Program Name: MCA

PO	Graduate Attribute	Description
PO1	Computational Knowledge	Develop and apply fundamentals of mathematics and computing to demonstrate competencies in IT ecosystem.
PO2	Problem Analysis	Identify, conduct survey use quantitative and qualitative techniques to develop critical thinking & problem solving skills.
PO3	Design /Development of Solutions	The ability to analyze problem domain & its variable factors to design a solution which is in sync with societal, cultural, public health, safety & environmental consideration
PO4	Conduct investigations of complex Computing problems	The ability to apply computing knowledge, research methodology to analyze & interpret complex computing problem
PO5	Modern Tool Usage	Adapt and apply appropriate modern tools & techniques to solve complex problems through practical lab sessions
PO6	Professional Ethics	Understand and develop awareness of ethical, social, cultural & cyber regulations for professional computing practices.
PO7	Life-long Learning	Recognizing the need for self development through up gradation to keep pace with dynamic IT industry.
PO8	Project management and finance	Illustrate the understanding of basic principles of management and apply the same to one's project and contribute effectively in various projects in a transnational, multicultural teams across the globe.
PO9	Communication Efficacy	Understand and efficiently communicate with IT professional and common audience about complex computing data through effective reports, documentation & presentation.
PO10	Societal and Environmental	Acknowledge & Sensitize towards the social, legal, cultural issues & their influence on computing practices & their consequential responsibility as an IT professional.
PO11	Individual and Team Work	Function as an effective collaborator, member, leader in a transnational workplace
PO12	Innovation and Entrepreneurship	Inculcate a spirit of innovation and enterprise through sustained training programs, mentoring, to create a budding entrepreneur & technocrat to contribute to a society at a large

MCA 2 Years (New Scheme) SEM I		
Course Name	**CO**	**Course Outcome**
Mathematical Foundation for Computer Science 1	CO1	Apply different statistical measures on various types of data
	CO2	Evaluate using regression analysis
	CO3	Analyze different types of Probability and their fundamental applications and random variable.
	CO4	Apply probability distribution to real world problems
	CO5	Formulate and test the hypothesis for business problem using various methods

Course Name	CO	Course Outcome
Advanced JAVA	CO1	Demonstrate use of data structure and data manipulation concept using Java Collection Framework and Lambda
	CO2	Create JSP using standard actions, custom tags, Introduction to JSP Standard Tag Library (JSTL) and JSTL Tags.
	CO3	Understand and develop applications using Spring Framework,Lightweight Container and Dependency Injection with
	CO4	Develop applications using Aspect Oriented Programming with Spring.
	CO5	Apply JDBC Data Access with Spring and demonstrateData access operations with Jdbc Template and Spring.
	CO6	Create Spring Boot Web Application and Spring Boot RESTful WebServices.
Course Name	**CO**	**Course Outcome**
Advanced Database Management System	CO1	Demonstrate complex database systems like parallel, distributed & object oriented databases
	CO2	Model data warehouse with ETL process and dimensional modeling and data analysis using OLAP operations.
	CO3	Discover association among items using Association rule mining.
	CO4	Evaluate different data mining techniques like classification,prediction, clustering, web and text mining to solve real

Course Name	CO	Course Outcome
Software Project Management	CO1	Define the key concepts of Software Project Management.
	CO2	Demonstrate understanding of the requirements Analysis and Application of UML Models.
	CO3	Make use of estimation logic for estimation of software size as well as cost of software.
	CO4	Examine the need of change management during software development as well as application of quality tools.
	CO5	Assess various factors influencing project management, quality assurance and risk assessment.
	CO6	Develop process for successful quality project delivery.

Course Name	CO	Course Outcome
Data Structures Lab with C and C++	CO1	Implement searching and sorting algorithms
	CO2	Implement linear and non-linear data structures
	CO3	Choose the appropriate data structures to solve complex real life problems
	CO4	Analyze hashing techniques for data storage and retrieval
Course Name	**CO**	**Course Outcome**
Advanced Java Lab	CO1	Demonstrate use of data structure and data manipulation concept using Java Collection Framework and Lambda
	CO2	Build JSP web application using standard actions, custom tags and JSTL Tags.
	CO3	Develop application using Spring Framework, Lightweight Containers and Dependency Injection with Spring.
	CO4	Develop applications using Aspect Oriented Programming with Spring.

	CO5	Build JDBC application with Spring using JdbcTemplate.
	CO6	Develop Spring Boot Web Application and Spring Boot RESTful web services.

Course Name	CO	Course Outcome
Advanced Database Management System	CO1	Demonstrate distributed and ORDBMS concepts
	CO2	Perform ETL operations used in the building data warehouse.
	CO3	Demonstrate and analysis various OLAP operations.
	CO4	Implement and evaluate different data mining techniques like classification, prediction, clustering and association rule
Course Name	**CO**	**Course Outcome**
Web Technology LAB	CO1	Build simple websites making use of various Node.js features
	CO2	Design a dynamic web application enabled with database connectivity
	CO3	Use the fundamentals of Angular.js Filters, Directives and Controllers to build applications
	CO4	Develop Forms and Single page applications (SPA)

Course Name	CO	Course Outcome
Mini Project 1 A	CO1	Demonstrate the ability to produce a technical document.
	CO2	Apply software project management skills during project work.
	CO3	Build small groups to work effectively in team on medium scale computing projects.
	CO4	Design and evaluate solutions for complex problems.

MCA 2 Years (New Scheme) SEM II		
Course Name	**CO**	**Course Outcome**
Mathematical Foundation for Computer Science II	CO1	Formulate mathematical model for a broad range of problems in business and industry.
	CO2	Apply mathematics and mathematical modeling to forecast implications of various choices in real world problems
	CO3	Think strategically and decide the optimum alternative from various available options
	CO4	Evaluate performance parameters of a real system using various methods

Course Name	CO	Course Outcome
Artificial Intelligence and Machine Learning	CO1	Interpret Artificial Intelligence concepts intelligence concepts
	CO2	Apply Artificial intelligence techniques for problem solving
	CO3	Analyze the fundamentals of machine learning, the learning algorithms and the paradigms of supervised and un-

	CO4	Identify methods to improve machine learning results for better predictive performance
Course Name	**CO**	**Course Outcome**
Information Security	CO1	Discuss the requirement of information security , private and public key algorithms and to examine the mathematics of cryptography
	CO2	Analyze authentication and integrity techniques available
	CO3	Interpret the importance of firewalls and intrusion detection systems and signatures.
	CO4	Relate to the security issues and technologies used in the web, internet,database and operating system

Course Name	**CO**	**Course Outcome**
MCAE241 Elective 1.1 Image Processing	CO1	Explain the fundamental concepts of a digital image processing System
	CO2	Apply techniques for enhancing digital images
	CO3	Examine the use of Fourier transforms for image processing in the frequency domain
	CO4	Compare various Image compression standards and morphological Operation
	CO5	Identify various Applications of Image Processing

Course Name	**CO**	**Course Outcome**
MCAE242 Elective 1.2 Internet of Things	CO1	Compare M2M and IoT; discuss applicability of IoT enabling technologies, characteristics of IoT systems and IoT levels.
	CO2	Explain different state of art IoT reference models and architectures as well as Architecture Reference Model (ARM) for
	CO3	Analyze various protocols for IoT, IoT security aspects and generic design methodology
	CO4	Develop cloud based and web based IoT Model for specific domains

Course Name	**CO**	**Course Outcome**
MCAE243 Elective 1.3 Robotic Process Automation	CO1	Define the key concepts of Robotic Process Automation and evolution.
	CO2	Demonstrate development of BOT with specific tools
	CO3	Apply RPA implementation cycle considering security and scaling
	CO4	Examine specifications of RPA tools and justify applications of appropriate tool for problem.
	CO5	Assess performance of BOTs in context of intelligent automation

Course Name	**CO**	**Course Outcome**
MCAE244 Elective 1.4 Computer	CO1	Explain Concepts and Applications of Computer Vision
	CO2	Apply image processing techniques to design Computer Vision applications
	CO3	Implement algorithms of face recognition and motion detection

Vision	CO4	Provide solutions to real world computer vision problems
Course Name	**CO**	**Course Outcome**
MCAE245 Elective 1.5 Embedded System	CO1	Explain hardware and software design requirements of Embedded Systems
	CO2	Discuss the architecture of 8051 processor
	CO3	Describe 8051 Processor Addressing modes and instruction sets
	CO4	Use Embedded C for writing basic programs for embedded systems
	CO5	Examine the use of various Embedded C programming constructs for writing programs for embedded systems.
Course Name	**CO**	**Course Outcome**
MCAE251 Elective 2.1 Natural Language Processing	CO1	Understand the computational properties of natural languages and the commonly used algorithms for processing
	CO2	Understand the information retrieval techniques using NLP
	CO3	Apply mathematical techniques that are required to develop NLP applications
	CO4	Analyze various NLP algorithms and text mining NLP applications
	CO5	Design real world NLP applications such as machine translation, text categorization, text summarization, information extraction by applying NLP techniques.

Course Name	**CO**	**Course Outcome**
MCAE252 Elective 2.2 Geographic Information System	CO1	Define the key concept of Geographic Information System
	CO2	Examine the various aspects of vector data model by survey and discover of concepts
	CO3	Elaborate and estimate raster data model by designing and developing effective plan
	CO4	Demonstrate understanding of the Terrain Mapping, View shade and Watershed Analysis in contrast by explaining main
	CO5	Experiment of Geocoding and Dynamic Segmentation by applying facts and techniques
	CO6	Present and explain importance of remote sensing by evaluating recommended set of criteria

Course Name	**CO**	**Course Outcome**
MCAE253 Elective 2.3 Design and Analysis of	CO1	Analyze the time and space complexity of various algorithms
	CO2	Analyze divide and conquer, greedy and dynamic programming strategies.
	CO3	Analyze backtracking, branch and bound and string matching algorithm.
	CO4	Explain NP hard NP complete problem.

Course Name	**CO**	**Course Outcome**

MCAE254 Elective 2.4 Digital Marketing and Business Analytics	CO1	Understand the role of Digital Marketing
	CO2	Demonstrate use of various Digital Marketing Tools.
	CO3	Discuss key element of Digital Marketing Strategy.
	CO4	Understand use of Digital Marketing Tools for Digital Marketing Campaigns
	CO5	Assess / Measure the effectiveness of the Digital Marketing Campaigns.
	CO6	Demonstrate practical skills using common digital marketing tools like SEO, SEM, Content Marketing…
Course Name	**CO**	**Course Outcome**
MCAE255 Elective 2.5 Research Methodology	CO1	Demonstrate knowledge of research concepts and processes
	CO2	Perform literature reviews, prepare the key elements of a research proposal
	CO3	Compare and contrast quantitative and qualitative research
	CO4	Define and develop a possible research interest area using specific research design
	CO5	Explain the rationale for research ethics, and its importance
	CO6	Demonstrate enhanced writing skills
Course Name	**CO**	**Course Outcome**
Artificial Intelligence and Machine Learning Lab	CO1	Apply the basic concepts of artificial intelligence and its applications
	CO2	Experiment with basic and ensemble the machine learning algorithms and its applications.
	CO3	Analyze dimensionality reduction techniques for feature extraction and selection.
	CO4	Develop models using appropriate machine learning algorithms for real world problems.

Course Name	**CO**	**Course Outcome**
Soft Skill Development Lab	CO1	Develop interpersonal skills that help in communication, teamwork, leadership and decision making.
	CO2	Methodically study, formulate and interpret different facets of organizational behavior.
	CO3	Develop holistic leaders and technocrats helping in individual and organizational growth.
Course Name	**CO**	**Course Outcome**
MCALE231	CO1	Understand different image file formats and their structure

Elective 1 Lab Image Processing Lab	CO2	Explain how Digital images are manipulated using various image enhancement techniques
	CO3	Learn the signal processing algorithms and techniques in image enhancement and image restoration.
	CO4	Implement digital transforms Creating
	CO5	Be able to understand and implement certain image compression techniques.

Course Name	CO	Course Outcome
MCALE232 Internet of things Lab	CO1	Identify basic electronic components and make use of arduino software/hardware and arduino simulator.
	CO2	Experiment with various I/O devices and sensors with Arduino.
	CO3	Build IoT application using Cloud
	CO4	Develop IoT based projects.

Course Name	CO	Course Outcome
MCALE233 Robotic Process Automation	CO1	Define the key concepts of Robotic Process Automation and evolution.
	CO2	Demonstrate development of BOT with specific tools
	CO3	Apply RPA commands to automate atsks
	CO4	Summarize this tool as a summation of Robotic Process Automation, Cognitive Analytics, and Workforce Analytics
Course Name	**CO**	**Course Outcome**
MCALE234 Computer Vision Lab	CO1	Understand Open CV Framework
	CO2	Develop applications using basic image processing techniques used in Computer Vision
	CO3	Design Applications to Detect Motion and Face in an image
	CO4	Create a Applications using CNN
Course Name	**CO**	**Course Outcome**
MCALE235 Embedded System Lab	CO1	Understand the programming environment of the 8051microcontroller
	CO2	Explain how microcontrollers can be programmed using embedded C programming
	CO3	Learn execution of Embedded C programming using simulators
	CO4	Implement some basic hardware interfacing programs for 8051 / ARM / Raspberry Pi / Arduino
Course Name	**CO**	**Course Outcome**
MCAL24 Advanced Web Technologies	CO1	Develop Web applications using various controls and programming techniques.
	CO2	Implement Data Binding applications using ADO.NET
	CO3	Solve identity management problems in web Applications application using session management and AJAX concepts.

	CO4	Create modern web applications using Web Services and MVC5

Course Name	CO	Course Outcome
MCAL25 Skill based Lab Course User Interface	CO1	Interpret user needs and context of User Interface design Specification
	CO2	Demonstrate the tools and techniques for designing informing models
	CO3	Develop high fidelity prototype for end to end solution.
	CO4	Apply best practices for evaluating user experience.

Course Name	CO	Course Outcome
MCAL26 Skill based Lab Course Networking	CO1	Demonstrate installation and configuration of Network simulator
	CO2	Construct network topologies using Network Simulator
	CO3	Analyze network traffic using network sniffing software
	CO4	Design and develop solutions to complex network problems using Network Simulator and Network Software

Course Name	CO	Course Outcome
Mini Project 1-B	CO1	Demonstrate the ability to produce a technical document.
	CO2	Apply software project management skills during project work
	CO3	Build small groups to work effectively in team on medium scale computing projects.
	CO4	Design and evaluate solutions for complex problems.

MCA 2 Years (New Scheme) SEM III		
Course Name	**CO**	**Course Outcome**
MCA31 Big Data Analytics and Visualization	CO1	Demonstrate the key issues in big data management and its associated application for business decision
	CO2	Develop problem solving and critical thinking skills in fundamental enabling techniques like Map Reduce , NoSQL, Hadoop Ecosystem
	CO3	Use of RDD and Data Frame to create Application in Spark.
	CO4	Implement exploratory data analysis using visualization

Course Name	CO	Course Outcome
MCA32 Distributed System	CO1	Illustrate principles and communication protocols of Distributed systems

and Cloud Computing	CO2	Analyze clock synchronization and various algorithms
	CO3	Analyze Distributed shared memory and management concepts.
	CO4	Analyze Cloud computing and cloud models

Course Name	CO	Course Outcome
Elective 3.1 Blockchain	CO1	Explain Blockchain technologies and their components
	CO2	Interpret the uses of cryptographic techniques in Blockchain
	CO3	Demonstrate the use of hyperledger fabric and its components
	CO4	Build the smart contracts in Ethereum
	CO5	Analyze the use of Blockchain technology in various domains

Course Name	CO	Course Outcome
MCAE332 Elective 3.2 Deep Learning	CO1	Demonstrate concepts, architectures and algorithms of Neural Networks to solve real world problems.
	CO2	Identify deep feed-forward networks and different regularization techniques used in Deep Learning
	CO3	Identify challenges in Neural Network optimization and different optimization algorithms used in Deep learning models
	CO4	Analyze deep learning algorithms which are more appropriate for various types of learning tasks in various domains

Course Name	CO	Course Outcome
MCAE333 Elective 3.3 Game Development	CO1	Demonstrate Principles of Game Development
	CO2	Build applications using various components of Game development
	CO3	Develop multilayered and interactive games
	CO4	Solve Problems in 2D game development

Course Name	CO	Course Outcome
MCA334 Elective 3.4 Ethical Hacking	CO1	Recall the networking, sql, and encryption algorithm concepts to further study ethical hacking techniques, threats, tools and prevention against attacks
	CO2	Understand ethical hacking concepts, cases, ethics and cyberlaws
	CO3	Apply available hacking tools to find a solution to a given hacking issue.
	CO4	Analyze and classify the real-world hacking cases and situations
Course Name	**CO**	**Course Outcome**

MCAE335 Elective 3.5 Quantum Computing	CO1	Understand basic principles and components of Quantum Computing
	CO2	Analyze Quantum Computing algorithms
	CO3	Design programs to perform basic Quantum Computing operations
	CO4	Identify classes of problems that can be solved using Quantum Computing
Course Name	**CO**	**Course Outcome**
MCAE341 Elective 4.1 Intellectual Property Rights	CO1	Define the key concepts of Intellectual Property and IP Infringements
	CO2	Understand and acquire knowledge of IPR policy followed in India
	CO3	Demonstrate the know-how required to identify, assess, and apply for IP rights protection under various applicable laws and treaties in force
	CO4	Analyze the development, registration procedure, protection, compliance, and enforcement of various intellectual

Course Name	**CO**	**Course Outcome**
MCAE342 Elective 4.2 Green Computing	CO1	Acquire expertise for improving the energy efficiency for laptops and personal computers by reducing the power consumption requirements
	CO2	Assess enterprise-wide and personal computing and computing energy consumption
	CO3	Recognize the necessity for long-term sustainability in IT
	CO4	Formulate plans for reducing IT heating and cooling requirements
	CO5	Evaluate the regulatory and governance issues surrounding IT
	CO6	Choose the best sustainable hardware for their applications

Course Name	**CO**	**Course Outcome**
MCAE343 Elective 4.3 Management Information	CO1	Understand theoretical aspects of Management Information Systems.
	CO2	Know the procedures and practices for handling information system effectively.
	CO3	Acquire knowledge in various Decision Support Systems.
	CO4	Recognize the necessity of IT security and Infrastructure in Management Information Systems.

Course Name	**CO**	**Course Outcome**
MCA344 Elective 4.4 Cyber Securtiy and Digital	CO1	Demonstrate understanding of basic concepts in cyber security
	CO2	Make use of various tools and methods used in cybercrime
	CO3	Adapt fundamental knowledge of digital forensics
	CO4	Determine skills and knowledge for solving digital forensics Probl e m s
Course Name	**CO**	**Course Outcome**

MCAE345 Elective 4.5 Entrepreneurship Management	CO1	Understand the concepts and fundamentals of Entrepreneurship.
	CO2	Understand the growth and development strategies for venture and Social Responsibilities
	CO3	Identify the Role of Small-Scale Industries (SSI) & Institutions Supporting Small Scale Enterprise.
	CO4	Analyse the process of Business Idea generation and converting the idea into a Business Model.
	CO5	Evaluate the effectiveness of different entrepreneurial strategies, policies and measures for promoting small industries.
	CO6	Create presentations and marketing strategies that articulate financial, operational, organizational, market, and sales knowledge for value creation
Course Name	**CO**	**Course Outcome**
MCAL31 Big Data Analytics and Visualization Lab	CO1	Demonstrate HDFS Commands in Hadoop
	CO2	Apply Map Reduce Programming Paradigm to solve the algorithmic problems
	CO3	Build No SQL Database and Query it Using Mongo DB
	CO4	Analyze the Data Using Hadoop Ecosystem Projects: Hive and Pig
	CO5	Explain RDD and Data Frame Creation in Apache Spark
	CO6	Create various Visualizations using Tableau.

Course Name	**CO**	**Course Outcome**
MCAL34 Distributed System and Cloud Computing Lab	CO1	Develop Remote Process Communication, Remote Procedure Call and Remote Method Invocation concepts.
	CO2	Develop Remote Object Communication programs.
	CO3	Develop mutual exclusion concept using Token ring algorithm.
	CO4	Implementation of Cloud Computing Services.
	CO5	Implementation of Identity Management using Cloud Computingconcept
	CO6	Design Apps using Cloud Computing for windows Azure / Amazon AWS using Windows Azure Platform Training Kit and Visual Studio and Google App Engine by using Eclipse IDE.
Course Name	**CO**	**Course Outcome**
MCALE331 Elective 3 Lab Block Chain Lab	CO1	Implement encryption algorithms and hash functions
	CO2	Construct a bitcoin blocks and validating
	CO3	Construct a smart contract in Ethereum
	CO4	Develop and deploy Dapp in Ethereum

Course Name	CO	Course Outcome
MCAL332, Deep Learning Lab	CO1	Demonstrate Tensor flow/Keras deep-learning workstations.
	CO2	Choose appropriate data preprocessing techniques to build neural network models
	CO3	Analyze different regularization and optimization techniques used in deep learning.
	CO4	Build neural network models using deep learning algorithms-CNN and RNN to solve real world problems.

Course Name	CO	Course Outcome
MCAL333 Game Development Lab	CO1	Build Games using Object Oriented Programming Concepts
	CO2	Simplify Game Development Process using Unity Framework
	CO3	Develop state of art 2D games
	CO4	Plan creation of 3D games and Test them

Course Name	CO	Course Outcome
MCAEL334 Ethical Hacking Lab	CO1	Applying foot printing tools for information gathering issue
	CO2	Applying tools for scanning networks, enumeration and sniffing.
	CO3	Applying tools for malware attacks, webserver and web applications, sql injection, session hijacking, wireless networking,
	CO4	Developing malwares and attack tools
		Designing pen testing report.

Course Name	CO	Course Outcome
MCALE335 Quantum Computing Lab	CO1	Understand the various Quantum Logic gates
	CO2	Design QC programs using quantum arithmetic
	CO3	Develop QC applications based on the quantum computing model
	CO4	Compare basic quantum computing algorithms

Course Name	CO	Course Outcome

MCAL34 Mobile Computing Lab	CO1	Demonstrate their understanding of the fundamental details of android and its components
	CO2	Implement various android applications using different layouts & rich user interactive interfaces
	CO3	Demonstrate their skills of using SQLite database for android application database
	CO4	Demonstrate their ability to develop programs with dart programming and flutter

Course Name	CO	Course Outcome
MCAL35 Software Testing And Quality	CO1	Apply manual software testing techniques to test a software application
	CO2	Implement Selenium tool to perform automation testing
	CO3	Implement TestNg frameworks to test the application
	CO4	Demonstrate validation checks and regression testing on the application

Course Name	CO	Course Outcome
MCAP31 Mini Project 2A	CO1	Demonstrate the ability to produce a technical document.
	CO2	Identify problems based on environmental, societal & research needs.
	CO3	Apply Knowledge and skills to analyze and interpret data by applying appropriate research methods to solve societal problems in a group.
	CO4	Design and evaluate solutions for complex problems. Creating
	CO5	Build small groups to work effectively in team on medium scale computing projects.
	CO6	Create value addition for the betterment of the individual and society

MCA SEM IV

Course Name	CO	Course Outcome
MCAI41 Internship	CO1	Demonstrate skills to use modern tools, software and equipment to analyze problems.
	CO2	Develop an exposure to real life organizational and environmental situations.
	CO3	Apply SDLC phases in developing software projects and in writing the project document
	CO4	Create computing solutions for the real life problems as per the requirements of the domain
	CO5	Adapt professional and interpersonal ethics.

Course Name	CO	Course Outcome
	CO1	Understand analytic approach towarShow data coherently, effectively and counter-hypothesis
	CO2	Apply experience in preparation of research material for publication or presentation.

	CO3	Identify relevant previous work that supports their research.
MCAR42	CO4	Analyze data and synthesize research findings.
Researh Paper	CO5	Create A Research Papaer

Course Name	CO	Course Outcome
MCAS44 ISR	CO1	Learner/student will be able to create awareness among individuals towards institutional & individual social responsibility for societal development.