understanding the various stages of project development .
	CO-3	Applying database queries for real life projects.
	CO-4	Developing technical skills for testing, maintaining, and deploying the software projects.
	CO-5	Developing real life projects for the industries.
MCA335	CO-1	Understanding the basic concepts of Android programming
	CO-2	Understanding Android Framework for application development
	CO-3	Applying event handling in android programming
	CO-4	Applying basic android styles and themes in android based applications.
	CO-5	Developing the android based applications for mobile phones.
MCA336	CO-1	Understanding the basics of R programming in terms of constructs, control statements, string functions
	CO-2	Understanding the use of R for regression analysis.
	CO-3	Applying R programming for Text processing
	CO-4	Applying the R programming from a statistical perspective
	CO-5	Developing the R programming based applications.
MCA337	CO-1	Understanding the basic concept of soft computing
	CO-2	Understanding fuzzy set, fuzzy rules, and fuzzy relations
	CO-3	Understanding the basic concept of genetic algorithm.
	CO-4	Applying fuzzy rules and relations for fuzzy based applications
	CO-5	Analyzing different kinds of artificial neural networks and their learning techniques.
MCA338	CO-1	Understanding the fundamental concepts of a digital image processing system.
	CO-2	Understanding the basic concept of morphological operations, image segmentation, and representation techniques
	CO-3	Understanding the techniques for image enhancement and image restoration.
	CO-4	Applying various image enhancement techniques to improve the quality of images.
	CO-5	Analyzing images in the frequency domain using various transforms
MCA339	CO-1	Understanding the basic architecture and principles of operation of computer systems and networks.
	CO-2	Understanding the network protocols, routing algorithms, connectivity methods and characteristics
	CO-3	Understanding the capabilities of next-generation networks and the role of wireless technologies in network design and operation.

	CO-4	Applying the wireless technologies in commercial and enterprise applications.
	CO-5	Analyzing various network protocols and routing algorithms
: **MCA340**	CO-1	Remembering vulnerability and the weaknesses of unsecured network.
	CO-2	Understanding information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of network security
	CO-3	Applying different encryption and decryption techniques to solve problems related to confidentiality and authentication
	CO-4	Analyzing and compare the performance of different encryption algorithms for verifying the integrity of varying message sizes.
	CO-5	Analyzing different digital signature algorithms to achieve authentication and create secure applications.
MCA341	CO-1	Understanding the basic concept Data Science and the skill sets needed to be a data scientist.
	CO-2	Understanding basic statistical modeling and analysis techniques.
	CO-3	Understanding the Data Science Process and its components.
	CO-4	Applying EDA and the Data Science process in a case study.
	CO-5	Applying basic machine learning algorithms like Linear Regression, k-Nearest Neighbors (k-NN), k-means, etc for predictive modeling.
MCA342	CO-1	Understanding the functionality of the various data mining and data warehousing component.
	CO-2	Understanding the strengths and limitations of various data mining and data warehousing models.
	CO-3	Understanding the analyzing techniques of various data.
	CO-4	Analyzing different approaches and techniques used in data mining and data ware housing.
	CO-5	Analyzing different approaches of classification and predictions techniques.
MCA343	CO-1	Understanding the basic concept of quantum model of computation.
	CO-2	Understanding the concepts, theories, models & techniques
	CO-3	Applying the algorithms to improve the performance of quantum computing.
	CO-4	Analyzing various quantum computing techniques.
	CO-5	Analyzing computing complexity of various quantum computing techniques.
MCA344	CO-1	Understanding the concepts of Natural Language, its architecture, algorithms and models.
	CO-2	Understanding the syntax of Natural Language.
	CO-3	Understanding the advanced features of natural language.
	CO-4	Applying natural language processing syntax and grammars in different types of applications.
	CO-5	Analysing semantics for creating grammar of the natural language.
TMUPA-302	CO-1	Applying the concepts of modern mathematics Divisibility rule, Remainder Theorem, HCF /LCM in Number System.
	CO-2	Relating the rules of permutation and combination, Fundamental Principle of Counting to find the probability.
	CO-3	Applying calculative and arithmetical concepts of ratio, Average and

		Percentage to analyze and interpret data.
	CO-4	Identifying different possibilities of reasoning based problems of Syllogisms and Coding-Decoding.
	CO-5	Employing the techniques of Percentage, Ratios and Average in inter related concepts of Time Speed and Distance.
MCA438	CO-1	Understanding the basic concepts of ASP.NET programming and working of different controls statements available in ASP.NET
	CO-2	Understanding the web services and WCF, WF application
	CO-3	Understanding the ASP.NET web application using Database.
	CO-4	Applying different validation controls in ASP.NET web application
	CO-5	Applying state management techniques in AP.NET web application.
MCA439	CO-1	Understanding the concept of Internet Programming, using Java Applets
	CO-2	Understanding the concept of creating the dynamic web pages using Servlets and JSP
	CO-3	Understanding the process of accessing database through Java programs, using java data base connectivity.
	CO-4	Understanding the multi-tier architecture of web-based enterprise applications using enterprise javabeans.
	CO-5	Applying Java Bean concepts to reuse software component.
MCA463	CO-1	Applying different validation controls in ASP.NET web application
	CO-2	Applying state management techniques in AP.NET web application
	CO-3	Developing Web application through ASP.NET.
	CO-4	Developing ASP.NET web based business applications.
	CO-5	Developing ASP.NET application by using AJAX.
MCA464	CO-1	Understanding Stateful, Stateless and Entity Beans.
	CO-2	Applying event handling on AWT and Swing components.
	CO-3	Developing dynamic web pages using Servlets and JSP
	CO-4	Developing the business applications using Java Applets
	CO-5	Developing the applications using menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, etc.
MCA465	CO-1	Applying the test cases in the various modules of the project.
	CO-2	Developing the real life projects by using the technical skills.
	CO-3	Developing the database design database queries for real life projects.
	CO-4	Developing technical skills for testing, maintaining, and deploying the software projects.
	CO-5	Developing real life projects for the industries.
MCA440	CO-1	Understanding programming skills in core Julia
	CO-2	Understanding Object Oriented Skills in Julia
	CO-3	Understanding the important aspects related with files, structure and objects, dictionary in Julia
	CO-4	Developing the ability to work on string and tuples in Julia.
	CO-5	Developing user defined functions and applications using Julia
MCA441	CO-1	Understanding programming skills in core ruby
	CO-2	Understanding Object Oriented Skills in ruby
	CO-3	Understanding the ruby's built in methods for manipulating strings, files, and hashes.

	CO-4	Developing methods and classes in Ruby.	
	CO-5	Developing useful standalone applications in ruby.	
MCA442	**CO-1**	Understanding the concepts of Pattern Recognition, its principles and various approaches.	
	CO-2	Understanding various methods of parameter estimation like Maximum Likelihood, Bayesian parameter and also methods of dimension reduction.	
	CO-3	Understanding various techniques for unsupervised learning and dimension reduction.	
	CO-4	Applying parametric and nonparametric techniques for pattern recognition.	
	CO-5	Analyzing various learning and pattern recognition techniques.	
MCA443	**CO-1**	Understanding the basic concepts of deep learning	
	CO-2	Understanding the main techniques in deep learning and the main research in this field.	
	CO-3	Understanding the basic concepts of tensor flow and convolution network.	
	CO-4	Applying various training methods for deep learning.	
	CO-5	Analyzing various deep learning and deep neural network techniques.	
MCA444	**CO-1**	Understanding fundamentals of wireless communications.	
	CO-2	Understanding the various routing protocols	
	CO-3	Understanding the different issues in MAC and routing issues in multi hop wireless and ad-hoc networks	
	CO-4	Applying knowledge of TCP/IP extensions for mobile and wireless networking.	
	CO-5	Analyzing security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks	
MCA445	**CO-1**	Understanding the current cloud and fog computing technologies, including technologies for different cloud and fog services.	
	CO-2	Understanding the large data processing in the cloud and fog computing	
	CO-3	Understanding the resource management in the cloud and fog in management	
	CO-4	Analyzing the components of cloud and fog computing showing how business agility in an organization can be created.	
	CO-5	Analyzing case studies to derive the best practice model to apply when developing and deploying cloud and fog based applications and security parameters.	
MCA446	**CO-1**	Understanding the basic concept of oracle database administration.	
	CO-2	Understanding oracle database storage structures.	
	CO-3	Understanding the backup and recovery in database	
	CO-4	Analyzing various database storage structures and the techniques of managing oracle database.	
	CO-5	Developing oracle database security features and skills for managing oracle database.	
MCA447	**CO-1**	Understanding the requirement of Big data with respect to 5 V's.	

	CO-2	Understanding the basic storage structure used in Big data with respect to clusters.
	CO-3	Understanding the Hadoop Ecosystem and its components.
	CO-4	Analyzing the data processing in Big data with HIVE , PIG and HBASE.
	CO-5	Analyzing the functionality and working of Zookeeper for monitoring Servers in Cluster.
MCA448	CO-1	Understanding the basic concept of blockchain and types of blockchain
	CO-2	Understanding basic building blocks of cryptography used in blockchain and how to use them in blockchains.
	CO-3	Understanding the applications of blockchain technology like bitcoin and its key features, characteristics including limitations and advantages.
	CO-4	Applying the ethereum platform and its working architecture to build blockchain applications
	CO-5	Analyzing various kind of blockchains and techniques to create the hyperledger.
MCA449	CO-1	Understanding the basic concept of big data analysis using spark
	CO-2	Understanding basics of spark framework
	CO-3	Understanding the Data Analysis with Spark Shell
	CO-4	Applying various classification and clustering techniques in Spark
	CO-5	Analyzing various methods of data analysis and the sentiment analysis in spark