MAHARAJA INSTITUTE OF TECHNOLOGY MYSORE
Autonomous Institution Affiliated to VTU

Competency Based Syllabus (CBS)
for

Master of Computer Applications
(Under Outcome Based Education (OBE) and
Choice-Based Credit System (CBCS))

Offered from 3rd to 4th Semesters of Study
In
Partial Fulfillment for the Award of Master's Degree in

Master of Computer Applications

2023 Scheme

Scheme Effective from the academic year 2023-24

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3rd Semester	PROFESSIONAL CORE COURSE (PC) MACHINE LEARNING	M23MCA301

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Mathematics and Statistics:	• **Linear Algebra**: Familiarity with vectors, matrices, eigenvalues, and matrix decompositions, as these are crucial for understanding algorithms and data representations. • **Probability and Statistics**: Understanding probability theory, statistical inference, distributions, and basic concepts such as expectation, variance, and hypothesis testing. • **Calculus**: Knowledge of differentiation and integration, particularly for understanding optimization techniques used in learning algorithms.
2	Fundamentals of Machine Learning:	• **Machine Learning Concepts**: Understanding core concepts like supervised and unsupervised learning, over-fitting and under-fitting, bias-variance tradeoff, and evaluation metrics. • **Common Algorithms**: Familiarity with fundamental machine learning algorithms such as linear regression, logistic regression, decision trees, and clustering methods.
3	Programming and Data Handling:	• Programming **Skills**: Proficiency in a programming language commonly used in machine learning, such as Python or R. Ability to implement algorithms and handle data efficiently. • **Data Manipulation**: Experience with libraries and tools for data processing and manipulation, such as NumPy, pandas, and Scikit-learn in Python.
4	Artificial Intelligence and Knowledge Representation:	☐ AI **Basics**: Basic understanding of artificial intelligence concepts, including search algorithms, optimization techniques, and foundational AI theories. • **Knowledge Representation**: Familiarity with concepts like propositional logic, predicate logic, and basic knowledge representation techniques relevant to Explanation-Based Learning and rule-based systems.

2. Competencies

S/L	Competency	KSA Description
1	Expertise in Machine Learning Concept and Decision Tree Analysis	**Knowledge:** • **Understanding Learning Problems:** Deep comprehension of various learning systems and issues related to designing them. This includes a strong grasp of problem definitions, objectives, and the implications of different learning strategies. • **Concept Learning:** Knowledge of concept learning theories, the role of version spaces, and the Candidate Elimination Algorithm for representing and refining hypotheses. • **Decision Tree Learning:** In-depth knowledge of decision tree algorithms, including how to represent decision trees, the mechanics of decision tree learning algorithms, and how heuristic space search methods are used to optimize tree construction. **Skills:** • **Algorithm Implementation:** Ability to implement concept learning algorithms such as the Candidate Elimination Algorithm and decision tree algorithms from scratch. This includes coding, debugging, and optimizing these algorithms to handle real-world data. • **Heuristic Optimization:** Proficiency in applying heuristic search

		techniques to enhance the efficiency of decision tree learning, such as using metrics like entropy and Gini impurity to make decisions on node splits. • System **Design:** Skill in designing and developing machine learning systems that incorporate these learning strategies, including crafting appropriate data representations, feature selections, and tuning model parameters. **Attitudes:** • Analytical **Curiosity:** A proactive approach to understanding and dissecting complex learning problems and systems. This involves a willingness to explore and question different aspects of machine learning methods to continually improve system design. • Problem-**Solving Orientation:** An attitude focused on solving real-world problems through effective application of concept learning and decision tree techniques, always striving to refine algorithms and adapt solutions to new challenges. • **Commitment to Learning:** Dedication to staying updated with the latest advancements in learning algorithms and decision tree methodologies, and continuously seeking to enhance both theoretical knowledge and practical skills.
2	**Advanced Computational Intelligence**	**Knowledge:** • **Neural Networks**: Understand the principles of neural network architectures, including perceptron's, multilayer networks, and back propagation algorithms. Comprehend advanced topics such as recurrent networks, convolutional networks, and their applications. • **Genetic Algorithms**: Familiar with the theory and implementation of genetic algorithms, including hypothesis space search and genetic programming. Knowledge of models of evolution, selection, crossover, mutation, and their influence on algorithm performance. **Skills:** • **Neural Networks**: Ability to design, implement, and train neural network models using various frameworks and tools. Proficient in handling problems related to neural network optimization, such as over-fitting, under-fitting, and convergence issues. Capable of applying backpropagation and other advanced training techniques. • **Genetic Algorithms**: Competent in configuring and applying genetic algorithms to solve optimization problems. Skillful in developing and tuning genetic programming solutions, as well as understanding the trade-offs in evolutionary models. Capable of implementing and evaluating different genetic algorithm operators and techniques. **Attitudes:** • **Neural Networks**: Demonstrate a proactive and analytical mindset towards problem-solving using neural networks. Embrace challenges and complexities associated with deep learning, and be willing to stay updated with the latest research and technological advancements in the field. • **Genetic Algorithms**: Exhibit creativity and resilience in applying genetic algorithms to diverse and complex problems. Show an openness to iterative experimentation and refinement of evolutionary models, recognizing the value of continuous improvement and adaptability in computational problem-solving.
3	**Advanced Bayesian and Computational**	**Knowledge:** • **Bayesian Fundamentals**: Understand Bayes' Theorem and its applications in probabilistic reasoning. Comprehend concepts like Maximum

		Learning	Likelihood Estimation (MLE), Minimum Description Length (MDL) Principle, and the Bayes Optimal Classifier.

- **Computational Learning Models**: Familiar with advanced algorithms and models, including the Gibbs Algorithm, Naïve Bayes Classifier, Bayesian Belief Networks (BBNs), and the Expectation-Maximization (EM) Algorithm. Knowledge of Probably Approximately Correct (PAC) Learning, sample complexity for both finite and infinite hypothesis spaces, and the Mistake Bound Model.

Skills:

- **Bayesian Methods**: Proficient in applying Bayes' Theorem and related techniques to develop probabilistic models. Skilled in implementing and interpreting Naïve Bayes Classifiers and Bayesian Belief Networks. Capable of employing the EM Algorithm for parameter estimation in complex models.

- **Computational Learning**: Ability to apply computational learning theories and algorithms, such as the Gibbs Algorithm, to real-world problems. Expertise in calculating and analyzing sample complexity, and understanding the implications of the Mistake Bound Model in learning scenarios.

Attitudes:

- **Bayesian Learning**: Demonstrate a rigorous and analytical mindset towards probabilistic models and Bayesian methods. Be open to exploring and validating assumptions, and continuously update knowledge with advancements in Bayesian inference and learning.

- **Computational Learning**: Show a critical and innovative approach to computational learning challenges. Embrace iterative problem-solving and model refinement, and remain adaptable to new techniques and insights in the field of computational learning.

Knowledge:

- **Instant-Based Learning**: Understand K-Nearest Neighbor (KNN) learning, Locally Weighted Regression, and Radial Basis Functions (RBFs). Comprehend the principles and applications of Case-Based Reasoning (CBR).

- **Learning Rule Sets**: Familiar with Sequential Covering Algorithms, Learning Rule Sets, Learning First Order Rules, and Learning Sets of First Order Rules. Knowledge of induction as inverted deduction and inverting resolution.

Skills:

4   **Advanced Instant-Based Learning and Rule-Based Learning**

- **Instant-Based Learning**: Proficient in implementing and tuning K-Nearest Neighbor algorithms, Locally Weighted Regression, and Radial Basis Functions for various types of data and problems. Skilled in applying Case-Based Reasoning to solve complex problems by leveraging historical cases.

- **Learning Rule Sets**: Ability to develop and apply Sequential Covering Algorithms to learn and refine rule sets. Capable of generating and evaluating First Order Rules and Sets of First Order Rules. Proficient in applying techniques like induction as inverted deduction and inverting resolution for rule-based learning and reasoning.

Attitudes:

- **Instant-Based Learning**: Demonstrate a practical and empirical approach to problem-solving using instance-based learning methods. Embrace the iterative nature of tuning and evaluating models, and maintain an openness to leveraging different instance-based techniques based on problem

		requirements.
		• **Learning Rule Sets**: Show a methodical and detail-oriented attitude towards learning and refining rule-based systems. Be willing to explore innovative approaches for rule induction and resolution, and stay current with advancements in rule-based learning methodologies.
5	**Evaluating Hypothesis And Reinforced Learning**	**Knowledge:** • **Evaluating Hypothesis**: Comprehend the Estimating hypothesis accuracy, Basics of sampling theorem. Difference in error of two hypothesis, Comparing learning algorithms • **Reinforcement Learning**: Comprehend the core principles of Reinforcement Learning, including task formulation, Q-Learning, and Temporal Difference (TD) Learning. Understand how these methods are used to model and solve sequential decision-making problems. **Skills:** • **Evaluating Hypothesis**: Proficient in applying Explanation-Based learning to improve learning efficiency by leveraging domain knowledge. Skilled in using Inductive-Analytical Approaches and implementing the Algorithm for concept learning and rule extraction. • **Reinforcement Learning**: Ability to design and implement reinforcement learning algorithms, including Q-Learning and Temporal Difference Learning, for various decision-making tasks. Capable of formulating tasks in terms of states, actions, and rewards, and applying these methods to optimize performance in complex environments. **Attitudes:** • **Evaluating Hypothesis**: Estimating hypothesis accuracy, Basics of sampling theorem. Difference in error of two hypothesis, Comparing learning algorithms • **Reinforcement Learning**: Show an innovative and persistent attitude towards solving sequential decision problems using reinforcement learning. Embrace experimentation and iterative improvement, and remain adaptable to advancements in reinforcement learning techniques and applications.

3. Syllabus

MACHINE LEARNING SEMESTER – III			
Course Code	**M23MCA301**	CIE Marks	**50**
Number of Lecture Hours/Week(L: T: P: S)	**(4:0:0:0)**	SEE Marks	**50**
Total Number of Lecture Hours	**50 hours Theory**	Total Marks	**100**
Credits	**04**	Exam Hours	**03**

Course Objectives:

• To understand the basic theory underlying machine learning

• To understand a range of machine learning algorithms along with their strengths and weaknesses

• To be able to formulate machine learning algorithms and solve problems for different applications

• To study statistical analysis of machine learning techniques

Module -1
INTRODUCTION, CONCEPT LEARNING AND DECISION TREES Learning Problems– Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.
Module -2

NEURAL NETWORKS AND GENETIC ALGORITHMS: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.	
Module -3	
BAYESIAN AND COMPUTATIONAL LEARNING Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model.	
Module -4	
INSTANT BASED LEARNING AND LEARNING SET OF RULES: K-Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions –Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules –Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution.	
Module -5	
EVALUATING HYPOTHESIS AND REINFORCED LEARNING: Motivation, estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning.	

TEXTBOOKS:

1. Tom M. Mitchell, Machine Learning, McGraw Hill, 2013.

REFERENCE BOOKS:

1. Ethem Alpaydin, Introduction to Machine Learning, 2nd Edition, PHI Learning Pvt. Ltd, 2013.
2. T.Hastie, Tibshirani, J. H., The Elements of Statistical Learning, 1st Edition, Springer, 2001.

4. Syllabus Timeline

S/L	Syllabus Timeline	Description
1	Week 1-3: **Introduction, Concept Learning And Decision trees**	**INTRODUCTION, CONCEPT LEARNING AND DECISIONTREES**: Learning Problems–Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Hypothesis Space Search.
2	Week 4-6: **Neural Networks And Genetic Algorithms**	**NEURAL NETWORKS AND GENETIC ALGORITHMS**: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.
3	Week 7-9: **Bayesian And Computational Learning Bayes Theorem**	**BAYESIAN AND COMPUTATIONAL LEARNING:** Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model.
4	Week 10-12: **Instant Based Learning And Learning Set Of Rules**	**INSTANT BASED LEARNING AND LEARNING SET OF RULES:** K-Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions –Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules –Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution.
5	Week 13-14: **Evaluating Hypothesis And Reinforced Learning**	**EVALUATING HYPOTHESIS AND REINFORCED LEARNING**: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning.

- **Teaching-Learning Process Strategies**

S/L	TLP Strategies:	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of Machine Learning concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
6	Laboratory Learning	Utilize the facilities available in the laboratories to understand the behavior of the data by performing few experiments.

1. **Assessment Details (both CIE and SEE)**
   Continuous Internal Evaluation:
   The minimum CIE marks requirement is 50% of maximum marks in each component.
   CIE Split up

	Components	Number	Weightage	Max. Marks	Min. Marks
(i)	Internal Assessment-Tests (A)	2	50%	25	12.5
(ii)	Assignments/Quiz/Activity (B)	2	50%	25	12.5
	Total Marks			**50**	**25**

Final CIE Marks = (A) + (B)

Average internal assessment shall be the average of the 2 (TWO) test marks conducted.

Semester End Examination:
1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

2. **Learning Objectives**

S/L	Learning Objectives	Description
1	Concept Learning and Decision Trees	Develop a comprehensive understanding and practical ability to design, analyze, and implement learning systems focusing on concept learning and decision tree algorithms, including their theoretical foundations, practical applications, and the associated issues and perspectives in machine learning.
2	Neural Networks and Genetic Algorithms	Acquire a deep understanding and practical proficiency in neural networks and genetic algorithms, including their representations, fundamental techniques, advanced concepts, and applications in hypothesis space search and evolutionary learning.
3	Bayesian and Computational Learning	Develop a thorough understanding and practical expertise in Bayesian and computational learning methods, focusing on the application of probabilistic models, concept learning, and advanced algorithms for classification, estimation, and hypothesis evaluation.
4	Instant-Based Learning and	Gain a deep understanding and practical skills in instant-based learning methods and rule-based learning systems, focusing on the implementation,

	Learning Sets of Rules	evaluation, and application of algorithms for nearest-neighbor learning, case-based reasoning, and rule induction.
5	Learning and Reinforcement Learning	Develop a thorough understanding and practical capability in analytical learning methods and reinforcement learning techniques, focusing on domain theories, explanation-based learning, inductive-analytical approaches, and advanced reinforcement learning algorithms.

3. Course Outcomes (COs) and Mapping with POs

Course Outcomes (COs)

COs	Description
M23MCA301.1	**Understand** the fundamentals of concept learning, algorithms, and associated procedures of machine learning.
M23MCA301.2	**Apply** machine learning techniques Supervised, unsupervised and reinforcement learning algorithms to train, test, and deploy machine learning models on real datasets.
M23MCA301.3	**Analyze** the performance of machine learning models to assess model effectiveness, identify strengths and weaknesses, and make improvements based on analysis of Neural networks, Bayes classifier and K-Nearest Neighbor for given problem.
M23MCA301.4	**Evaluate** the statistics to infer the correctness of the written machine learning algorithm for a given real-world problems that address specific business or research challenges.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA301.1	2	-	-	-	-	-	-	-
M23MCA301.2	-	3	-	-	-	-	-	-
M23MCA301.3	-	-	3	-	-	-	-	-
M23MCA301.4	-	-	-	3	-	-	-	-
M23MCA301	2	3	3	3				

4. Assessment Plan

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	CO4	Total
Module 1	10				10
Module 2		10			10
Module 3			10		10
Module 4				10	10
Module 5				10	10
Total	10	10	10	20	50

Semester End Examination (SEE)

	CO1	CO2	CO3	CO4	Total
Module 1	20				20
Module 2		20			20
Module 3			20		20
Module 4				20	20
Module 5				20	20
Total	20	20	20	40	100

5. **Future with this Subject:**

❖ **Advancements in Algorithms and Models**

• **Deep Learning**: Continued innovation in deep learning techniques, including novel neural network architectures (e.g., transformers, graph neural networks), will drive breakthroughs in complex data analysis, such as natural language understanding and computer vision.

• **Quantum Machine Learning**: Quantum computing holds the promise of solving computationally intensive problems more efficiently. Quantum machine learning will explore new algorithms that leverage quantum computation to accelerate training and inference processes.

❖ **Integration with Emerging Technologies**

• **Artificial General Intelligence (AGI)**: Research will progress towards developing AGI systems capable of understanding, learning, and applying knowledge across a broad range of tasks, resembling human-like intelligence.

• **Edge Computing**: Machine learning models will be increasingly deployed on edge devices, enabling real-time processing and decision-making without reliance on central servers. This will enhance applications in IoT, smart devices, and autonomous systems.

❖ **Interdisciplinary Applications**

• **Healthcare**: Machine learning will revolutionize healthcare by advancing personalized medicine, predictive diagnostics, and drug discovery. Techniques like genomics, medical imaging, and electronic health records analysis will become more integrated.

• **Finance**: In finance, machine learning will enhance algorithmic trading, fraud detection, credit scoring, and risk management. Advanced models will provide better predictions and insights into market dynamics.

• **Climate Science**: Machine learning will be pivotal in climate modeling, predicting environmental changes, and optimizing energy usage. Models will aid in understanding complex climate patterns and devising mitigation strategies.

3rd Semester	**PROFESSIONAL CORE COURSE (PC)** **INTERNET OF THINGS**	**M23MCA302**

1. Prerequisites

S/L	Proficiency	Prerequisites
1	**Basic Science**	• **Basic understanding of electronic components**: Knowledge of resistors, capacitors, transistors, diodes, and inductors. Ability to analyze basic circuits and understand their applications in real-world scenarios. • **Fundamental physics concepts**: Understanding of electricity, magnetism, electromagnetic waves, and the behavior of materials under different physical conditions. Grasp the principles behind circuits, sensors, and communication systems. • **Energy conversion and signal processing**: Familiarity with converting energy forms (e.g., electrical to mechanical) and basic signal processing techniques like filtering and amplification. Ability to interpret and process signals from sensors.
2	**Mathematics**	• **Algebra proficiency:** Ability to solve linear and quadratic equations, work with inequalities, and simplify complex expressions. Understanding of algebraic manipulation in the context of system modeling and analysis. • **Calculus:** Understanding of differentiation and integration, their applications in real-world problems like rate of change, optimization, and area under curves. Proficiency in solving differential equations and applying calculus in signal processing. • **Probability, statistics, and matrices:** Knowledge of probability distributions, random variables, statistical inference, and matrix operations. Ability to apply these concepts in modeling and analyzing data, especially for IoT and machine learning applications
3	**Computer Science**	• **Programming languages:** Proficiency in Python or C/C++ for developing algorithms, writing efficient code, and automating tasks. Understanding of object-oriented programming, modular design, and debugging techniques. • **Data structures and algorithms:** Knowledge of common data structures (e.g., arrays, linked lists, trees, graphs) and algorithms (e.g., sorting, searching, dynamic programming). Ability to analyze the efficiency of algorithms and apply them to real-world problems. • **Networking fundamentals:** Understanding of networking protocols (e.g., TCP/IP, HTTP, FTP), addressing schemes, and basic concepts in cybersecurity. Ability to design and troubleshoot simple network systems, focusing on IoT connectivity and data transfer.
4	**Embedded Systems**	• **Microcontroller platforms:** Familiarity with Arduino, Raspberry Pi, or similar platforms. Understanding of microcontroller architecture, programming, and interfacing with peripheral devices such as sensors, actuators, and displays. • **Interfacing sensors and actuators**: Experience in connecting sensors (e.g., temperature, motion, gas) and actuators (e.g., motors, LEDs, relays) to hardware platforms. Knowledge of analog and digital signal processing for accurate data acquisition and control. • **Embedded software development:** Basic knowledge of embedded C/C++ or Python for writing firmware, using integrated development environments (IDEs), and debugging tools like oscilloscopes and logic analyzers.
5	**Communication Systems**	• **Wireless communication technologies:** Understanding of Wi-Fi, Bluetooth, Zigbee, and other wireless technologies. Knowledge of frequency bands, modulation techniques, and wireless networking for efficient and reliable IoT

communication.
- **IoT communication protocols:** Familiarity with MQTT, CoAP, and other lightweight communication protocols optimized for IoT applications. Understanding of message queuing, data serialization, and energy-efficient communication.
- **Networking and communication theory:** Basic knowledge of communication principles such as signal propagation, noise, channel capacity, and error detection/correction. Ability to apply these concepts in the design of IoT communication systems.

2. **Competencies**

S/L	Competency	KSA Description
1	**Introduction to IoT**	**Knowledge:** • Understanding the evolution of IoT, enabling technologies, and key networking components. **Skills:** • Ability to identify and describe IoT components and addressing strategies. **Attitudes**: • Curiosity about the interdependence of technologies and a willingness to explore new concepts in IoT.
2	**IoT Sensing and Actuation**	**Knowledge:** • In-depth knowledge of various sensors and actuators, including their characteristics and types. **Skills:** • Proficiency in selecting and interfacing sensors and actuators with IoT hardware platforms. **Attitudes:** • Precision in sensor calibration and a problem-solving approach to handling sensorial deviations.
3	**IoT Processing Topologies**	**Knowledge:** • Understanding of IoT processing topologies, data formats, and processing requirements. **Skills:** • Ability to design and optimize IoT device processing strategies and make decisions on processing offloading. **Attitudes:** • Attention to efficiency and optimization in processing design.
4	**IoT Connectivity Technologies**	**Knowledge:** • Comprehensive knowledge of various IoT connectivity technologies (e.g., Zigbee, LoRa, NB-IoT, Wi-Fi, Bluetooth). **Skills:** • Proficiency in selecting and configuring appropriate communication technologies for IoT applications. **Attitudes:** • Proactiveness in learning and implementing emerging communication protocols and standards.
5	**IoT Case Studies and Future Trends**	**Knowledge:** • Familiarity with the application of IoT in sectors like agriculture and transportation, and an understanding of future IoT trends. **Skills:** • Ability to analyze case studies and draw insights for practical IoT

		applications. **Attitudes:** • Open-mindedness toward new IoT trends and a desire to innovate.
6	**IoT Hardware Projects**	**Knowledge:** • Understanding of basic IoT hardware components, including Arduino boards and sensors like the MQ-2 Gas sensor. **Skills:** • Ability to build and program simple IoT projects, interfacing sensors with microcontrollers like Arduino and NodeMCU. **Attitudes:** • Hands-on approach to learning, with persistence in troubleshooting and debugging hardware issues.

3. Syllabus

INTERNET OF THINGS SEMESTER – III			
Course Code	**M23MCA302**	CIE Marks	**50**
Number of Lecture Hours/Week(L: T: P: S)	**(3:0:0:0)**	SEE Marks	**50**
Total Number of Lecture Hours	**40 Hours theory**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Course Objectives:

- To Understand IoT basics and components.
- To learn the Interface sensors and actuators with IoT devices.
- To analyze IoT processing and manage data.
- To Explore and apply IoT connectivity technologies.
- To Study IoT applications and future trends.
- To Build and implement practical IoT projects using hardware.

Module-1

Introduction to IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT.

Module-2

IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.

Module-3

IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.

Module-4

IoT Connectivity Technologies: Introduction, IEEE 802.15.4, Zigbee, Thread, ISA100.11A, Wireless HART, RFID, NFC, DASH7, Z-Wave, Weightless, Sigfox, LoRa, NB-IoT, Wi-Fi, Bluetooth.

Module-5

IOT Case Studies And Future Trends: Introduction, Components of an agricultural IoT, Advantages of IoT in agriculture, Smart irrigation management system, Introduction to Vehicular IoT Components of vehicular IoT, Advantages of vehicular IoT.

IoT Hardware Projects: Introduction to Arduino Boards, LED interface with Arduino, LED interface with Arduino, MQ-2 Gas sensor interface with NodeMCU

TEXTBOOKS:
1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT", Cambridge University Press 2021**.**

REFERENCE BOOKS:
1. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014.
3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.

Weblinks and Video Lectures (e-Resources):
1. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/

4. **Syllabus Timeline**

S/L	Syllabus Timeline	Description
1	**Week 1-3 Introduction to IoT**	Introduction to IoT: Introduction, evolution of IoT, enabling technologies, complex interdependence of technologies, IoT networking components, addressing strategies in IoT.
2	**Week 4-6 IoT Sensing and Actuation**	IoT Sensing and Actuation: Introduction, sensors, sensor characteristics, sensorial deviations, sensing types, sensing considerations, actuators, actuator types, actuator characteristics.
3	**Week 7-9 IoT Processing Topologies and Types**	IoT Processing Topologies and Types: Data formats, importance of processing in IoT, processing topologies, IoT device design and selection considerations, processing offloading.
4	**Week 10-11 IoT Connectivity Technologies:**	IoT Connectivity Technologies: Introduction, IEEE 802.15.4, Zigbee, Thread, ISA100.11A, Wireless HART, RFID, NFC, DASH7, Z-Wave, Weightless, Sigfox, LoRa, NB-IoT, Wi-Fi, Bluetooth.
5	**Week 12-14 IoT Case Studies and Future Trends**	IoT Case Studies and Future Trends: Introduction, components of agricultural IoT, advantages of IoT in agriculture, smart irrigation management system, and introduction to vehicular IoT, components and advantages of vehicular IoT.

5. **Teaching-Learning Process Strategies**

S/L	TLP Strategies:	Description
1	**Lecture Method**	Deliver structured lectures on IoT basics, including its evolution, technologies, networking components, and addressing strategies. Use clear explanations and real-life examples to reinforce learning.
2	**Video/Animation**	Use videos and animations to illustrate IoT sensing, actuation, processing topologies, and connectivity technologies. Visual aids will help in understanding complex systems and interactions.
3	**Collaborative Learning**	Promote group projects and collaborative activities to apply IoT concepts, design systems, and solve problems together. This will enhance teamwork skills and deepen understanding of practical IoT applications.
4	**Real-World Application**	Incorporate case studies and practical examples of IoT applications, such as smart homes and industrial IoT, to connect theoretical concepts with real-world scenarios.
5	**Flipped Class Technique**	Implement a flipped classroom approach by providing pre-class resources (e.g., articles, videos) on IoT topics. Use class time for hands-on activities and deeper discussions.
6	**Laboratory Learning**	Conduct hands-on lab sessions for practical experience with IoT hardware, such as Arduino boards and sensors. This will provide students with practical skills in building and programming IoT projects.
7	**Guest Lectures/Workshops**	Invite industry experts to deliver guest lectures or conduct workshops on emerging IoT technologies and trends. This provides students with insights into current industry practices and innovations.

6. **Assessment Details (both CIE and SEE)**
   Continuous Internal Evaluation:

The minimum CIE marks requirement is 50% of maximum marks in each component.

CIE Split up

	Components	Number	Weightage	Max. Marks	Min. Marks
(i)	Internal Assessment-Tests (A)	2	50%	25	12.5
(ii)	Assignments/Quiz/Activity (B)	2	50%	25	12.5
	Total Marks			**50**	**25**

Final CIE Marks = (A) + (B)

Average internal assessment shall be the average of the 2 test marks conducted.

Semester End Examination:

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 questions from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

7. Learning Objectives

S/L	Learning Objectives	Description
1	**Understand IoT Fundamentals**	Understand the fundamentals of IoT, including its evolution, enabling technologies, key components, and addressing strategies.
2	**Integration of Sensors and Actuators**	Develop practical skills in interfacing various sensors and actuators with IoT hardware platforms like Arduino and Raspberry Pi, laying the foundation for building functional IoT projects.
3	**Analyze IoT Processing Techniques**	Analyze different IoT processing topologies, data formats, and processing strategies, including processing offloading.
4	**Explore IoT Connectivity Technologies**	Explore various IoT connectivity technologies and communication protocols, and understand their application in IoT systems.
5	**Study IoT Applications and Trends**	Study case studies and future trends in IoT, focusing on agricultural and vehicular applications to understand practical uses and emerging developments
6	**Build and Implement IoT Projects**	Build and implement practical IoT projects using hardware components, such as Arduino boards and sensors, to apply theoretical knowledge in real-world scenarios.

8. Course Outcomes (COs) and Mapping with POs

Course Outcomes (COs)

COs	Description
M23MCA302.1	Present comprehensive on the fundamentals of IoT, including its evolution, architecture, and key components.
M23MCA302.2	Apply skills to interface various sensors and actuators with IoT hardware platforms.
M23MCA302.3	Analyze and evaluate different IoT processing topologies and data management techniques.
M23MCA302.4	Evaluate and select appropriate IoT connectivity technologies and communication protocols.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA302.1	3	-	-	-	-	-	-	-

M23MCA302.2	-	3	-	3	-	-	-	-
M23MCA302.3	-	3	3		-	-	-	3
M23MCA302.4	-	-	3	3	-	-	-	3
M23MCA302	3	3	3	3	-	-	-	3

9. **Assessment Plan**

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	CO4	Total
Module 1	10				10
Module 2			10		10
Module 3	10				10
Module 4		10			10
Module 5				10	10
Total	**20**	**10**	**10**	**10**	**50**

Semester End Examination (SEE)

	CO1	CO2	CO3	CO4	Total
Module 1	20				20
Module 2			20		20
Module 3	20				20
Module 4		20			20
Module 5				20	20
Total	**40**	**20**	**20**	**20**	**100**

10. **Future with this Subject:**

❖ **Embracing Advanced Tools**: Future IoT courses will integrate advanced computational tools and software for simulating and designing IoT systems. This will enhance your ability to experiment and refine IoT projects, building on the foundational knowledge of IoT architecture and hardware.

❖ **Incorporating Edge Computing and AI**: As IoT evolves; there will be a stronger focus on edge computing and AI. This means developing systems that can process data at the edge and make real-time decisions, expanding your understanding of IoT processing and connectivity technologies.

❖ **Exploring Interdisciplinary Applications**: IoT applications will increasingly intersect with smart cities, healthcare, and industrial automation. Expect to see how IoT sensing and actuation, along with connectivity technologies, can be applied to these areas to address real-world challenges..

❖ **Focusing on Security and Privacy:** With the growing use of IoT devices, ensuring security and privacy will be crucial. Future coursework will address practices for securing IoT systems and protecting data, building on your knowledge of communication protocols and IoT case studies..

3rd Semester	PROFESSIONAL CORE COURSE (PC) CLOUD COMPUTING	M23MCA303

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Basic Cloud Concepts	• Basic understanding of cloud computing fundamentals (e.g., IaaS, PaaS, SaaS) • Familiarity with key cloud service providers (AWS, Google Cloud, Azure). • Basic IT knowledge, including networking, storage, and computing principles.
2	Cloud Resource Management	• Ability to deploy and manage basic cloud resources (e.g., virtual machines, storage). • Knowledge of cloud provider interfaces and tools. • Basic skills in resource provisioning and monitoring
3	Cloud Security Fundamentals	• Understanding of fundamental security principles (authentication, authorization, encryption). • Basic knowledge of common cloud security threats and vulnerabilities. • Familiarity with basic security configurations and practices in cloud environments.
4	Cloud Automation Basics	• Knowledge of automation tools and scripting languages (e.g., Terraform, Python) • Basic understanding of cloud infrastructure automation concepts. • Ability to write and execute simple automation scripts for managing cloud resources
5	Advanced Cloud Security	• In-depth knowledge of cloud security practices, including compliance and regulatory requirements. • Experience with advanced security tools and techniques (e.g., IAM, encryption, key management). • Skills in performing security audits and incident management in cloud environments
6	Cloud Cost Management	• Understanding of cloud pricing models and cost management principles. • Basic skills in tracking and analyzing cloud usage and expenditures. • Ability to implement cost-saving measures and optimize cloud spending.
7	Cloud Architecture Design	• Knowledge of designing scalable and reliable cloud architectures. • Experience with designing multi-tier applications and integrating various cloud service • Skills in optimizing cloud architectures for performance and cost.

2. Competencies

S/L	Competency	KSA Description
1	Cloud Architecture Design	**Knowledge**: • **Cloud Models and Services:** Understanding of IaaS, PaaS, SaaS, and their use cases. Familiarity with the architecture of major cloud platforms (AWS, Google Cloud, Azure). • **Scalability and High Availability:** Knowledge of designing scalable and highly available cloud systems **Skills:** • **Designing Solutions:** Ability to design cloud architectures that meet performance, reliability, and security requirements. • **Resource Optimization:** Skills in optimizing cloud resources for cost and performance, including instance types, storage options, and networking configurations.

		Attitudes: • **Strategic Planning:** Ability to develop strategic cloud architecture plans that align with organizational goals and scalability needs. • **Problem Solving:** Capability to troubleshoot and resolve architectural issues in cloud deployments.
2	**Cloud Security Management**	**Knowledge:** • **Security Best Practices:** Understanding of cloud security principles, including encryption, identity management, and compliance requirements. • **Threats and Vulnerabilities:** Knowledge of common cloud security threats and how to mitigate them. **Skills:** • **Configuration and Management:** Ability to configure cloud security settings, such as firewalls, IAM policies, and encryption. • **Monitoring and Auditing:** Skills in using security tools and practices to monitor, audit, and ensure compliance. **Attitudes:** • **Incident Response:** Ability to respond to and manage security incidents and breaches. • **Risk Assessment:** Capability to assess and mitigate security risks in cloud environments.
3	**Cloud Cost Management**	**Knowledge:** • **Pricing Models:** Understanding of cloud pricing structures and cost management strategies. • **Billing and Budgeting:** Knowledge of tools and techniques for monitoring and controlling cloud spending. **Skills:** • **Cost Optimization:** Ability to analyze cloud usage and identify opportunities for cost savings, such as right-sizing and reserved instances. • **Budget Management:** Skills in setting and managing cloud budgets, forecasting expenses, and reporting. **Attitudes:** • **Cost Analysis:** Ability to perform detailed cost analysis and provide recommendations for cost reduction. • **Strategic Budgeting:** Capability to develop and implement cost management strategies that align with organizational financial goals.
4	**Cloud Service Integration**	**Knowledge:** • **Service Integration:** Understanding of how to integrate various cloud services and APIs. • **Interoperability:** Knowledge of best practices for integrating cloud services with on-premises systems and other cloud platforms. **Skills:** • **API Management:** Ability to work with cloud APIs and integrate services for a cohesive solution. • **Interfacing Systems:** Skills in ensuring smooth data and process integration between cloud and on-premises systems. **Attitudes:** • **Solution Development:** Ability to develop and implement integrated cloud solutions that meet business requirements. • **Collaboration:** Capability to work with cross-functional teams to integrate cloud services effectively.

3. **Syllabus**

CLOUD COMPUTING SEMESTER – III			
Course Code	M23MCA303	CIE Marks	50
Number of Lecture Hours/Week(L: T: P: S)	(4:0:0:0)	SEE Marks	50
Total Number of Lecture Hours	50 hours Theory	Total Marks	100
Credits	4	Exam Hours	03

Course Objectives:

- Understand the foundational concepts of cloud computing.
- Discuss the characteristics, delivery models and benefits of cloud computing.
- Explore the key technical, organizational and compliance challenges of cloud computing.
- Understand the trends in cloud computing.
- Explore the security issues that arise from cloud computing architectures intended for delivering Cloud based enterprise IT services.

Module -1

Introduction: Introduction, definition of cloud computing, characteristics of cloud computing, cloud Models: service Models, deployment Models, cloud services examples: Iaas: amazon EC2, google compute engine, Azure VMs, PaaS: google app engine, SaaS: Salesforce

Cloud-based Services & Applications: cloud ccomputing for Healthcare, cloud ccomputing for eenergy ssystems, cloud ccomputing for ttransportation ssystems, cloud ccomputing for mmanufacturing iindustry, cloud ccomputing for ggovernment, cloud ccomputing for eeducation, cloud ccomputing for mmobile ccommunicationn

Module -2

Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open- source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

Module -3

Cloud Computing Application Paradigms: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High- performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

Module -4

Compute Services and platform: Compute Services: Amazon Elastic Compute Cloud, Google Compute Engine, Windows Azure Virtual Machines. Storage Services: Amazon Simple Storage Service, Google Cloud Storage,Windows Azure Storage. Database Service: Amazon Relational Data Store,Amazon Dynamo DB, Google Cloud SQL, Google Cloud Data store, Windows Azure SQL Database, Windows Azure Table Service

Module -5

Cloud Security: Introduction, CSA cloud ssecurity aarchitecture, aauthentication, Single Sign-On (SSO), aauthorization, identity & access management, data security, securing data at rest, securing data in motion, key management, Auditing.

TEXTBOOKS:

1. Cloud Computing: A Hands-on Approach", Arshdeep Bahga, Vijay Madisetti, UniversitiesPress.
2. Cloud Computing: Theory and Practice, Dan C Marinescu Elsevier (MK), 2013.

REFERENCE BOOKS:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing, Mc Graw Hill Education,2013.

2 .Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 2011.

VIDEO LINKS:

- https://www.javatpoint.com/cloud-computing-tutorial
- https://www.tutorialspoint.com/cloud_computing/index.html
- https://www.digimat.in/nptel/courses/video/106105167/L01.html (**Video Lectures**)

4. **Syllabus Timeline**

S/L	Syllabus Timeline	Description
1	**Week 1-3: Introduction Cloud-Based Services & Applications**	**Introduction:** Introduction, definition of cloud computing, characteristics of cloud computing, cloud Models: service Models, deployment Models, cloud services examples:laas: amazon EC2, google compute engine, Azure VMs ,PaaS: google app engine,SaaS: Salesforce **Cloud-based Services & Applications:** cloud ccomputing for Healthcare, cloud ccomputing for eenergy ssystems, cloud ccomputing for ttransportation ssystems, cloud ccomputing for mmanufacturing iindustry, cloud ccomputing for ggovernment, cloud ccomputing for eeducation, cloud ccomputing for mmobile ccommunicationn
2	**Week 4-6: Cloud Infrastructure**	**Cloud Infrastructure:** Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open- source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.
3	**Week 7-9: Cloud Computing Applications Paradigms**	**Cloud Computing Application Paradigms:** Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High- performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.
4	**Week 10-11 Compute Services and Platform**	**Compute Services and platform:** Compute Services: Amazon Elastic Compute Cloud, Google Compute Engine, Windows Azure Virtual Machines. Storage Services: Amazon Simple Storage Service, Google Cloud Storage, Windows Azure Storage. Database Service: Amazon Relational Data Store, Amazon Dynamo DB, Google Cloud SQL, Google Cloud Data store, Windows Azure SQL Database, Windows Azure Table Service
5	**Week 12-14 Cloud Security**	**Cloud Security:** Introduction, CSA cloud ssecurity aarchitecture, aauthentication, Single Sign-On (SSO), aauthorization, identity & aaccess mmanagement, data security, securing data at rest, ssecuring data in motion, key management, Auditing.

5. **Teaching-Learning Process Strategies**

S/L	TLP Strategies:	Description
1	**Lecture Method**	Utilize various teaching methods within the lecture format to reinforce competencies. This includes interactive lectures, Q&A sessions, and summarizing key points
2	**Video/Animation**	Incorporate visual aids like videos/animations to enhance understanding of complex concepts, making abstract ideas more tangible and easier to grasp
3	**Group Discussions**	Facilitate group discussions and debates on current trends and future directions in cloud computing, encouraging collaborative learning and critical

		thinking.
4	**Case Studies**	Analyze real-world case studies to understand the application of cloud computing in various industries, highlighting both successes and challenges.
5	**Guest Lectures**	Invite industry experts to share insights and experiences, providing students with up-to-date industry knowledge and networking opportunities.

6. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation:

The minimum CIE marks requirement is 50% of maximum marks in each component.

CIE Split up

	Components	Number	Weightage	Max. Marks	Min. Marks
(i)	Internal Assessment-Tests (A)	2	50%	25	12.5
(ii)	Assignments/Quiz/Activity (B)	2	50%	25	12.5
	Total Marks			**50**	**25**

Final CIE Marks = (A) + (B)

Average internal assessment shall be the average of the 2 test marks conducted.

Semester End Examination:

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

7. Learning Objectives

S/L	Learning Objectives	Description
1	**Understand Cloud Computing Fundamentals**	Gain a thorough understanding of the foundational concepts of cloud computing, including cloud service models (IaaS, PaaS, SaaS) and deployment models (public, private, hybrid, multi-cloud).
2	**Explore Cloud Computing Architecture**	Analyze the architecture of cloud computing platforms, including virtualized resources, networking, storage, and data management, to understand how these components interact to provide cloud services.
3	**Examine Major Cloud Service Providers**	Compare and contrast the services offered by major cloud providers such as AWS, Azure, and Google Cloud, and understand their unique features, strengths, and use cases.
4	**Implement Cloud Solutions**	Develop skills to deploy and manage cloud-based solutions, utilizing various tools and platforms to set up virtual machines, storage solutions, and networking configurations.
5	**Understand Security in Cloud Computing**	Learn about the security challenges in cloud environments, including data privacy, encryption, identity and access management, and strategies to mitigate security risks.
6	**Explore Serverless Computing**	Understand the concepts and benefits of server less computing, and gain hands-on experience with server less platforms and services, focusing on building and deploying server less applications.

8. Course Outcomes (COs) and Mapping with POs

Course Outcomes (COs)

COs	Description
M23MCA303.1	Understand the fundamental and core concepts of cloud computing
M23MCA303.2	Apply the the architecture, infrastructure and delivery models of cloud computing
M23MCA303.3	Analyse the compute services and storage services
M23MCA303.4	Analyse the known threats, risks, vulnerabilities and privacy issues associated with Cloud based IT services.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA303.1	-	2	-	-	-	-	-	2
M23MCA303.2	3	-	-	3	-	2	-	-
M23MCA303.3	-	3	-	-	-	-	-	-
M23MCA303.4	-	3	-	-	-	-	-	3
M23MCA303	3	2.6	-	3	-	2	-	2.5

9. Assessment Plan

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	CO4	Total
Module 1	10				10
Module 2		10			10
Module 3		10			10
Module 4			10		10
Module 5				10	10
Total	10	20	10	10	50

Semester End Examination (SEE)

	CO1	CO2	CO3	CO4	Total
Module 1	20				20
Module 2		20			20
Module 3		20			20
Module 4			20		20
Module 5				20	20
Total	20	40	20	20	100

10. Future with this Subject:

❖ **Enhanced Cloud Models and Services:** · **Expansion of Service Models:** As cloud computing evolves, we can expect new service models beyond IaaS, PaaS, and SaaS, such as Function as a Service (FaaS) and Blockchain as a Service (BaaS), providing more specialized and flexible cloud solutions.

❖ **Industry-Specific Cloud Applications: Personalized Healthcare Solutions:** Cloud computing will drive the development of personalized healthcare applications, leveraging big data and AI for more accurate diagnostics and treatments.

❖ **Evolving Cloud Security Practices: Zero-Trust Security Models:** The shift towards zero-trust architectures will strengthen cloud security by continuously verifying user identities and access rights.

❖ **Advanced Data Security Techniques:** New methods for securing data at rest and in motion, including homomorphic encryption and quantum-resistant cryptography, will emerge, providing stronger protection against evolving threats.

3rd Semester	INTEGRATED PROFESSIONAL CORE COURSE (IPC) WEB TECHNOLOGIES	M23MCA304

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Basic Computer Literacy	• Understanding how to use a computer, navigate the internet, and perform basic tasks like file management. • Fundamental for working with web technologies and using development tools.
2	Understanding of Operating Systems	• Familiarity with operating systems like Windows, macOS, or Linux, including command-line usage. • Helps in setting up development environments and managing software installations.
3	Basic Knowledge of HTML and CSS	• Understanding HTML (Hypertext Markup Language) for structuring web content and CSS (Cascading Style Sheets) for styling web pages. • Essential for creating and designing basic web pages.
4	Familiarity with Web Browsers	• Knowledge of how web browsers work, including concepts like rendering, developer tools, and browser compatibility. • Crucial for testing and debugging web applications.
5	Basic Programming Skills	• Experience with at least one programming language, such as Python, JavaScript, or Java. Understanding programming concepts like variables, loops, functions, and conditionals. • Programming skills are necessary for developing interactive and dynamic web applications.
6	Internet and Networking Basics	• Knowledge of how the internet works, including concepts like HTTP/HTTPS, DNS, IP addresses, and client-server architecture. • Provides a foundational understanding of how web applications communicate over the internet.
7	Introduction to JavaScript	• Familiarity with JavaScript, the primary scripting language used in web development. Understanding basic syntax, DOM manipulation, and event handling. • JavaScript is essential for creating interactive web pages and is a core technology in modern web development.
8	Problem-Solving and Logical Thinking	• The ability to approach problems logically and develop solutions systematically. • Web development often involves troubleshooting and solving complex issues, requiring strong problem-solving skills.
9	Introduction to Web Development Tools	• Familiarity with integrated development environments (IDEs), text editors (e.g., VS Code, Sublime Text), and web development frameworks (e.g., Bootstrap, React).

2. Competencies

S/L	Competency	KSA Description
1	XHTML5	**Knowledge**: • Knowledge of the XHTML5 specification and its relationship to HTML5. • Familiarity with the principles of XHTML, including the requirement for well-formed XML syntax and stricter document structure compared to HTML. • Awareness of XHTML5 syntax rules, such as proper element nesting,

		• attribute usage, and closing tags. • Familiarity with how XHTML5 integrates with other web technologies like CSS3 and JavaScript. **Skills**: • Ability to create XHTML5 documents that adhere to XML syntax rules and standards. • Proficiency in using validation tools to ensure XHTML5 documents are well-formed and compliant with XHTML5 standards. • Ability to use modern CSS techniques to enhance the presentation of XHTML5 content. • Strong attention to detail in maintaining XHTML5 document integrity and proper structure. **Attitude**: • Ability to diagnose and resolve issues related to XHTML5 syntax and document structure. • Capability to apply XHTML5 concepts and principles in conjunction with modern web standards and practices.
2	**CSS (Cascading Style Sheets)**	**Knowledge:** • Understanding of CSS syntax and rules for styling HTML elements. • Familiarity with advanced CSS features like Flexbox, Grid, and CSS animations. • Knowledge of CSS preprocessors like SASS or LESS for efficient styling. **Skills:** • Ability to create responsive layouts using media queries and fluid design principles. • Proficiency in designing and implementing complex UI components with CSS. • Competence in optimizing CSS for performance and cross-browser compatibility. **Attitude:** • Ability to design aesthetically pleasing and consistent user interfaces. • Capability to adapt and apply CSS techniques to different project requirements.
3	**JavaScript**	**Knowledge:** • Solid understanding of core JavaScript concepts like variables, functions, objects, and events. • Familiarity with ES6+ features such as arrow functions, promises, and modules. • Knowledge of asynchronous programming (e.g., callbacks, promises, async/await). **Skills:** • Proficiency in manipulating the DOM and handling events dynamically. • Ability to write clean, modular, and reusable JavaScript code. • Competence in integrating JavaScript with APIs and managing data flow in web applications. **Attitude:** • Ability to develop interactive and dynamic web applications. • Capability to debug and optimize JavaScript code for performance.
4	**Bootstrap**	**Knowledge:** • Familiarity with the Bootstrap framework, including its grid system, components, and utilities.

		• Understanding of Bootstrap's customization capabilities through themes and SASS variables. **Skills:** • Ability to quickly build responsive and mobile-first web pages using Bootstrap. • Proficiency in utilizing Bootstrap components (e.g., modals, carousels, navigation bars) to enhance UI. • Competence in customizing Bootstrap's default styles to match project branding. **Attitude:** • Capability to rapidly prototype and deploy web interfaces with a consistent look and feel. • Ability to extend Bootstrap's components for specific project needs.
5	**jQuery**	**Knowledge:** • Understanding of jQuery's syntax and methods for DOM manipulation, event handling, and animations. • Familiarity with jQuery plugins and how to integrate them into projects. **Skills:** • Proficiency in simplifying complex JavaScript tasks using jQuery's concise methods. • Ability to create dynamic and interactive web elements with jQuery. • Competence in managing AJAX requests with jQuery for asynchronous data handling. **Attitude:** • Ability to enhance user interactions with smooth animations and effects using jQuery. • Capability to integrate jQuery plugins to extend functionality in web applications.
6	**AngularJS**	**Knowledge:** • Understanding of AngularJS architecture, including concepts like two-way data binding, directives, and services. • Familiarity with the MVC (Model-View-Controller) pattern used in AngularJS. **Skills:** • Proficiency in building single-page applications (SPAs) with AngularJS. • Ability to create reusable components and directives to streamline development. • Competence in managing application state and data flow using AngularJS services and dependency injection. **Attitude:** • Capability to develop modular, maintainable, and scalable web applications with AngularJS. • Ability to optimize AngularJS applications for performance and user experience.

3. Syllabus

WEB TECHNOLOGIES SEMESTER – III			
Course Code	**M23MCA304**	CIE Marks	**50**

Number of Lecture Hours/Week(L: T: P: S)	(3:2:0)	SEE Marks	50
Total Number of Lecture Hours	40 hours Theory + 10 hours Lab	Total Marks	100
Credits	04	Exam Hours	03

Course objectives:
- Creating the small web page using xhtml5.
- Use different tags of html to create web page.
- Use of CSS and JavaScript.
- Developing the dynamic document using JavaScript.

Module -1
Web browsers, web servers, MIME, URL, HTTP Introduction to XHTML5 tags, Basic syntax and structure, text markups, images, lists, tables, progress, Media tags-audio and video, forms, frames.

Module -2
Introduction to CSS, Levels of CSS, Selectors, Font, color and Text Properties, BOX Model, Span and Div tags. Introduction to JavaScript, controls statements, Arrays and functions, pattern matching, Element Access, Event Handling.

Module -3
Introduction to Bootstrap, First example, containers, Bootstrap elements: colors, tables, images, buttons, button groups, progress bars, Forms, utilities, Classes, alerts, custom forms, Grid System.

Module -4
Introduction to jQuery, Syntax, selectors, events, jQuery HTML, jQuery Effects, jQuery CSS.

Module -5
Introduction to Angular JS, Directives, Expressions, Directives, Controllers, Filters, Services, Events, Forms, Validations, Examples.

Practical Component of IPCC

S/L	Experiments
1	Create an XHTML page that provides information about your department. Your XHTML page must use the following tags: a) Text Formatting tags b) Horizontal rule c) Meta element d) Links e) Images f) Tables (Use of additional tags encouraged).
2	Develop and demonstrate the usage of inline, external and internal style sheet using CSS. Use XHTML page that contains at least three paragraphs of text, listed elements and a table with four rows and four columns.
3	Develop and demonstrate a XHTML file that includes JavaScript script for the following problems: a) Input : A number n obtained using prompt Output : The first n Fibonacci numbers b) Input : A number n obtained using prompt Output : A table of numbers from 1 to n and their squares using alert
4	Develop, test and validate an XHTML document that has checkboxes for apple (59 cents each), orange (49 cents each), and banana (39 cents each) along with submit button. Each check boxes should have its own onclick event handler. These handlers must add the cost of their fruit to a total cost. An event handler for the submit button must produce an alert window with the message „your total cost is $xxx", where xxx is the total cost of the chose fruit, including 5 percent sales tax. This handler must return „false" (to avoid actual submission of the form data). Modify the document to accept quantity for each item using textboxes.
5	Develop and demonstrate a HTML file which includes JavaScript that uses functions for the following problems: a. Parameter: A string Output: The position in the string of the left-most vowel. b. Parameter: A number Output: The number with its digits in the reverse order.
6	Develop and demonstrate, using JavaScript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible. Modify the above document so that when a text is moved from the top stacking position, it returns to its original position rather than to

	the bottom	

TEXTBOOKS:
1. Web Programming By Chris Bates , Wiley Publications
2. Angular JS By Krishna Rungta
3. Bootstrap essentials by Snig by Packt-open source

REFERENCE BOOKS:
1. HTML5 Black Book by Dreamtech

VIDEO LINKS:
1. https://www.geeksforgeeks.org/learn-web-development-basics-with-html-css-and-javascript/
2. https://learn.jquery.com/
3. https://docs.angularjs.org/guide/introduction

4. Syllabus Timeline

S/L	Syllabus Timeline	Description
1	**Week 1-3: Introduction to XHTML5**	Understanding what XHTML is, its history, and how it relates to HTML. Learning the strict syntax rules of XHTML, including proper nesting of elements, closing tags, and case sensitivity.
2	**Week 4-6: Introduction to CSS and JavaScript**	CSS enhances the visual appeal of a webpage; JavaScript adds interactivity and dynamic content.
3	**Week 8-11: Introduction to Bootstrap**	Studying Bootstrap will help for responsive; mobile-first front-end web development and it is a free and open-source CSS framework.
4	**Week 7-8: Introduction to jQuery**	Understanding jQuery helps to design and simplify HTML DOM tree traversal and manipulation,
5	**Week 9-12: Introduction to Angular JS**	AngularJS is a popular open-source framework that simplifies web development by creating interactive single-page applications.

5. Teaching-Learning Process Strategies

S/L	TLP Strategies:	Description
1	**Lecture Method**	Utilize various teaching methods within the lecture format to reinforce competencies.
2	**Video/Animation**	Incorporate visual aids like videos/animations to enhance understanding of concepts.
3	**Collaborative Learning**	Encourage collaborative learning for improved competency application.
4	**Real-World Application**	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	**Flipped Class Technique**	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
6	**Laboratory Learning**	Utilize the facilities available in the laboratories to understand the behavior of the materials by performing few experiments.

6. **Assessment Details (both CIE and SEE)**

   Continuous Internal Evaluation:

   The minimum CIE marks requirement is 50% of maximum marks in each component.

   CIE Split up

Components		Number	Weightage	Max. Marks	Min. Marks
Theory (A)	Internal Assessment-Tests (A)	2	**60%**	**15**	**7.5**
	Assignments/Quiz/Activity (B)	2	**40%**	**10**	**05**
	Total Marks		**100%**	**25**	**12.5**

Components		Number	Weightage	Max. Marks	Min. Marks
Laboratory (B)	Record Writing	Continuous	**60%**	15	7.5
	Test at the end of the semester	1	**40%**	10	05
	Total Marks		**100%**	**25**	**12.5**

Final CIE Marks = (A) + (B)

Semester End Examination:

1. Question paper pattern will be 10 questions. Each question is set for 20 marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 questions from each module, each of the 2 questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. The question paper may include questions from the laboratory component.
5. Marks scored will be proportionally scaled down to 50 marks.

7. Learning Objectives

S/L	Learning Objectives	Description
1	**Understanding Web Fundamentals**	Learn the basics of HTML (HyperText Markup Language), CSS (Cascading Style Sheets), and JavaScript. Understand how these technologies work together to create and style web pages.
2	**Developing Web Pages**	Acquire skills to create and structure web pages using HTML. Learn to apply styles and layout techniques with CSS. Implement interactive features and client-side scripting with JavaScript.
3	**Responsive Design**	Learn to create web pages that work well on various devices and screen sizes. Understand the principles of responsive web design and how to use media queries.
4	**Web Development Best Practices**	Adopt best practices for writing clean, maintainable, and scalable code. Understand the importance of code documentation and testing.
5	**Web Development Frameworks and Libraries**	Use jQuery for simplified DOM manipulation, event handling, and AJAX operations. Understand the basics of a JavaScript framework/library for building dynamic, single-page applications.

8. Course Outcomes (COs) and Mapping with POs

Course Outcomes (COs)

COs	Description
M23MCA304.1	Explore Basic Concepts and tools of web technologies.
M23MCA304.2	Demonstrate the development of XHTML documents using JavaScript and CSS.
M23MCA304.3	Apply the features of jQuery and Bootstrap for the given web-based problem.
M23MCA304.4	Design and implement user interactive dynamic web-based applications using Angular JS and jQuery.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA304.1	3	-	-	-	-	-	-	-
M23MCA304.2	-	3	3	3	-	-	-	-
M23MCA304.3	3	3	3	3	-	-	-	-
M23MCA304.4	-	3	3	3	-	-	-	-
M23MCA304	3	3	3	3	-	-	-	-

9. **Assessment Plan**

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	CO4	Total
Module 1	5	5			10
Module 2		10			10
Module 3			10		10
Module 4			5	5	10
Module 5	5			5	10
Total	10	15	15	10	50

Semester End Examination (SEE)

	CO1	CO2	CO3	CO4	Total
Module 1	10	10			20
Module 2		20			20
Module 3			20		20
Module 4			10	10	20
Module 5	10			10	20
Total	20	30	30	20	100

10. **Future with this Subject:**
    ❖ **Progressive Web Apps (PWAs):** PWAs combine the best of web and mobile apps, offering offline functionality, push notifications, and faster load times. They aim to provide a more app-like experience on the web. Expect to see wider adoption of PWAs as they become increasingly integrated with native operating system features and improve performance.
    ❖ **Artificial Intelligence and Machine Learning:** AI and ML will be increasingly used to create personalized content, chatbots, and advanced analytics. Expect more sophisticated user interfaces and interactions powered by AI, such as intelligent recommendations and voice-driven commands.
    ❖ **Web3 and Decentralization:** Web3 technologies aim to create a decentralized internet using blockchain and other distributed technologies, focusing on privacy, ownership, and trust. These technologies will impact web applications by enabling new business models and financial transactions directly on the web.
    ❖ **Advanced Web Development Frameworks:** New frameworks and libraries will continue to evolve, offering better performance, improved developer experience, and more powerful tools for building modern web applications. Frameworks like React, Vue, and Angular will evolve, focusing on reusable components and better state management.
    ❖ **Web Standards and Interoperability:** Efforts to standardize web technologies will continue to improve interoperability and ensure a consistent experience across different browsers and devices. New and improved APIs will enable better integration and functionality for web applications.
    ❖ **Sustainable and Green Web Development:** There will be a growing focus on reducing the environmental impact of web development through energy-efficient coding practices and optimized resource usage. The adoption of sustainable hosting solutions and energy-efficient data centers will contribute to a greener web.

3rd Semester	PROFESSIONAL ELECTIVE III ADVANCED PROGRAMMING (C#.NET)	M23MCA305A

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Basic Programming Knowledge.	Familiarities with fundamental concepts of programming languages like C++ and Java.
2	Structure and Syntax	Knowledge of keywords and syntaxes.
3	Delegates and Events	Basic understanding of objects and Methods.
4	Data connectivity and Access	Knowledge of RDBMS.
5	Building Applications	Understanding Graphical user Interface and Controls.
6	Web Development	Knowledge of webpage tools and Controls.

2. Competencies

S/L	Competency	KSA Description
1	Introduction to dot NET framework and C#.	**Knowledge:** • Understanding of the fundamental of the .NET Structures and Syntaxes of C#. • Familiarity with the structure and components of a Dotnet Framework. • Knowledge of Structures, Syntax and familiarities with C# keywords. **Skills:** • Ability to utilize the dot net framework tools. • Knowledge of Programming Skills. **Attitudes:** • Ability to adapt to newer technologies. • Knowledge of utilizing keyword and data types to build the programs .
2	Objects and Methods Concepts	**Knowledge:** • Understanding of the concept of a Objects and Method declarations and utilizing in Programs. • Familiarity with functions definition with objects and Methods. **Skills:** • Acquiring enough skills to use delegates in application building. • Skill in using exception handling and protecting system. **Attitudes**: • Ability to use Delegates concept in Application Building. • Efficiently using in programming.
3	Data Access and Connectivity	**Knowledge:** • Ability to connect to database using ADO.net. • Development of application with database connectivity. **Skills**: • Acquiring sufficient knowledge to develop applications. • Efficient usage of ADO.net tool to work with database. **Attitudes**: • Developing the required application according to the need of customer requirements

4	**Graphical User Interface**	**Knowledge:** ● Understanding the available tools and Controls required to develop GUI. ● Familiarity with various tools and its usage in the real scenarious. **Skills:** ● Gaining sufficient knowledge in building Graphical user interface with form designing. ● Proficiency in applying and using various tools in the software industry. **Attitudes:** ● Critical thinking skills to identify Real world problems and designing GUI for the required application.
5	**Web Application development**	**Knowledge:** ● Gaining enough skills for web application using various tools. ● Familiarities with web development and working with database connectivity. **Skills:** ● Able to develop real time web application using ADO.NET tool for backend connectivity. ● Proficiency in ADO.net tools and its usage in web application projects. **Attitudes**: ● Ability to design and implement robust web application.

3. **Syllabus**

ADVANCED PROGRAMMING (C#.NET) SEMESTER – III			
Course Code	**M23MCA305A**	CIE Marks	**50**
Number of Lecture Hours/Week (L: T: P: S)	**(3:0:0:0)**	SEE Marks	**50**
Total Number of Lecture Hours	**40 hours Theory**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Course Objectives:

● Understanding the basics of .NET framework, keywords, and Datatypes.

● Applying tools on simple application development.

● To apply classes and Objects.

● To understand and implement Delegates.

● To use different tools for web development.

Module -1

Getting started with. NET Framework 4.0 and C#

Understanding Previous Technologies, Benefits of .NET Framework, Architecture of .NET Framework 4.0,.NET Execution Engine, Components of .NET Framework 4.0: CLR, CTS, Metadata and Assemblies, .NET Framework Class Library, Windows Forms, ASP .NET and ASP .NET AJAX, ADO .NET, Windows workflow Foundation, Windows Presentation Foundation, Windows Communication Foundation, Widows Card Space and LINQ.

Creating a Simple C# Console Application, Identifiers and Keywords. System Data Types, Variables and Constants: Value Types, Reference Types, Understanding Type Conversions, Boxing and UnBoxing. Namespaces, The System namespace, . NET Array Types.

Module -2

Classes, Objects and Object Oriented Programming
Classes and Objects: Creating a Class, Creating an Object, Using this Keyword, Creating an Array of Objects, Using the Nested Classes, Defining Partial Classes and Method, Returning a Value from a Method and Describing Access Modifiers. Static Classes and StaticMembers, Properties: Read-only Property, Static Property, Indexers, Structs: Syntax of a struct and Access Modifiers for structs, System.Object Class. **Encapsulation:** Encapsulation using accessors and mutators, Encapsulation using Properties. Inheritance: Inheritance and Constructors, Sealed Classes and Sealed Methods, Extension methods.

Module -3
Delegates, Events, Exception Handling and ADO. NET
Delegates: Creating and using Delegates, Muticasting with Delegates. Events: Event Sources, Event Handlers, Events and Delegates, Multiple Event Handlers. **Exception Handling:** The try/catch/throw/finally statement, Custom Exception.System.Exception, Handling Multiple Exception. **Data Access with ADO.NET:** Understanding ADO.NET: Describing the Architecture of ADO.NET, ADO.NET, ADO.NET Entity Framework. Creating Connection Strings: Syntax for Connection Strings. Creating a Connection to a Database: SQL Server Database, OLEDB Database, ODBC Data Source. Creating a Command Object. Working with Data Adapters: Creating Data Set from Data Adapter.

Module -4
Graphical User Interface with Windows Forms and WPF
Windows Forms: Introduction, Windows Forms, Event Handling: A Simple Event- Driven GUI, Control Properties and Layout, Labels, TextBoxes and Buttons, GroupBoxes and Panels, CheckBoxes and RadioButtons, ToolTips, Mouse-Event Handling, Keyboard-Event Handling. Menus, Month Calendar Control, LinkLabel Control, ListBox Control, ComboBox Control, TreeView Control, ListView Control, TabControl and Multiple Document Interface (MDI) Windows. **WPF:** New WPF Controls, WPF Architecture: Presentation Framework, Presentation Core, WindowsBase, MIL or Milcore, Working with WPF Windows: Using XAML in WPF 4.0 Applications : Contents of XAML and WPF Applications: XAML Elements Namespace and XAML, XAML Property Syntax, Markup Extensions.

Module -5
Web App Development and Data Access using ADO. NET
Introduction, Web Basics, Multitier Application Architecture, Your First Web Application: Building Web-Time Application, Examining Web-Time.aspx's Code- Behind File, Understanding Master pages, Standard Web Controls: Designing a Form, Validation Controls, GridView Control, DropDownList, Session Tracking, ASP.NET

Text Books:
1. . NET 4.0 Programming (6-in-1), Black Book, Kogent Learning Solutions Inc., Wiley- Dream Tech Press. (Chapters: 1,10,11,12,13,14 and 19).
2. Paul Deitel and Harvey Deitel: C# 2010 for Programmers, 4th Edition, Pearson Education. (Chapters: 14,15,19 and 27.3)
Reference Books:
1. Andrew Trolsen: Pro C# 5.0 and the . NET 4.5 Framework, 6th Edition, Wiley-Appress.
2. Bart De Smet: C# 4.0 Unleashed, Pearson Education- SAMS Series.
3. Herbert Schildt: Complete Reference C# 4.0, Tata McGraw Hill, 2010.

4. **Syllabus Timeline**

S/L	Syllabus Timeline	Description
1	Week 1-3:	ADO.NET framework, C# Structures

	Basics of ADO.NET Framework and Introduction to c#	Class libraries, Windows forms Introduction to C# keywords and Data types
2	**Week 4-6: Object Oriented programs and Delegates**	Objects and Methods Boxing and Unboxing Concepts Delegates and its Implementation
3	**Week 7-8: Encapsulation and Exception Handling**	Encapsulation and its concept Exception handling with example programs Different methods used in handling exceptions
4	**Week 9-10: Data access with ADO.NET**	Database connectivity Accessing database Simple application development
5	**Week 11--12: Graphical user Interface**	Graphical user Interface using windows forms Different controls for GUI Development
6	**Week 13-14: Web development and data access**	Web development tools and accessing database using ADO.NET tools

5. Teaching-Learning Process Strategies

S/L	TLP Strategies:	Description
1	**Lecture Method**	Utilize various teaching methods within the lecture format to reinforce competencies.
2	**Video/Animation**	Incorporate visual aids like videos/animations to enhance understanding concepts.
3	**Collaborative Learning**	Encourage collaborative learning for improved competency application.
4	**Higher Order Thinking (HOTS) Questions:**	Pose HOTS questions to stimulate critical thinking related to each competency
5	**Problem-Based Learning (PBL)**	Implement PBL to enhance analytical skills and practical application of competencies
6	**Multiple Representations**	Introduce topics in various representations to reinforce competencies
7	**Real-World Application**	Discuss practical applications to connect theoretical concepts with real-world competencies.
8	**Flipped Class Technique**	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
9	**Programming Assignments**	Assign programming tasks to reinforce practical skills associated with competencies.

6. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation:

The minimum CIE marks requirement is 50% of maximum marks in each component.

CIE Split up

	Components	Number	Weightage	Max. Marks	Min. Marks
(i)	Internal Assessment-Tests (A)	2	50%	25	12.5
(ii)	Assignments/Quiz/Activity (B)	2	50%	25	12.5
	Total Marks			**50**	**25**

Final CIE Marks = (A) + (B)

Average internal assessment shall be the average of the 2 test marks conducted.

Semester End Examination:

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

7. Learning Objectives

S/L	Learning Objectives	Description
1	**Understanding DOT net frame work and c#.**	Students will understand the basics of framework of Dot net and c# features.
2	**Classes, Objects and Object-oriented programming Concept**	Students will gain sufficient knowledge defining classes, objects and its usage in development of real world applications.
3	**Delegates, Events, Exception Handling**	Students will understand the usage of delegates, Events and exception handling with examples.
4	**Database connectivity and Graphical User Interface**	They gain hands on experience to develop the applications with database access.
5	**Web Applications**	Students will work on web application development and accessing data.
6	**C# DOT net present and future**	They will understand present and future of C# DOT net in different areas.

8. Course Outcomes (COs) and Mapping with POs

Course Outcomes (COs)

COs	Description
M23MCA305A.1	Apply the fundamentals of DOTNET framework, C# Syntax and Keywords for simple application development.
M23MCA305A.2	Analyze the real-world problems and apply oops concept and delegates.
M23MCA305A.3	Identify the web development tools and to apply in software development.
M23MCA305A.4	Implement & develop a web based and Console based application with Database connectivity.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA305A.1	3	-	-	-	-	-	-	-
M23MCA305A.2	-	3	-	-	-	-	-	-
M23MCA305A.3	-	-	3	-	-	-	-	-
M23MCA305A.4	-	-	-	3	-	-	-	-
M23MCA305A	3	3	3	3				

9. Assessment Plan

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	CO4	Total
Module 1	05	05	-	-	10
Module 2	-	05	05	-	10
Module 3	-	05	05	-	10
Module 4	-	-	05	05	10
Module 5	-	05	-	05	10
Total	**05**	**20**	**15**	**10**	**50**

Semester End Examination (SEE)

	CO1	CO2	CO3	CO4	Total
Module 1	10	10	-	-	20
Module 2	-	10	10	-	20
Module 3	-	10	10	-	20
Module 4	-	-	10	10	20
Module 5	-	10	-	10	20
Total	**10**	**40**	**30**	**20**	**50**

10. Future with this Subject

Performance Improvements

- **Native AOT (Ahead-of-Time Compilation):** .NET is increasingly incorporating AOT compilation to improve startup times and reduce memory usage.
- **JIT (Just-In-Time) Compiler Enhancements:** Continued work on the JIT compiler aims to improve runtime performance and efficiency.

Cloud-Native and Micro services

- .NET is becoming more adept at supporting cloud-native architectures and microservices. Features like minimal APIs and improved container support are making .NET a strong candidate for building scalable cloud applications.

Cross-Platform Development

- **MAUI (Multi-platform App UI):** .NET MAUI is enhancing cross-platform development for desktop and mobile apps, unifying the experience for developers working across Windows, macOS, iOS, and Android.
- **Blazor:** Blazor allows for building interactive web UIs using C# instead of JavaScript, and its capabilities are expanding to support more complex scenarios and integrations.

Language Features

- **New C# Features:** Each new version of C# brings new features to improve developer productivity and code safety. Features like record types, pattern matching, and new data-oriented APIs are examples of the language evolving to meet modern programming needs.
- **C# 12 and Beyond:** Anticipated features might include improvements in nullability, pattern matching, and data-oriented programming constructs.

Integration with AI and Machine Learning

- With the increasing relevance of AI and machine learning, .NET is likely to improve its integration with AI frameworks and tools, making it easier for developers to incorporate machine learning models and AI functionalities into their applications.

Improved Developer Tools

- **Visual Studio and VS Code Enhancements:** Ongoing improvements in development environments will streamline workflows, debugging, and productivity.

3rd Semester	PROFESSIONAL ELECTIVE III(PE) ENTERPRISE RESOURCE PLANNING	M23MCA305B

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Overview and related technologies of ERP	Familiarities with Data mining, Data warehousing and related tools.
2	ERP Methodologies and its Implementations	Cost analysis skills, Business analytical tools and different analytical tools.
3	ERP packages and its Implementations	Knowledge about Human resources, quality Management, finance and Maintenance in Various Business.
4	ERP marketing with case studies	Familiarities with different company business and marketing strategies
5	Enterprise Resource Planning present and future prediction.	Basics of E-commerce and ERP System.

2. Competencies

S/L	Competency	KSA Description
1	Introduction to Enterprise Resource Planning, Data warehousing and Data mining.	**Knowledge:** • Extracting the required data and data analysis with newer technologies. **Skills:** • Ability to store and retrieve the useful data. **Attitudes:** • Appreciation to understand the importance of data storage and efficient retrieval of data.
2	Enterprise Resource Planning Methodologies and its Implementation	**Knowledge:** • Understanding of basic elements of various ERP methods with latest tools **Skills:** • Analyzing, storing and retrieving data base on vendors requirements. **Attitudes:** • Designing tools for data mining and Warehousing.
3	Business ERP Packages and its maintenance	**Knowledge:** • Ability to analyze and manage business establishments. **Skills:** • Designing tools for Business management and future predictions by using data mining concept. **Attitudes:** • Valuing the importance Data storage and efficient retrieval of data for future prediction.
4	ERP marketing with case studies	**Knowledge:** • Understanding the importance of Data analysis of various companies for future predictions. **Skills:** • Applying Marketing strategies on various business establishments and efficiently managing the data. **Attitudes:** • Openness to understand much about business establishments.

5	**Future directions in ERP and its models**	**Knowledge:** • Understanding present and Futures of ERP. **Skills:** • Prediction of future of ERP using various business models. **Attitudes:** • Appreciation for the way how the business is handled in present and future.

3. Syllabus

PROFESSIONAL ELECTIVE III **ENTERPRISE RESOURCE PLANNING**				
Course Code		**M23MCA305B**	CIE Marks	**50**
Number of Lecture Hours/Week(L: T: P: S)		**(3:0:0:0)**	SEE Marks	**50**
Total Number of Lecture Hours		**40 hours**	Total Marks	**100**
Credits		**03**	Exam Hours	**03**

Course objectives: This course will enable students to:
- To learn basics of ERP, Data Mining and Data Warehousing.
- To understand ERP Implementation and its Life Cycle.
- To gain knowledge on Business models and organizing business Implementations.
- Create applications using advanced features of JDBC and implement projects.

Module -1
Introduction To ERP Overview, Benefits of ERP, ERP and Related Technologies, BusinessProcess Reengineering, Data Warehousing, Data Mining, On–line AnalyticalProcessing, Supply Chain Management.
Module -2
ERP Implementation: Implementation of Life Cycle, Implementation Methodology,Hidden Costs, Organizing Implementation, Vendors, Consultants and Users, Contracts, Project Management and Monitoring
Module -3
Business Modules: Business Modules in an ERP Package, Finance, Manufacturing,Human Resource, Plant Maintenance, Materials Management, Quality Management, Sales, and Distribution.
Module -4
ERP Market: ERP Market Place, SAP AG, People Soft, Baan Company, JD Edwards World Solutions Company, Oracle Corporation, QAD, System Software Associates.
Module -5
ERP–Present And Future: Turbo Charge the ERP System, EIA, ERP and E–Commerce, ERP and Internet, Future Directions in ERP.

Textbooks:
1. Alexis Leon, "ERP Demystified", Tata McGraw Hill, 1999.
2. Joseph A. Brady, Ellen F. Monk, Bret J. Wangner, "Concepts in Enterprise Resource Planning", Thomson Learning, 2001.

References:
1. Vinod Kumar Garg and N.K .Venkata Krishnan, "Enterprise Resource Planningconcepts and Planning", Prentice Hall, 1998.
2. Jose Antonio Fernandz, " The SAP R /3 Hand book", Tata McGraw Hill

4. Syllabus Timeline

S/L	Syllabus Timeline	Description
1	**Week 1-2: Overview and Introduction to ERP**	Basics of ERP, need for ERP, Importance of Data Mining and Data Warehousing.

2	**Week 3-4:** **Life cycle of ERP and its Implementation**	ERP methodologies, organizing, Project management and monitoring.
3	**Week 5-6:** **Business Modules and Different ERP Packages**	Class Methods with Polymorphism and Access Control, using methods in Java Classes and accessing the members and class using appropriate access control with polymorphism and designing and implementing class methods through polymorphism and access mechanism. Exception and Assertions, Try Catch and finally block
4	**Week 7-8:** **ERP marketing**	Applying Strategies of marketing on various companies,
5	**Week 9-10:** **Future of ERP**	Present ERP and building new ERP based on Vendor Requirements
6	**Week 11-12:** **Directions in ERP**	Understanding the current business requirements and prediction of newer business strategies.

5.   **Teaching-Learning Process Strategies**

S/L	TLP Strategies:	Description
1	**Lecture Method**	Utilize various teaching methods within the lecture format to reinforce competencies.
2	**Image/Video/Animation**	Incorporate visual aids like image/videos/animations to enhance understanding of programming constructs.
3	**Collaborative Learning**	Encourage collaborative learning for improved competency application.
4	**Higher Order Thinking (HOTS) Questions:**	Pose HOTS questions to stimulate critical thinking related to each competency.
5	**Programming-Based Learning (PBL)**	Implement PBL to enhance analytical skills and practical application of competencies
6	**Real-World Application**	Discuss practical applications to connect theoretical concepts with real-world competencies.
8	**Flipped Class Technique**	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
9	**Programming Assignments**	Assign programming tasks to reinforce practical skills associated with competencies.

6.   **Assessment Details (both CIE and SEE)**

Continuous Internal Evaluation:
The minimum CIE marks requirement is 50% of maximum marks in each component.
CIE Split up

	Components	Number	Weightage	Max. Marks	Min. Marks
(i)	Internal Assessment-Tests (A)	2	50%	25	12.5
(ii)	Assignments/Quiz/Activity (B)	2	50%	25	12.5
	Total Marks			**50**	**25**

Final CIE Marks = (A) + (B)
Average internal assessment shall be the average of the 2 test marks conducted.

Semester End Examination:
1.   Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2.   There shall be 2 question from each module, each of the two questions under a module (with a

maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

7.   Learning Objectives

S/L	Learning Objectives	Description
1	Understanding ERP and its Overview	Students will understand the basics of ERP, Data mining and Data warehousing and its related technologies.
2	ERP implementation and its lifecycle	Students will gain sufficient knowledge on ERP Implementation using different business models and lifecycle of ERP.
3	Business modules in ERP	Students will understand different business modules and its applications in different fields.
4	ERP marketing	They gain hands on experience using use case study in ERP marketing.
5	ERP marketing	Students will work collaboratively in teams on design projects, enhancing their ability to communicate effectively, share ideas, and solve problems collectively.
6	ERP present and future	They will understand present and future of ERP in E-commerce and Internet.

8.   Course Outcomes (COs) and Mapping with POs

Cos	Description
M23MCA305B.1	Understand the principles of ERP, Data warehousing/Mining and OLAP for the given problem.
M23MCA305B.2	Analyze the implementation of ERP in the context of business of the different organization.
M23MCA305B.3	Analyze and apply ERP for different business models.
M23MCA305B.4	With the help of a case study explain ERP marketing

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA305B.1	3		-	-	-	-	-	-
M23MCA305B.2	-	3	-	-	-	-	-	-
M23MCA305B.3	-	3	-	-	-	-	-	-
M23MCA305B.4	-	-	-	-	-	3	-	-
M23MCA305B	3	3	-	-	-	3	-	-

9.   Assessment Plan

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	CO4	Total
Module 1	10				10
Module 2	5	10			15
Module 3		5			5
Module 4			10		10
Module 5				10	10

Total	15	15	10	10	50

Semester End Examination (SEE)

	CO1	CO2	CO3	CO4	Total
Module 1	20				20
Module 2	10	20			30
Module 3		10			10
Module 4			20		20
Module 5				20	20
Total	**30**	**30**	**20**	**20**	**100**

10. **Future with this Subject**

The future of Enterprise Resource Planning (ERP) is shaping up to be quite transformative, driven by advancements in technology and changing business needs. Here are some key trends and developments to watch:

1. **Cloud-Based Solutions**: The shift towards cloud-based ERP systems is accelerating. Cloud ERP offers scalability, flexibility, and lower upfront costs. It also facilitates easier updates and integration with other cloud services, enhancing overall efficiency and agility.

2. **Artificial Intelligence and Machine Learning**: AI and machine learning are being integrated into ERP systems to automate routine tasks, provide advanced analytics, and enable predictive insights. This can improve decision-making, optimize processes, and personalize user experiences.

3. **Integration with Other Technologies**: Future ERP systems will increasingly integrate with other emerging technologies like the Internet of Things (IoT), blockchain, and advanced data analytics. This will enhance real-time data collection, ensure data integrity, and provide deeper insights into business operations.

4. **Enhanced User Experience**: ERP systems are focusing on improving user interfaces and overall user experience. This includes intuitive dashboards, mobile access, and customizable features to ensure that users can easily interact with the system and extract valuable insights.

5. **Modular and Scalable Solutions**: Businesses are moving towards modular ERP systems that allow them to choose and integrate only the components they need. This modular approach offers greater flexibility and scalability as businesses grow and their needs evolve.

3rd Semester	PROFESSIONAL ELECTIVE III (PE) CRYPTOGRAPHY AND NETWORK SECURITY	M23MCA305C

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Mathematics	• **Discrete Mathematics:** Understanding concepts such as sets, functions, relations, and combinatorics is crucial. Topics like modular arithmetic, number theory (prime numbers, greatest common divisors), and combinatorial analysis are particularly relevant. • **Linear Algebra:** Basic knowledge of vectors and matrices can be useful, especially in cryptographic algorithms that involve matrix operations. • **Probability and Statistics:** Basics of probability can help in understanding encryption strength and attacks.
2	Computer Science Fundamentals	• **Algorithms and Data Structures:** Familiarity with algorithms (e.g., sorting, searching) and data structures (e.g., trees, graphs) is essential, as cryptographic algorithms often involve complex computations. • **Programming:** Proficiency in at least one programming language (e.g., Python, C++) is important for implementing cryptographic algorithms and security protocols. • **Complexity Theory:** Understanding computational complexity and algorithm efficiency can provide insights into the feasibility of cryptographic schemes.
3	Networking Basics	• **Network Protocols:** Knowledge of fundamental networking concepts such as TCP/IP, DNS, and HTTP/HTTPS is important, as cryptographic techniques are often used in securing network communications. • **Network Architecture:** Understanding how networks are structured and operate helps in applying security measures appropriately.
4	Security Fundamentals	• **Introduction to Security Concepts:** Understanding basic concepts such as confidentiality, integrity, and availability is foundational to grasping cryptographic principles.

2. Competencies

S/L	Competency	KSA Description
1	Computer Security Concepts	**Knowledge:** • Understanding basic security principles (confidentiality, integrity, availability). • Familiarity with common security threats and vulnerabilities. • Awareness of basic security policies and practices. • Understanding of attack vectors and methods. • Familiarity with different steganographic methods and their applications. **Skills:** • Ability to identify and describe different types of security threats and attacks. • Skill in applying basic security principles to real-world scenarios. • Skill in analyzing the impact and implications of security attacks. • Skill in detecting and analyzing steganographic content. **Attitude:** • A proactive approach to learning about security risks. • A commitment to staying updated on current security issues and trends. • Awareness of ethical and legal implications of using steganographic techniques.
2	Mastering	**Knowledge:**

		Block Ciphers, DES, and Block Cipher Operations	• Understand the structure and functionality of block ciphers, including the basic concept of encrypting data in fixed-size blocks. • Gain detailed knowledge of the Data Encryption Standard (DES), including its algorithm, key scheduling, and encryption/decryption processes. • Be familiar with key concepts such as substitution-permutation networks (SPNs) and Feistel structures, which are fundamental to DES. **Skill:** • Ability to implement the DES algorithm or a similar block cipher algorithm in a programming language (e.g., Python, C++). Skill in analyzing the security of DES, including understanding its vulnerabilities (e.g., susceptibility to brute-force attacks) and comparing it to more modern block ciphers like AES. **Attitude:** A commitment to deeply understanding the principles behind DES and block ciphers, recognizing their historical significance and evolving security landscape. • Openness to learning about advancements beyond DES, such as AES, and understanding their impact on modern cryptographic practices.
3		**Understanding Number Theory and Public-Key Cryptography**	**Knowledge:** • Understand key number theory concepts such as prime numbers, modular arithmetic, greatest common divisors (GCD), and the Euclidean algorithm. • Be familiar with how these number theory concepts underpin public-key cryptographic algorithms, including the role of large prime numbers and modular inverses in encryption and decryption processes. • Understand the basic principles of public-key cryptography, including the concept of asymmetric encryption where different keys are used for encryption and decryption. • Gain detailed knowledge of widely used public-key algorithms such as RSA, ElGamal, and elliptic curve cryptography (ECC), including how they leverage number theory. **Skill:** • Ability to solve number theory problems relevant to cryptography, such as computing modular inverses, performing modular exponentiation, and applying the Chinese Remainder Theorem. • Skill in implementing number theory algorithms (e.g., finding GCD, primality testing) in a programming language to support cryptographic operations. • Ability to implement and test public-key cryptographic algorithms like RSA or ECC, including key generation, encryption, and decryption processes. • Skill in analyzing the security of public-key systems, including understanding potential vulnerabilities and how to mitigate them. **Attitude:** • **Curiosity:** An eagerness to explore and understand the mathematical foundations that support cryptographic methods, recognizing the importance of number theory in securing digital communications. • **Security-First Mindset:** A proactive attitude towards ensuring the security of public-key cryptographic systems by staying informed about new threats and best practices. • **Ethical Responsibility:** A commitment to applying cryptographic

		knowledge ethically and responsibly, understanding the impact of cryptographic technology on privacy and security.
4	**Mastery of Cryptographic Hash Functions**	**Knowledge:** • Understand what cryptographic hash functions are and their purpose in security, such as ensuring data integrity and supporting digital signatures. • Familiarize yourself with essential properties of cryptographic hash functions, including preimage resistance, second preimage resistance, collision resistance, and avalanche effect. • Gain knowledge of widely used hash functions like MD5, SHA • Understand how hash functions are used in various applications, such as password hashing, digital signatures, and message integrity checks. **Skill:** • Ability to implement cryptographic hash functions using libraries in programming languages like Python, Java, or C++. • Skill in validating the functionality and security of hash functions, including performing tests to ensure they meet desired properties (e.g., resistance to collisions). • Ability to assess the strength and appropriateness of different hash functions for various applications, understanding their resistance to attacks and choosing suitable algorithms based on security requirements. **Attitude:** • A commitment to staying informed about the latest developments and vulnerabilities related to cryptographic hash functions, adapting to emerging threats and changes in best practices. • A careful and critical approach to evaluating the suitability of hash functions for specific use cases, ensuring that chosen algorithms meet current security standards.
5	**Proficiency in Digital Signatures**	**Knowledge:** • Understand what digital signatures are, their role in ensuring authenticity, integrity, and non-repudiation of digital communications. • Be familiar with how digital signatures work, including the use of cryptographic algorithms for signing and verification, and the concept of public-key infrastructure (PKI). • Knowledge of common digital signature algorithms and standards, such as RSA, DSA (Digital Signature Algorithm). **Skill:** • **Practical Application:** Ability to implement digital signature processes using relevant libraries or tools. • Skill in verifying digital signatures to ensure the authenticity and integrity of received data or documents, and correctly handling any verification failures. **Attitude:** • A commitment to maintaining high standards of security in the implementation and management of digital signatures, including staying informed about emerging threats and best practices. • A careful approach to handling cryptographic keys and implementing digital signatures, recognizing the critical role these elements play in maintaining security and trust.

3. **Syllabus**

CRYPTOGRAPHY AND NETWORK SECURITY SEMESTER – III			
Course Code	**M23MCA305C**	CIE Marks	**50**
Number of Lecture Hours/Week(L: T: P: S)	**(3:0:0:0)**	SEE Marks	**50**
Total Number of Lecture Hours	**40 hours Theory**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Course objectives:

- To provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures.
- To explain various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes.
- To familiarize Digital Signature Standard and provide solutions for their issues.
- To familiarize with cryptographic techniques for secure communication of two parties over an insecure channel; verification of the authenticity of the source of a message.

Module -1
Introduction: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security. Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography.

Module -2
Block Ciphers And The Data Encryption Standard: Block Cipher Principles, The Data Encryption Standard (DES), A DES Example, The Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles. Block Cipher Operation: Multiple Encryption and Triple DES, Electronic Codebook Mode, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode. Stream Ciphers: Stream Ciphers, RC4.

Module -3
Number Theory: Divisibility and the Division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Prime Numbers, Fermat "sandEuler"s Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms. Public- Key Cryptography, RSA and other public-Key crypto systems: Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie-Hellman Key Exchange, ElGamal Cryptosystem.

Module -4
Cryptographic Hash Functions: Applications of Cryptographic Hash Function, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA). Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Message Authentication Codes, Security of MACs, MACs Based on Hash Functions (HMAC).

Module -5
Digital signatures: Digital Signatures, ElGamal Digital Signature Scheme, Schnorr Digital Signature Scheme, Digital Signature Standard(DSS). Key management and distribution: Symmetric key distribution using symmetric encryption, Symmetric key distribution using asymmetric encryption, Distribution of public keys, X.509 certificates, Public key infrastructure**.**

Text Books:
1.William Stallings: Cryptography And Network Security- Principles And Practice, 5thEdition, Pearson/PHI, 2011.

Reference books:
1. William Stallings, "Network Security Essentials (ApplicationsandStandards)", 4thEdition, Pearson Education., 2012
2. Charlie Kaufman, Radia Perlman and Mike Speciner: "Network Security – Private Communication in a Public World",2nd Edition, Pearson/PHI,2002.
3. EricMaiwald: "Fundamentals of Network Security",1st Edition, Dreamtech Press, 2003.
4. Whitman:"Principles of Information Security",3rdEdition,Thomson,2009.
5. Robert Bragg, Mark Rhodes: "Network Security: The complete reference",1st Edition,TMH,2004.
6. Buchmann: "Introduction to Cryptography", 2nd Edition, Springer, 2004.

4. **Syllabus Timeline**

S/L	Syllabus Timeline	Description
1	**Week 1-3: Introduction: Computer Security Concepts**	Introduction: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security. Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography.
2	**Week 4-6: Block Ciphers And The Data Encryption Standard:**	Block Ciphers And The Data Encryption Standard: Block Cipher Principles, The Data Encryption Standard (DES), A DES Example, The Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles. Block Cipher Operation: Multiple Encryption and Triple DES, Electronic Codebook Mode, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode. Stream Ciphers: Stream Ciphers, RC4.
3	**Week 7-8: Number Theory**	Number Theory-: Divisibility and the Division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Prime Numbers, Fermat ˝sandEuler˝s Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms. Public- Key Cryptography, RSA and other public-Key crypto systems: Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie-Hellman Key Exchange, ElGamal Cryptosystem.
4	**Week 9-11: Cryptographic Hash Functions**	Cryptographic Hash Functions: Applications of Cryptographic Hash Function, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA). Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Message Authentication Codes, Security of MACs, MACs Based on Hash Functions (HMAC).
5	**Week 12-14: Digital signatures-Digital Signatures**	Digital signatures-Digital Signatures, ElGamal Digital Signature Scheme, Schnorr Digital Signature Scheme, Digital Signature Standard(DSS). Key management and distribution: Symmetric key distribution using symmetric encryption, Symmetric key distribution using asymmetric encryption, Distribution of public keys, X.509 certificates, Public key infrastructure**.**

5. **Teaching-Learning Process Strategies**

S/L	TLP Strategies:	Description
1	**Lecture Method**	Utilize various teaching methods within the lecture format to reinforce competencies.
2	**Video/Animation**	Incorporate visual aids like videos/animations to enhance understanding of Security concepts.
3	**Collaborative**	Encourage collaborative learning for improved competency application.

	Learning	
4	**Real-World Application**	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	**Flipped Class Technique**	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
6	**Laboratory Learning**	Utilize the facilities available in the laboratories to understand the behavior of the Network by performing few experiments.

6.Assessment Details (both CIE and SEE)

Continuous Internal Evaluation:

The minimum CIE marks requirement is 50% of maximum marks in each component.

CIE Split up

	Components	Number	Weightage	Max. Marks	Min. Marks
(i)	Internal Assessment-Tests (A)	2	50%	25	12.5
(ii)	Assignments/Quiz/Activity (B)	2	50%	25	12.5
	Total Marks			**50**	**25**

Final CIE Marks =(A) + (B)

Average internal assessment shall be the average of the 2 test marks conducted.

Semester End Examination:

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

7.Learning Objectives

S/L	Learning Objectives	Description
1	**Understand Basic Security Principles**	• The core principles of computer security, including confidentiality, integrity, and availability (the CIA triad). • Recognize and categorize various types of security threats and attacks, such as malware, phishing, denial of service, and insider threats.
2	**Block Ciphers and the Data Encryption Standard**	• Students should be able to define block ciphers, describe their purpose in encryption, and explain how data is processed in fixed-size blocks. • Describe the DES algorithm, including its structure, key scheduling, and encryption/decryption processes. • Demonstrate the ability to implement DES encryption and decryption algorithms in a programming language. • Compare DES with modern block ciphers, such as AES (Advanced Encryption Standard), in terms of security, efficiency, and applicability.
3	**Public-Key Cryptography & Number theory**	• Describe how public-key cryptography uses a pair of keys for encryption and decryption and understand its advantages over symmetric key cryptography. • Demonstrate the ability to implement common public-key cryptographic algorithms in a programming language. • Assess the security properties of public-key cryptographic systems, including their resistance to attacks such as key factorization and chosen ciphertext attacks.
4	**Cryptographic**	• Understand the cryptographic hash functions are and their primary

	Hash Functions	purpose in security. • Describe the essential properties of cryptographic hash functions, including preimage resistance, second preimage resistance, collision resistance, and the avalanche effect. • Understand widely used cryptographic hash algorithms such as MD5, SHA-1.
5	**Digital signatures**	• Explain what digital signatures are and their role in ensuring authenticity, integrity, and non-repudiation in digital communications and digital signature algorithms. • Describe the technical mechanisms and algorithms used to create and verify digital signatures, including key concepts like hashing and asymmetric encryption.

8.Course Outcomes (COs) and Mapping with POs

Course Outcomes (COs)

COs	Description
M23MCA305C.1	Understand the classical encryption techniques and block ciphers, data encryption standard.
M23MCA305C.2	Apply Key management and distribution schemes on design User Authentication, such as Diffie-Hellman Key Exchange, ElGamal Crypto system.
M23MCA305C.3	Analyze the hash and MAC algorithms, and digital signatures on various inputs.
M23MCA305C.4	Evaluate the public-key cryptography, RSA and other public-key crypto systems on various systems.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA305C.1	2	3	-	-	-	-	-	-
M23MCA305C.2	-	3	-	-	-	-	-	-
M23MCA305C.3	-	-	3	-	-	-	-	-
M23MCA305C.4	-	-	-	3	-	-	-	-
M23MCA305C	2	3	3	3	-	-	-	-

9.Assessment Plan

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	CO4	Total
Module 1	**10**				**10**
Module 2		**10**			**10**
Module 3			**10**		**10**
Module 4				**10**	**10**
Module 5				**10**	**10**
Total	**10**	**10**	**10**	**20**	**50**

Semester End Examination (SEE)

	CO1	CO2	CO3	CO4	Total
Module 1	**20**				**20**
Module 2		**20**			**20**
Module 3			**20**		**20**
Module 4				**20**	**20**
Module 5				**20**	**20**
Total	**20**	**20**	**20**	**40**	**100**

10. Future with this Subject:

- ❖ With the advancement of quantum computing, traditional cryptographic algorithms like RSA and ECC may become vulnerable to quantum attacks.
- ❖ AI and machine learning are being increasingly integrated into security systems for threat detection, anomaly detection, and response automation.
- ❖ Researchers are developing post-quantum cryptographic algorithms that are resistant to quantum computing threats. Standardization efforts, such as those led by NIST, are focused on identifying and promoting these new algorithms.
- ❖ Privacy concerns are driving the development of advanced privacy-preserving technologies, such as homomorphic encryption, secure multi-party computation, and differential privacy.
- ❖ Blockchain technology is being explored for its potential to enhance security through decentralized, tamper-proof systems.
- ❖ Cryptography will be integrated with emerging technologies like the Internet of Things (IoT), 5G networks, and edge computing to address new security challenges.

3rd Semester	PROFESSIONAL ELECTIVE III (PE) NoSQL	M23MCA305D

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Database Fundamentals	• Basic knowledge of SQL, relational database design, normalization, and indexing. Understanding of Atomicity, Consistency, Isolation, and Durability in the context of transactions
2	Understanding of Data Structures	• Know basic data structures like arrays and lists.
3	Introduction to JSON	• Basics knowledge of JSON (JavaScript Object Notation), a common data format used in NoSQL databases.
4	Programming Languages:	• Proficiency in at least one programming language (e.g., Python, Java, JavaScript) since NoSQL databases often require code integration.
5	Concept of Scalability	• A basic understanding of what scalability means in the context of databases and applications.

2. Competencies

S/L	Competency	KSA Description
1	Types of NoSQL Databases	• **Knowledge**: Understanding document stores (e.g., MongoDB), key-value stores, column-family stores (e.g., Cassandra), and graph databases (e.g., Neo4j). • **Skills**: Identifying and selecting the appropriate type of NoSQL database for a given use case. • **Attitude**: Ability to adapt and implement different types of NoSQL databases based on project requirements.
2	Data Modelling	• **Knowledge**: Knowledge of schema-less and flexible schema design principles and familiarity with data formats like JSON, BSON, and XML. • **Skills**: Ability to design flexible and efficient data models for NoSQL databases. • **Attitude**: Applying critical thinking to create optimal data models that meet application needs.
3	Consistency Models	• **Knowledge**: Understanding eventual consistency, strong consistency, and other consistency models. • **Skills**: Selecting and implementing the appropriate consistency model based on application requirements. • **Attitude**: Ability to balance consistency requirements with performance and availability considerations.
4	CAP Theorem	• **Knowledge**: Comprehension of the trade-offs between Consistency, Availability, and Partition Tolerance. • **Skills**: Evaluating and making informed decisions on trade-offs for different applications. • **Attitude**: Applying theoretical knowledge of the CAP theorem to practical database design and implementation.
5	Replication and Sharding	• **Knowledge**: Knowledge of data replication mechanisms and sharding strategies. • **Skills**: Implementing replication and sharding to ensure data availability and distribution.

		• **Attitude**: Ability to design and manage a distributed database system effectively.
6	**Indexing Techniques**	• **Knowledge**: How indexing works in various NoSQL databases and how to optimize indexing for performance. • **Skills**: Creating and optimizing indexes to improve query performance. • **Attitude**: Troubleshooting and fine-tuning indexes to enhance database performance.
7	**Query Languages**	• **Knowledge**: Familiarity with NoSQL-specific query languages like MongoDB's query language and Cassandra Query Language (CQL). • **Skills**: Proficiency in writing and optimizing queries in NoSQL query languages. • **Attitude**: Adapting to different query languages and utilizing them effectively for data retrieval and manipulation.
8	**Database Management**	• **Knowledge**: Managing NoSQL databases, including installation, configuration, and maintenance. • **Skills**: Proficiency in database management tasks. • **Attitude**: Efficiently managing and maintaining NoSQL databases.
9	**Programming**	• **Knowledge**: Proficiency in programming languages commonly used with NoSQL databases, such as JavaScript, Python, or Java. • **Skills**: Writing code to interact with NoSQL databases. • **Attitude**: Developing and maintaining applications that utilize NoSQL databases.

3. **Syllabus**

NoSQL			
SEMESTER – III			
Course Code	**M23MCA305D**	CIE Marks	**50**
Number of Lecture Hours/Week(L: T: P: S)	**(3:0::00)**	SEE Marks	**50**
Total Number of Lecture Hours	**40 hours Theory**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Course Objectives:
1. Understand the significant properties and potential uses of NoSQL
2. Compare between structured and unstructured data
3. Work with key-value and document databases
4. Write Map-Reduce programs for analysis
5. Analyze the framework of NOSQL

Module -1
Introduction to NoSQL, Definition of NoSQL, History of NoSQL and Different NoSQL products. Exploring NoSQL Exploring Mongo DB Java/Ruby/Python, Interfacing and Interacting with NoSQL.
Module -2
NoSQL Basics: NoSQL Storage Architecture, CRUD operations with Mongo DB, Querying, Modifying and Managing. **Data Storage in NoSQL:** NoSQL Data Stores, Indexing and ordering datasets (Mongo DB/Couch DB/Cassandra)
Module -3
Advanced NoSQL, NoSQL in Cloud, Parallel Processing with Map Reduce, Big Data with Hive.
Module -4

Working with NoSQL, Surveying Database Internals, migrating from RDBMS to NoSQL, Web Frameworks and NoSQL, using MySQL as a NoSQL.

Module -5
Developing Web Application with NOSQL and NOSQL Administration Php and MongoDB, Python and MongoDB, Creating Blog Application with PHP.

TEXTBOOKS:
1. Professional NOSQL, Shashank Tiwari, 2011, WROX Press.

REFERENCE BOOKS:
1. The Definitive guide to MongoDB, The NoSQL Database for Cloud and Desktop Computing, Apress 2010.

VIDEO LINKS:
1. https://nptel.ac.in/courses/106104135
2. https://www.ibm.com/cloud/learn/nosql-databases
3. https://www.geeksforgeeks.org/introduction-to-nosql/

4. **Syllabus Timeline**

S/L	Syllabus Timeline	Description
1	**Week 1-3: Introduction to NoSQL and exploring NoSQL**	Introduction to NoSQL gives brief history of NoSQL and different NoSQL products. Understanding the concepts of MongoDB Java/Ruby/Python with NoSQL.
2	**Week 4-6: NoSQL Basics and data storage**	Understanding the storage structure of NoSQL, CRUD operations with Mongo DB. Indexing and ordering datasets
3	**Week 8-11: Advanced NoSQL**	Studying NoSQL in cloud, parallel processing with Map reduce and big data with Hive
4	**Week 7-8: Data Migration and web frameworks**	Migrating from RDBMS to NoSQL, different web frameworks and NoSQL, using MySQL as NoSQL
5	**Week 9-12: Web application development with NoSQL**	Developing web applications using NoSQL and using Python and PHP with MongoDB

5. **Teaching-Learning Process Strategies**

S/L	TLP Strategies:	Description
1	**Lecture Method**	Utilize various teaching methods within the lecture format to reinforce competencies.
2	**Video/Animation**	Incorporate visual aids like videos/animations to enhance understanding of concepts.
3	**Collaborative Learning**	Encourage collaborative learning for improved competency application.
4	**Real-World Application**	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	**Flipped Class Technique**	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
6	**Laboratory Learning**	Utilize the facilities available in the laboratories to understand the behavior of the materials by performing few experiments.

6. **Assessment Details (both CIE and SEE)**

Continuous Internal Evaluation:

The minimum CIE marks requirement is 50% of maximum marks in each component.

CIE Split up

	Components	Number	Weightage	Max. Marks	Min. Marks
(i)	Internal Assessment-Tests (A)	2	50%	25	12.5
(ii)	Assignments/Quiz/Activity (B)	2	50%	25	12.5
	Total Marks			**50**	**25**

Final CIE Marks = (A) + (B)

Average internal assessment shall be the average of the 2 test marks conducted.

Semester End Examination:

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

7. **Learning Objectives**

S/L	Learning Objectives	Description
1	**Basics of NoSQL**	Grasp the core concepts of NoSQL, including its definition, the differences between NoSQL and traditional relational databases, and the scenarios where NoSQL is most applicable.
2	**Different Types of NoSQL Databases**	Learn about the various types of NoSQL databases, such as key-value stores, document stores, column-family stores, and graph databases, including their unique features and use cases.
3	**Data Modeling in NoSQL**	Understand how to model data in NoSQL databases, recognizing the differences in schema design compared to relational databases. Learn how to design flexible, scalable data models tailored to NoSQL.
4	**NoSQL Query Mechanisms**	Explore how data is queried and manipulated in NoSQL databases, focusing on the query languages or APIs used by different NoSQL systems.
5	**Scalability and Performance Aspects of NoSQL**	Study how NoSQL databases achieve scalability, including concepts like sharding, replication, and eventual consistency. Understand performance optimization techniques specific to NoSQL.
6	**Hands-On Experience with NoSQL Databases**	Gain practical experience by installing, configuring, and using popular NoSQL databases such as MongoDB, Cassandra, or Redis. Implement real-world applications to reinforce theoretical knowledge.
7	**Trade-offs of NoSQL vs. SQL**	Understand the trade-offs between using NoSQL and SQL databases, considering factors like consistency, availability, partition tolerance (CAP theorem), and data integrity.

8. **Course Outcomes (COs) and Mapping with POs**

Course Outcomes (COs)

COs	Description
M23MCA305D.1	Analyse and Manage the Data using CRUD operations
M23MCA305D.2	Apply and Develop the applications using NoSQL
M23MCA305D.3	Realize the concept of Map Reduce its applicability in the real-world application

	development
M23MCA305D.4	Apply the framework of NoSQL to find the solutions

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA305D.1	-	3	-	-	-	-	-	-
M23MCA305D.2	-	-	3	3	-	-	-	-
M23MCA305D.3	-	3	3	-	-	-	-	-
M23MCA305D.4	-	-	3	3	-	-	-	-
M23MCA305D	-	3	3	3	-	-	-	-

9. **Assessment Plan**

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	CO4	Total
Module 1	10				10
Module 2		5		5	10
Module 3			10		10
Module 4		5		5	10
Module 5		5		5	10
Total	**10**	**15**	**10**	**15**	**50**

Semester End Examination (SEE)

	CO1	CO2	CO3	CO4	Total
Module 1	20				20
Module 2		10		10	20
Module 3			20		20
Module 4		10		10	20
Module 5		10		10	20
Total	**20**	**30**	**20**	**30**	**100**

10. **Future with this Subject:**
   ❖ **Continued Growth in Big Data and Real-Time Analytics**: As organizations continue to generate and process vast amounts of data, the demand for databases that can handle unstructured, semi-structured, and real-time data will grow. NoSQL databases are well-suited for these tasks due to their scalability and flexibility.
   ❖ **Integration with AI and Machine Learning:** The integration of NoSQL databases with artificial intelligence (AI) and machine learning (ML) models will become more prevalent. NoSQL's ability to store and retrieve large, diverse datasets makes it ideal for feeding data-hungry AI/ML algorithms.
   ❖ **Hybrid Database Solutions:** As organizations seek the best of both relational and NoSQL worlds, hybrid database solutions that combine SQL and NoSQL cap Attitude will gain traction. These systems will allow developers to choose the best data model for specific use cases within the same platform.
   ❖ **Advances in Distributed and Cloud-Based NoSQL Systems:** The shift towards cloud computing and distributed architectures will continue to drive innovation in NoSQL databases. These systems are inherently designed to operate in distributed environments, making them a natural fit for cloud-based applications.
   ❖ **Focus on Data Security and Privacy:** With growing concerns about data security and privacy, NoSQL databases will need to evolve to offer more robust security features, including encryption, access controls, and compliance with regulations like GDPR and CCPA.
   ❖ **Adoption in IoT and Edge Computing:** The Internet of Things (IoT) and edge computing are generating massive amounts of data at the edge of the network. NoSQL databases, with their ability to handle distributed data and operate efficiently in resource-constrained environments, are well-positioned to serve these markets.

3rd Semester	PROFESSIONAL ELECTIVE IV (PE) USER INTERFACE DESIGN	M23MCA306A

1. Prerequisites

S/L	Proficiency	Prerequisites
1	**Basic UI Concepts**	• Understanding of Usability Principles: Basic knowledge of usability and user experience (UX) principles, including the importance of designing for user needs and creating intuitive interfaces. • Familiarity with Design Tools: Introduction to commonly used UI design tools such as Adobe XD, Figma, or Sketch. • Basic IT Knowledge: Understanding of basic IT concepts, including familiarity with web technologies (e.g., HTML, CSS, JavaScript) and design principles such as color theory, typography, and layout design
2	**UI Design and Development**	• Design Process and Methodologies: Knowledge of design processes, including user research, wireframing, prototyping, and user testing. • Interaction Design Skills: Ability to design interactive elements such as buttons, forms, and navigation menus, considering user behavior and accessibility. • Familiarity with User-Centered Design (UCD): Understanding of User-Centered Design principles, focusing on creating interfaces that are easy to use and meet the needs of the target audience
3	**Familiarity with Responsive Design**	• Understanding Responsive Design Principles: Knowledge of responsive design techniques to ensure interfaces work well on various devices and screen sizes, from desktops to mobile phones. • Experience with Media Queries and Fluid Grids: Basic understanding of media queries, fluid grids, and flexible images to create layouts that adapt to different screen resolutions. • Mobile-First Design Approach: Familiarity with the mobile-first design philosophy, where interfaces are designed primarily for mobile devices and then scaled up for larger screens.
4	**User Research and Analysis Skills**	• Conducting User Research: Ability to gather user requirements through various methods such as interviews, surveys, and usability testing. • User Persona Creation: Experience in creating user personas and scenarios to guide design decisions and ensure the interface meets the needs of its intended audience. • Analyzing User Behavior: Understanding of how to analyze user behavior data (e.g., heatmaps, user flow) to refine and improve interface designs.
5	**Knowledge of Interaction Design Principles**	• Understanding of Interaction Design: Familiarity with the core principles of interaction design, including feedback, constraints, and affordances. • Experience with Animation and Transitions: Basic knowledge of how to use animations and transitions effectively to enhance user experience without overwhelming the user. • Prototyping and Interaction Modeling: Ability to create interactive prototypes to model user interactions and gather feedback before finalizing design

2. Competencies

S/L	Competency	KSA Description
1	**Basic UI Concepts**	**Knowledge:** • **Usability Principles:** Understanding of fundamental usability concepts, including how to create interfaces that are user-friendly, efficient, and

		satisfying. • **Design Tools:** Familiarity with design tools such as Adobe XD, Figma, or Sketch, including their functionalities and features. • **Design Principles:** Basic knowledge of design principles like color theory, typography, layout, and visual hierarchy. **Skills:** • **Design Creation:** Ability to create user interfaces that are aesthetically pleasing and functional using design tools. • **Technical Proficiency:** Basic skills in web technologies such as HTML, CSS, and JavaScript for implementing design elements. • **Problem-Solving:** Skills to identify and address design issues related to usability and aesthetics. **Attitudes:** • **Attention to Detail:** Capability to produce detailed design elements and maintain consistency across the interface. • **Creative Thinking:** Ability to apply creative solutions to design challenges and innovate within established guidelines.
2	**UI Design and Development**	**Knowledge:** • **Design Processes:** Understanding of design methodologies including user research, wire framing, prototyping, and user testing. • **Interaction Design:** Knowledge of designing interactive elements such as buttons, forms, and navigation components. • **User-Centered Design (UCD):** Familiarity with UCD principles and their application in creating intuitive and effective interfaces. **Skills:** • **Prototyping:** Ability to create wireframes and prototypes to visualize and test design concepts. • **Interaction Design:** Skills in designing and implementing interactive elements that enhance user experience. • **Feedback Integration:** Proficiency in incorporating user feedback into design improvements. **Attitudes:** • **User Empathy:** Capability to understand and anticipate user needs and behaviors, ensuring that designs meet their requirements. • **Adaptability:** Ability to adapt design approaches based on feedback and evolving project needs.
3	**Understanding of Accessibility Standards**	**Knowledge:** • **Accessibility Guidelines:** Understanding of accessibility standards such as WCAG and how they apply to web and application design. • **Assistive Technologies:** Knowledge of assistive technologies and their interaction with user interfaces. **Skills:** • **Accessible Design:** Ability to design interfaces that comply with accessibility standards and are usable by individuals with disabilities. • **Testing and Validation:** Skills in testing designs with assistive technologies and making necessary adjustments. **Attitudes:** • **Inclusive Design:** Capability to create inclusive designs that provide a positive experience for all users, including those with diverse needs. • **Regulatory Compliance:** Ability to ensure that designs meet legal and ethical accessibility requirements.

4	**Familiarity with Responsive Design**	**Knowledge:** • **Responsive Design Principles:** Understanding of responsive design principles and how to apply them to ensure usability across various devices and screen sizes. • **Responsive Techniques:** Knowledge of techniques such as media queries, fluid grids, and flexible images. **Skills:** • **Adaptive Layouts:** Ability to create layouts that adapt to different screen sizes and orientations. • **Cross-Device Testing:** Skills in testing designs across multiple devices and ensuring consistent user experience. **Attitudes:** • **Mobile-First Thinking:** Capability to prioritize mobile design and scale up to larger screens, ensuring a seamless experience across all devices. • **Design Optimization:** Ability to optimize designs for performance and usability on various devices.

3. Syllabus

USER INTERFACE DESIGN SEMESTER – III			
Course Code	**M23MCA306A**	CIE Marks	**50**
Number of Lecture Hours/Week(L: T: P: S)	**(3:0:0:0)**	SEE Marks	**50**
Total Number of Lecture Hours	**40 hours Theory**	Total Marks	**100**
Credits	**3**	Exam Hours	**03**

Course Objectives:

- Fundamental uunderstanding of UI design principles.
- Proficiency in design ttools and ttechniques.
- Ability to create rresponsive and aaccessible ddesigns
- Competence in cconducting user rresearch and aanalysis.
- Ability to iimplement iinteraction design and pprototyping
- Capability to evaluate and iimprove ddesigns basked on ffeedback
- Understanding of eethical and llegal cconsiderations in UI design.

Module -1
Introduction: Usability of Interactive Systems: Introduction, Usability Goals and Measures, Usability Motivation, Universal Usability, Goals for our profession. Guideline, principles, and theories: Introduction, Guidelines, principles, Theories.

Module -2
Development Processes: Managing Design Processes: Introduction, Organizational Design to support Usability, The Four Pillars of Design, Development methodologies: Ethnographic Observation, Participatory Design, Scenario Development, Social Impact statement for Early Design Review, Legal Issues.

Module -3
Evaluating Interface: Design Introduction, Expert Reviews, Usability Testing and Laboratories, Survey Instruments, Acceptance tests, Evaluation during Active Use, Controlled Psychologically Oriented Experiments.

Module -4
Direct Manipulation and Virtual Environments: Introduction, Examples of Direct Manipulation, Discussion of direct manipulation, 3D Interfaces, Tele-operation, Virtual and Augmented Reality Menu Selection, Form Filling and Dialog Boxes: Introduction, Task-Related Menu Organization, Single Menus,

Combination of Multiple Menus, Content Organization, Fast Movement Through Menus, Data Entry With Menus, Form Filling, Dialog Boxes and Alternatives, Audio Menus and Menus for Small

Module -5
Command and Natural Languages: Introduction, Command-organization functionality strategies and structure, Naming and Abbreviations, Natural Language in computing. Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory interfaces, Displays-Small and Large Displays
TEXTBOOKS: 1.BenShneiderman, Plaisant, Cohen, Jacobs: Designing the User Interface, 5th Edition, Pearson ,Education, 2010. **REFERENCE BOOKS:** 1 Alan Dix, Janet Finalay, Gregory D AbiwdmRusselBealel: Human-Computer Interaction, III Edition, Pearson , Education, 2008. 2 Eberts: User Interface Design, Prentice Hall, 1994 3 Wilber O Galitz: The Essential Guide to User Interface Design- An Introduction to GUI Design, Principles and Techniques, Wiley-Dreamtech India Pvt Ltd, 2011 **VIDEO LINKS:** • https://www.javatpoint.com/user-interface-design • https://www.tutorialspoint.com/software_architecture_design/user_interface.htm

4. **Syllabus Timeline**

S/L	Syllabus Timeline	Description
1	**Week 1-3: Introduction:**	Usability of Interactive Systems: Introduction, Usability Goals and Measures, Usability Motivation, Universal Usability, Goals for our profession. Guideline, principles, and theories: Introduction, Guidelines, principles, Theories.
2	**Week 4-6: Development Processes:**	Managing Design Processes: Introduction, Organizational Design to support Usability, The Four Pillars of Design, Development methodologies: Ethnographic Observation, Participatory Design, Scenario Development, Social Impact statement for Early Design Review, Legal Issues.
3	**Week 7-8: Evaluating Interface**	Design Introduction, Expert Reviews, Usability Testing and Laboratories, Survey Instruments, Acceptance tests, Evaluation during Active Use, Controlled Psychologically Oriented Experiments.
4	**Week 9-11: Direct Manipulation and Virtual Environments:**	Introduction, Examples of Direct Manipulation, Discussion of direct manipulation, 3D Interfaces, Tele-operation, Virtual and Augmented Reality Menu Selection, Form Filling and Dialog Boxes: Introduction, Task-Related Menu Organization, Single Menus, Combination of Multiple Menus, Content Organization, Fast Movement Through Menus, Data Entry With Menus, Form Filling, Dialog Boxes and Alternatives, Audio Menus and Menus for Small
5	**Week 12-14: Command and Natural Languages**	Introduction, Command-organization functionality strategies and structure, Naming and Abbreviations, Natural Language in computing. Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory interfaces, Displays-Small and Large Displays

5.**Teaching-Learning Process Strategies**

S/L	TLP Strategies:	Description

1	Lecture Method	Engaging lectures with multimedia, examples, and interactive elements.
2	Collaborative Learning	Group work and peer reviews to enhance teamwork and problem-solving.
3	Simulations and Role-Playing	Activities to mimic real-world scenarios and practice design skills.
4	Continuous Assessment	Ongoing assessments and feedback to track progress and improve learning.
5	Technology Integration	Use of technology tools and platforms to enhance learning experiences.

6.Assessment Details (both CIE and SEE)

Continuous Internal Evaluation:

The minimum CIE marks requirement is 50% of maximum marks in each component.

CIE Split up

	Components	Number	Weightage	Max. Marks	Min. Marks
(i)	Internal Assessment-Tests (A)	2	50%	25	12.5
(ii)	Assignments/Quiz/Activity (B)	2	50%	25	12.5
	Total Marks			**50**	**25**

Final CIE Marks = (A) + (B)

Average internal assessment shall be the average of the 2 test marks conducted.

Semester End Examination:

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

7.Learning Objectives

S/L	Learning Objectives	Description
1	**Development Processes**	Manage design processes, implement methodologies, and address legal/social impacts.
2	**Evaluating Interfaces**	Conduct evaluations, analyze data, and assess interfaces during active use.
3	**Direct Manipulation and Virtual Environments**	Explain direct manipulation principles, design for 3D and virtual environments, and integrate VR/AR applications.
4	**Usability of Interactive Systems**	Define usability goals, apply guidelines, and evaluate systems using various methods.
5	**Command and Natural Languages**	Implement command organization strategies and integrate natural language processing.
6	**Interaction Devices**	Design and optimize interfaces for keyboards, pointing devices, speech, and various display types.

8.Course Outcomes (COs) and Mapping with POs

Course Outcomes (COs)

COs	Description

M23MCA306A.1	**Understand the** usability concepts, goals, and principles.
M23MCA306A.2	**Apply** design methodologies and processes, considering organizational and legal aspects.
M23MCA306A.3	**Analyze and Implement** command-based and natural language interfaces, and various interaction devices.
M23MCA306A.4	**Evaluate** interfaces using various methods to identify issues and suggest improvements.
M23MCA306A.5	**Design and Develop** interactive systems with advanced interfaces and user interaction techniques.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA306A.1	2	-	-	-	-	-	-	-
M23MCA306A.2	3	-	-	-	-	-	-	3
M23MCA306A.3	-	3	-	-	-	-	-	-
M23MCA306A.4	-	-	3	-	-	-	-	-
M23MCA306A.5	-	-	3	-	-	2	-	-
M23MCA306A	2.5	3	3	-	-	2	-	3

9.Assessment Plan

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	CO4	CO5	Total
Module 1	10					10
Module 2		10				10
Module 3				10		10
Module 4					10	10
Module 5			10			10
Total	10	10	10	10	10	50

Semester End Examination (SEE)

	CO1	CO2	CO3	CO4	CO5	Total
Module 1	20					20
Module 2		20				20
Module 3				20		20
Module 4					20	20
Module 5			20			20
Total	20	20	20	20	20	100

10.Future with this Subject:

 ❖ **Increased Focus on User Experience (UX):** Future UI design will place even greater emphasis on overall user experience, integrating deeper UX research to create more intuitive and user-friendly interfaces.
 ❖ **Evolution of Development Processes:** Agile methodologies, continuous design, and automated usability testing for faster, iterative development.
 ❖ **Ethical and Inclusive Design:** Focus on inclusive design practices and ethical considerations in interactive system development.
 ❖ **Advanced Interaction Techniques:** Development of NUIs, AR, and VR for more natural and immersive interactions
 ❖ **Evolving Menu Design and Data Entry Techniques:** Context-aware menus and advanced natural language interfaces for intuitive interactions.

3rd Semester	PROFESSIONAL ELECTIVE IV(PE) SOFTWARE TESTING AND PRACTICES	M23MCA306B

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Basic Computer Skills	**Familiarity with Operating Systems:** Understand how to navigate and use different operating systems like Windows, macOS, or Linux. Basic File Management: Know how to create, modify, and manage files and folders.
2	Understanding of Software Development	**Programming Basics:** While not always required, having a basic understanding of programming concepts (like variables, loops, functions, and data structures) can be beneficial, especially if you want to get into automation testing. **Software Development Life Cycle (SDLC):** Understand the phases of software development, such as requirement analysis, design, coding, testing, and maintenance.
3	Basic Knowledge of Databases	**SQL Fundamentals:** Understanding how to write basic SQL queries to interact with databases is important since many applications store data in databases, and testers often need to verify data integrity.
4	Problem-Solving Skills	**Analytical Thinking:** Being able to think critically and analytically to identify potential issues in software. **Attention to Detail:** A keen eye for detail to spot issues that others might miss.
5	Communication Skills	**Documentation:** Ability to write clear and concise bug reports and test cases. **Collaboration:** Good communication skills to work effectively with developers, project managers, and other stakeholders.

2. Competencies

S/L	Competency	KSA Description
1	Understanding Software Testing	**Knowledge** • **Core Concepts**: Familiarity with the fundamental concepts of software testing, including its purpose, scope, and importance in the software development lifecycle. • **Quality Assurance Practices**: Understanding the role of testing within the broader context of quality assurance, including concepts like verification and validation. **Skills** • **Test Design and Execution**: Ability to design effective test cases that cover various scenarios and execute them efficiently. • **Adaptability**: Ability to adapt testing strategies to different project environments, whether Agile, Waterfall, or hybrid, and to new tools and technologies as they emerge. **Attitudes** • **Attention to Detail**: A meticulous approach to testing, with an emphasis on thoroughly checking every aspect of the software to ensure it meets the required standards.
2	Approach for Software Testing	**Knowledge** • **Tools and Techniques**: Familiarity with the tools and technologies used in testing (e.g., manual vs. automated testing tools, test management tools) and their respective advantages and disadvantages.

		Skills • **Tool Proficiency**: Competence in using testing tools (e.g., Selenium, JUnit, TestNG) to automate and manage tests, as well as interpreting the results. **Attitudes** • **Quality-Driven Mindset**: A strong commitment to delivering high-quality software by ensuring that all defects are identified and resolved before release.
3	**Various types Testing**	**Knowledge** • **Testing Methodologies**: Understanding different types of testing (e.g., unit testing, integration testing, system testing, acceptance testing) and when to apply each. • **Testing Levels**: Knowledge of various levels of testing, such as functional, non-functional, regression, and exploratory testing. **Skills** • **Defect Identification and Reporting**: Skill in identifying defects, assessing their impact, and documenting them clearly for developers and stakeholders. **Attitudes** • **Problem-Solving**: An attitude of anticipating potential issues before they occur, rather than merely reacting to them after they arise. • **Continuous Improvement**: A mindset geared towards constantly refining testing practices, learning new techniques, and improving efficiency.
4	**Testing Scenarios**	**Knowledge** • Knowledge of what performance testing is, its purpose, and its importance in ensuring that software applications meet speed, scalability, and stability requirements. • Awareness of different types of performance testing: Load Testing, Stress Testing, Endurance Testing, Volume Testing, and Scalability Testing. **Skills** • Test Script Development, Monitoring and Analysis, Troubleshooting and Skills in optimizing system performance based on test results by tuning application code, database queries, and server configurations **Attitudes** • Thorough approach to ensuring that every aspect of the software is tested and validated after changes. Continuously improving regression testing processes to make them more efficient and effective.
5	**Organization Structure and Plan**	**Knowledge** • Knowledge of different roles within a testing team, including Test Manager, Test Lead, Test Analysts, Automation Engineers, and Testers. • Awareness of the responsibilities and hierarchy within the team, including how they interact with development teams, product managers, and stakeholders. **Skills** • Ability to coordinate tasks and manage communication between different roles within the testing team. • Resource Management: Skills in managing and allocating resources

| | | **Attitudes**
• A proactive attitude towards finding and implementing new ways to automate testing processes for greater efficiency and accuracy.
• A focus on creating highly reliable and precise test scripts and automation frameworks.
• An attitude that values the efficiency and scalability provided by test automation |

3. Syllabus

<table>
<tr><td colspan="5" align="center">SOFTWARE TESTING AND PRACTICES
SEMESTER – III</td></tr>
<tr><td>Course Code</td><td>M23MCA306B</td><td>CIE Marks</td><td colspan="2">50</td></tr>
<tr><td>Number of Lecture Hours/Week(L: T: P: S)</td><td>(3:0:0:0)</td><td>SEE Marks</td><td colspan="2">50</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>40 hours Theory</td><td>Total Marks</td><td colspan="2">100</td></tr>
<tr><td>Credits</td><td>03</td><td>Exam Hours</td><td colspan="2">03</td></tr>
</table>

Course objectives: This course will enable students to:
1. Understand Fundamental Concepts and Techniques in Software Testing
2. Develop a Strategic Approach to Software Testing
3. Differentiate Between and Apply Various Testing Types
4. Execute and Manage Testing Processes Effectively
5. Understand and Implement Software Test Automation

Module -1

Introduction to Software Testing -Definitions, Test Cases, Test case design techniques, Preparing a Test Plan, Levels of Testing, Software testing life cycle, Software testing methodologies: Waterfall testing, Agile Testing, Iterative testing, QA, QC & Testing Case study- Develop test cases for any real-world application using test case description template

Module -2

Essentials of Software Testing: Workbench, Important Features of Testing Process, Misconceptions about Testing, Principles of Software Testing, Salient Features of Good Testing, Test Policy, Test Approach, Test Planning, Testing Process and no.of defects found in Testing, Mutation Testing, Challenges in Testing, Test Team Approach, Cost Aspects of Testing, Defect Categories, Developing Test Strategy, Developing Testing Methodologies, Testing Process, Skills Required by Tester

Module -3

Types of Testing: Black Box Testing and White Box Testing- Integration Testing - Integration Testing as a type of Testing, Integration Testing as a Phase of Testing, Scenario Testing, Defect Bash. System and Acceptance testing- Overview, Why is System Testing Done? Functional Vs Non-Functional Testing, Acceptance Testing.

Module -4

Testing Scenarios: Performance Testing, Factors Governing Performance Testing, Methodology, Tools, Process and Challenges. Regression Testing - Types, When to do Regression Testing? How to do Regression Testing? Best practices. Adhoc Testing - Overview, Buddy Testing, Pair Testing, Exploratory Testing, Iterative Testing, Agile and Extreme Testing, Defect Seeding.

Module -5

Organization Structure: Testing Teams, Test Planning, Management, Execution, and Reporting, Test Process, Best Practices. Software Test Automation - Skills needed for Automation, What to Automate, Scope of Automation, Challenges in Automation. Test Metrics and Measurements - Why Metrics in Testing, Project Metrics, Progress Metrics, Productivity Metrics. Test Process Improvement Problems, Need, Stages and Graphical Representation.

Text Books

1. Software Testing - Principles and Practices; Srinivas Desikan, Gopalaswamy Ramesh – PEARSON
2. Software Testing - Principles, Techniques and Tools - M G Limaye - Mc Graw Hill Education
3. Paul C. Jorgensen, ―Software Testing, A Craftsman's Approach‖, Auerbach Publications, 4th Edition, First Indian Reprint, 2014,

Reference Books

1. Software Testing concepts and Tools by Nageshwar Rao pusuluri, Greentech Press.
2. Aditya P Mathur, "Foundations of Software Testing 2E", Pearson Publications.

4. Syllabus Timeline

S/L	Syllabus Timeline	Description
1	Week 1-3: **Introduction to Software Testing**	Overview of software testing, its importance in the software development lifecycle, the role of quality assurance, and key testing concepts such as defects, bugs, and test cases. Introduction to the software testing lifecycle (STLC) and the difference between verification and validation.
2	Week 4-5: **Essentials of Software Testing**	Exploration of fundamental testing techniques, including black-box, white-box, and gray-box testing. Detailed study of different levels of testing (unit, integration, system, acceptance) and their purposes.
3	Week 6-7: **Approach towards Software Testing**	Discussion on developing effective test strategies and plans, understanding test design techniques, and the importance of test data management. Introduction to risk-based testing and prioritization of test cases based on risk.
4	Week 8-9: **Types of Testing**	Deep dive into various types of testing such as functional vs. non-functional testing, manual vs. automated testing, and exploratory testing. Overview of specialized testing types like performance testing, security testing, and usability test.
5	Week10-11: **Testing Scenarios**	Application of testing knowledge to real-world scenarios, including developing and executing test cases for different software environments. Introduction to scenario-based testing and understanding the importance of test coverage.
6	Week 12-14: **Organization Structure**	Study of the organization and structure of testing teams, roles and responsibilities within a team, and how testing integrates into the broader software development process. Overview of test management practices, including test planning, execution, and reporting, as well as an introduction to best practices in test automation.

5. Teaching-Learning Process Strategies

S/L	TLP Strategies:	Description
1	**Lecture Method**	Utilize various teaching methods within the lecture format to reinforce competencies.
2	**Video/Animation**	Incorporate visual aids like videos/animations to enhance understanding of concepts.
3	**Collaborative Learning**	Encourage collaborative learning for improved competency application.
4	**Higher Order Thinking (HOTS) Questions:**	Pose HOTS questions to stimulate critical thinking related to each competency.

5	Problem-Based Learning (PBL)	Implement PBL to enhance analytical skills and practical application of competencies
6	Multiple Representations	Introduce topics in various representations to reinforce competencies
7	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
8	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
9	Programming Assignments	Assign programming tasks to reinforce practical skills associated with competencies.

6. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation:

The minimum CIE marks requirement is 50% of maximum marks in each component.

CIE Split up

	Components	Number	Weightage	Max. Marks	Min. Marks
(i)	Internal Assessment-Tests (A)	2	50%	25	12.5
(ii)	Assignments/Quiz/Activity (B)	2	50%	25	12.5
	Total Marks			**50**	**25**

Final CIE Marks = (A) + (B)

Average internal assessment shall be the average of the 2 test marks conducted.

Semester End Examination:

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

7. Learning Objectives

S/L	Learning Objectives	Description
1	Understand Fundamental Concepts and Techniques in Software Testing	Grasp the foundational concepts of software testing, including definitions, types of testing, test case design techniques, and the software testing life cycle. Students will also learn how to prepare a test plan and understand the different levels of testing, such as unit, integration, system, and acceptance testing.
2	Develop a Strategic Approach to Software Testing	Learn how to develop effective test strategies and methodologies, understand the essential features of the testing process, and recognize the challenges in testing. Students will be equipped to create a comprehensive test plan and develop testing methodologies tailored to specific project needs.
3	Differentiate Between and Apply Various Testing Types	Acquire in-depth knowledge of different testing types, including black-box and white-box testing, system and acceptance testing, and specialized testing techniques like performance, regression, and adhoc testing. Students will be able to identify when and how to apply these testing methods in real-world scenarios.
	Execute and Manage	Gain the skills required to manage the entire testing process, from planning and execution to reporting and metrics analysis. Students will

| 4 | **Testing Processes Effectively** | learn about testing tools, methodologies, and best practices to ensure the testing process is efficient and yields high-quality results. |
| 5 | **Understand and Implement Software Test Automation** | Learn about the scope, challenges, and skills needed for software test automation. Students will understand what aspects of testing can be automated, how to select appropriate tools, and how to integrate automation into the overall testing strategy. Additionally, students will gain insight into test metrics and how to use them for process improvement. |

8. **Course Outcomes (COs) and Mapping with POs**

Course Outcomes (COs)

COs	Description
M23MCA306B.1	Apply Comprehensive Testing Strategies and Techniques
M23MCA306B. 2	Analyze and Implement Essential Testing Processes
M23MCA306B. 3	Differentiate and Utilize Various Testing Types and Scenarios
M23MCA306B. 4	Manage and Automate Testing Processes

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA306B.1	3	-	-	-	-	-	-	-
M23MCA306B. 2	-	3	-	-	-	-	-	-
M23MCA306B. 3	-	-	3	-	-	-	-	-
M23MCA306B. 4	-	-	-	3	-	-	-	-
M23MCA306B	3	3	3	3	-	-	-	-

9. **Assessment Plan**

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	CO4	Total
Module 1	5	5			10
Module 2	5	5			10
Module 3		5	5		10
Module 4			5	5	10
Module 5			5	5	10
Total	10	15	15	10	50

Semester End Examination (SEE)

	CO1	CO2	CO3	CO4	Total
Module 1	10	10			20
Module 2	10	10			20
Module 3		10	10		20
Module 4			10	10	20
Module 5			10	10	20
Total	20	30	30	20	100

Conditions for SEE Paper Setting:

Each module of SEE question paper should be allocated with questions for 20% of the total SEE marks

10. Future with this Subject

- **Automation Growth**: More testing tasks will be automated, reducing manual testing and increasing efficiency.

- **AI and Machine Learning**: AI will help predict potential issues and improve test coverage by analyzing large datasets and patterns.

- **Continuous Testing**: As part of DevOps, testing will become continuous, integrating seamlessly with development to ensure faster releases.

- **Shift-Left and Shift-Right**: Testing will start earlier in the development cycle (shift-left) and continue in production (shift-right) to catch issues sooner and ensure quality.

- **Testers as Quality Engineers**: The role of testers will expand to include more involvement in the entire software lifecycle, focusing on overall quality, not just bug detection.

- **Security and Performance**: With growing cybersecurity threats, security and performance testing will become more critical.

    Overall, software testing will be more integrated, automated, and essential to delivering high-quality software quickly.

3rd Semester	PROFESSIONAL ELECTIVE IV(PE) PROJECT MANAGEMENT AND REPORT WRITING	M23MCA306C

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Software Development Basics	• **Programming Knowledge** provides familiarity with programming concepts and languages. • **Software Development Life Cycle gives** basic knowledge of different software development methodologies
2	Project Management Concepts	• **Basic Project Management Concepts:** Understanding of project lifecycle, scope, scheduling, and budgeting. • **Knowledge of Project Management Tools:** Familiarity with tools like Microsoft Project.
3	Mathematical and Analytical Skills	• **Quantitative Skills:** Ability to perform basic calculations and data analysis, which can be useful for estimating project metrics and evaluating progress.
4	Communication Skills	• **Writing Proficiency**: Ability to write clearly and effectively, which is essential for report writing. • **Presentation Skills:** Ability to present ideas and progress reports to stakeholders.
5	Familiarity with Report Writing Techniques	• **Report Structure:** Knowledge of how to structure different types of reports (e.g., status reports, final reports). • **Technical Writing:** Ability to write technical content that is accurate and accessible to non-technical stakeholders**.**
6	Teamwork and Collaboration Skills	• **Team Dynamics:** Understanding of how to work effectively in a team environment, including communication and conflict resolution.
7	Basic Knowledge of Software Tools	• **Document Management:** Familiarity with tools like Microsoft Word or Google Docs for report writing. • **Version Control:** Basic understanding of version control systems

2. Competencies

S/L	Competency	KSA Description
1	Introduction to Project Management	**Knowledge:** • Provides foundational knowledge of how to plan, execute, and oversee projects effectively, including understanding project life cycles, defining project goals, and managing resources and risks. **Skills:** • Equips you with skills in planning and scheduling, risk assessment, resource allocation, and effective communication, enabling you to manage projects efficiently from initiation to completion. **Attitudes:** • Typically include a proactive mindset, a commitment to organization and planning, an appreciation for team collaboration, and a results-oriented approach to achieving project goals.
2	Activity Planning	**Knowledge:** • Includes the ability to define tasks, sequence activities, estimate timeframes, allocate resources, and create a project schedule while identifying dependencies and managing potential risks. **Skills:** • Include the ability to effectively schedule tasks, allocate resources, estimate timeframes, manage dependencies, and optimize project timelines for

		successful project delivery.
		Attitudes:
		• Includes a proactive approach to anticipating challenges, a detail-oriented mindset, a commitment to thorough planning, and an appreciation for the importance of time management and coordination in achieving project goals.
3	**Monitoring and control**	**Knowledge**: • Includes tracking progress, identifying deviations from the plan, implementing corrective actions, and ensuring project objectives are met within scope, time, and budget constraints. **Skills:** • Includes risk management, performance tracking, data analysis, problem-solving, effective communication, and the ability to implement corrective measures to keep the project on track. **Attitudes:** • Includes attention to detail, proactive decision-making, a focus on continuous improvement, accountability, and a commitment to meeting project objectives while adapting to changes.
4	**Managing People and Working in teams**	**Knowledge:** • Includes understanding group dynamics, effective communication strategies, conflict resolution, leadership styles, and how to motivate and align team members towards common goals. **Skills:** • Includes leadership, active listening, conflict resolution, collaboration, delegation, and the ability to motivate and guide team members toward achieving shared objectives. **Attitudes:** • Includes empathy, patience, openness to diverse perspectives, a collaborative mindset, and a commitment to fostering a positive and inclusive team environment.
5	**Report Writing**	**Knowledge:** • Includes structuring reports effectively, presenting data clearly, articulating findings and recommendations, and ensuring the document meets the audience's needs and adheres to formal guidelines. **Skills:** • Includes organizing information logically, writing concisely, analyzing and interpreting data, and crafting clear, professional documents that convey complex information effectively. **Attitudes:** • Includes attention to detail, a commitment to clarity and accuracy, professionalism, and a focus on delivering valuable and actionable insights to the audience.

3. Syllabus

PROJECT MANAGEMENT AND REPORT WRITING SEMESTER – III			
Course Code	**M23MCA306C**	CIE Marks	**50**
Number of Lecture Hours/Week(L: T: P: S)	**(3:0:0:0)**	SEE Marks	**50**
Total Number of Lecture Hours	**40 hours Theory**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Course Objectives:
➢ To equip learners with foundational knowledge and essential skills in project planning, execution, monitoring, and control.

- ➤ To teach learners how to effectively break down project goals into specific tasks, sequence activities, estimate time and resources.
- ➤ To equip learners with the skills to track project performance, identify and manage deviations from the plan, implement corrective actions.
- ➤ To develop the skills needed to lead, motivate, and collaborate effectively within teams, manage conflicts, and build strong, cohesive teams to achieve project goals.

Module -1
Introduction to Project Management: Introduction, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.
Module -2
Activity Planning: Objectives of Activity planning, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass –Backword Pass, Critical Path Method, Shortening Project Duration, Networks Risk Management, Nature of Risk, Categories of Risk, A framework for dealing with Risk, Risk Identification, Risk analysis and Prioritization.
Module -3
Monitoring and control: Creating a frame work, Collecting the data, Review, Visualizing Progress, Earned value analysis, Prioritising Monitoring, Getting Project Back to Track,, Change Control, Software Configuration Management.
Module -4
Managing People and Working in teams : Managing people, Organizational Behaviour: A Background, Best methods of Staff selection, Introduction in the best methods, The Oldham-Hackman Job Characteristics Model, Stress- health and Safety Working In teams, Becoming a team, Decision Making, Communication plans, Leadership
Module -5
Report Writing: Introduction to Project Report Writing: Purpose and Importance, Types of Project Reports, Structure and Organization: Report Structure, Formatting Guidelines, Research and Data Collection: Conducting Effective Research: Data Collection Techniques, Writing Techniques and Style, Clarity and Precision, Technical Writing Style, Avoiding Common Mistakes, Formatting and Documentation, Citation Styles, References and Bibliographies, Ensuring Proper Formatting.

TEXTBOOKS:
    1. Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018.
    2. Technical Communication: Principles and Practice" by William S. Pfeiffer and Nancy J. Vick
REFERENCE BOOKS:
  1. Roger S. Pressman. Software Engineering – A Practioner's Approach, Eighth Edition, Tata McGraw-Hill publishers; 2014.
  2. Jalote P. Software Project Management in practice, Second edition, Person Education; 2003.

4. Syllabus Timeline

S/L	Syllabus Timeline	Description
1	**Week 1-3 Introduction to Project Management**	Introduction, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.
2	**Week 4-6 Understanding the**	Understanding the Objectives of Activity planning, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward

	Objectives and Risk Management	Pass –Backward Pass, Critical Path Method, Shortening Project Duration, Networks Risk Management, Nature of Risk, Categories of Risk, A framework for dealing with Risk, Risk Identification, Risk analysis and Prioritization.
3	**Week 8-11 Frame work and Data Collection**	Creating a frame work, Collecting the data, Review, Visualizing Progress, Earned value analysis, Prioritizing Monitoring, Getting Project Back to Track,, Change Control, Software Configuration Management.
4	**Week 7-8 Organizational Behavior**	Managing people, Organizational Behavior: A Background, Best methods of Staff selection, Introduction in the best methods, The Oldham-Hackman Job Characteristics Model, Stress- health and Safety Working In teams, Becoming a team, Decision Making, Communication plans, Leadership
5	**Week 9-12**	Introduction to Project Report Writing: Purpose and Importance, Types of Project Reports, Structure and Organization: Report Structure, Formatting Guidelines, Research and Data Collection: Conducting Effective Research: Data Collection Techniques, Writing Techniques and Style, Clarity and Precision, Technical Writing Style, Avoiding Common Mistakes, Formatting and Documentation, Citation Styles, References and Bibliographies, Ensuring Proper Formatting.

5. Teaching-Learning Process Strategies

S/L	TLP Strategies:	Description
1	**Lecture Method**	Utilize various teaching methods within the lecture format to reinforce competencies.
2	**Video/Animation**	Incorporate visual aids like videos/animations to enhance understanding of concepts.
3	**Collaborative Learning**	Encourage collaborative learning for improved competency application.
4	**Real-World Application**	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	**Flipped Class Technique**	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
6	**Laboratory Learning**	Utilize the facilities available in the laboratories to understand the behavior of the materials by performing few experiments.

6. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation:

The minimum CIE marks requirement is 50% of maximum marks in each component.

CIE Split up

	Components	Number	Weightage	Max. Marks	Min. Marks
(i)	Internal Assessment-Tests (A)	2	50%	25	12.5
(ii)	Assignments/Quiz/Activity (B)	2	50%	25	12.5
	Total Marks			**50**	**25**

Final CIE Marks = (A) + (B)

Average internal assessment shall be the average of the 2 test marks conducted.

Semester End Examination:

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.

4. Marks scored will be proportionally scaled down to 50 marks

7. Learning Objectives

S/L	Learning Objectives	Description
1	**Introduction to Project Management**	• Understanding the fundamental concepts and principles of project management and identifying and defining the roles and responsibilities of project managers and team members. • Learning how to develop and manage project plans, including scope, schedule, and budget and applying tools and techniques for project planning, execution, and monitoring. • Recognizing and managing project risks and issues and understanding the importance of communication and stakeholder management in successful project execution.
2	**Activity Planning**	• Defining Project Activities: Understanding how to break down project goals into manageable activities and tasks. • Developing a Work Breakdown Structure (WBS): Creating a hierarchical decomposition of project deliverables and activities. • Estimating Time and Resources: Learning to estimate the time, resources, and dependencies required for each activity. • Identifying and establishing the logical order and dependencies between activities.
3	**Monitoring and control**	• **Tracking Project Performance:** Understanding how to measure and monitor project progress against the plan, including schedule, cost, and quality metrics. • Maintaining Stakeholder Communication: Understanding the importance of regular updates and effective communication with stakeholders to ensure alignment and manage expectations. • Learning to assess and respond to emerging risks and changes in the project environment.
4	**Managing People and Working in teams**	• Understanding Team Dynamics: Learning about group behavior, team roles, and the factors that influence team performance. • Effective Leadership: Developing skills to lead, motivate, and guide team members toward achieving project goals. • Building Team Cohesion: Developing strategies to foster collaboration, trust, and a positive team culture. • Performance Management: Gaining skills in setting goals, providing feedback, and evaluating team performance to ensure project success.
5	**Report Writing**	• Understanding Report Structure: Learning the components and structure of a well-organized project report, including introduction, methodology, findings, and conclusions. • Effective Data Presentation: Developing skills to present data and information clearly and accurately using charts, graphs, and tables. • Writing Style and Clarity: Improving the ability to write concisely, professionally, and in a manner that is easily understood by readers. • Adhering to Guidelines: Understanding and applying formal guidelines and standards for report formatting and citation.

8. Course Outcomes (COs)

COs	Description
M23MCA306C.1	**Understand and Apply the** role of project planning and quality management in software development

M23MCA306C.2	Ability to develop detailed project plans, including defining objectives, scope, timelines, budgets, and resources.
M23MCA306C.3	**Leadership and Team Collaboration provides** Improved leadership skills for managing teams, resolving conflicts, and fostering a collaborative project environment.
M23MCA306C.4	Stakeholder Management and Communication provides Skills to effectively communicate with stakeholders, manage expectations, and provide clear updates on project progress.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA306C.1	3	-	-	-	-	-	-	-
M23MCA306C.2	-	-	3	-	-	-	-	-
M23MCA306C.3	-	-	-	-	3	-	-	-
M23MCA306C.4	-	-	-	-	-	3	-	-
M23MCA306C	3	-	3	-	3	3	-	-

9. Assessment Plan

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	CO4	Total
Module 1	10				10
Module 2		10			10
Module 3			10		10
Module 4				10	10
Module 5				10	10
Total	10	10	10	20	50

Semester End Examination (SEE)

	CO1	CO2	CO3	CO4	Total
Module 1	20				20
Module 2		20			20
Module 3			20		20
Module 4				20	20
Module 5				20	20
Total	20	20	20	40	100

10. Future with this Subject:

In the future, the intersection of project management and report writing is likely to be shaped by advancements in technology, evolving industry standards, and new methodologies. Here are some key trends and developments:

➢ **Advanced Data Analytics Integration:** Project reports will increasingly incorporate sophisticated data analytics and real-time reporting tools, providing deeper insights and more actionable information.

➢ **Automated Reporting Tools:** Automation and AI will play a significant role in generating and formatting reports, reducing manual effort and improving accuracy.

➢ **Real-time Project Tracking:** Enhanced project management tools will enable real-time tracking of progress, risks, and budgets, leading to more dynamic and up-to-date reports.

➢ **Integration with Other Tools:** Seamless integration with project management software and other tools will streamline the reporting process, improving efficiency and coordination.

➢

3rd Semester	PROFESSIONAL ELECTIVE IV(PE) BUSINESS INTELLIGENCE	M23MCA306D

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Business Intelligence:	• Understanding the architecture and operations of data warehouses, including data extraction, transformation, and loading (ETL) processes. • Familiarity with BI frameworks that integrate data, processes, and tools to support business decision-making. • Knowledge of the different types of analytics and how they are used to interpret data, forecast outcomes, and recommend actions.
2	Decision Making:	• Understanding of the foundational theories of decision making, including rational choice theory and behavioral decision theory. • Strong grounding in mathematics and statistics, essential for constructing and evaluating decision models. • Awareness of key business processes and how decisions impact these processes at various levels (strategic, tactical and operational).
3	Basic Concepts of Neural Networks:	• Understanding of linear algebra concepts such as vectors, matrices, and eigenvalues, which are fundamental in neural networks and SVMs. • Strong proficiency in Python, the primary language for machine learning, with familiarity in libraries like NumPy, pandas, and scikit-learn. • Understanding of basic algorithms and data structures, which are essential in implementing and optimizing machine learning models.
4	Decision Support Systems Modelling:	• Advanced proficiency in Excel, including the use of functions, pivot tables, Solver, and data analysis tools. • Familiarity with simulation techniques and software (e.g., @RISK, Arena) used in decision support modeling. • Awareness of the specific context in which decision models are applied, such as finance, healthcare, or supply chain management.
5	Decision Modelling with Spreadsheets:	• To build proficiency in these areas, engage in hands-on projects that involve real-world decision modeling scenarios. Participating in case studies, simulations, and optimization challenges will also enhance your skills. • Skills in communicating the results of decision models to stakeholders in a clear and actionable manner. • Understanding of basic project management principles, which are important when implementing decision models in real-world scenarios.
6	Artificial Intelligence Field	• Basic understanding of AI principles, including machine learning, neural networks, and natural language processing. • Solid foundation in mathematics, particularly in areas like linear algebra, probability, and statistics, which are crucial for understanding AI algorithms. • Understanding of different knowledge representation techniques, such as rules, frames, and ontologies.

2. Competencies

S/L	Competency	KSA Description
1	An Overview of Business Intelligence, Analytics, and Decision Support	**Knowledge:** • Familiarity with the principles, tools, and technologies used in BI. Understanding different types of analytics: descriptive, predictive, and prescriptive. **Skills:** • Ability to analyze complex datasets to identify trends, patterns, and

		insights. Competence in BI tools like Tableau, Power BI. **Attitudes:** • A proactive approach to staying updated with the latest BI and analytics trends, tools, and technologies. Precision in analyzing data and ensuring accuracy in the insights generated.
2	**Decision Making**	**Knowledge:** • In-depth knowledge of the four key phases—Intelligence, Design, Choice, and Implementation. Recognize how each phase contributes to the overall decision-making process. **Skills:** • Ability to identify and articulate problems during the Intelligence Phase, including data collection and problem diagnosis. **Attitudes**: • A commitment to staying updated with the latest developments in decision-making processes, DSS technologies, and related tools.
3	**Neural Networks and Sentiment Analysis**	**Knowledge:** • Understanding the architecture of neural networks, including layers (input, hidden, output), neurons, activation functions, and how they mimic the human brain's neural structure. **Skills:** • Ability to design, implement, and train neural networks using programming languages like Python and frameworks such as TensorFlow, Keras, or PyTorch. **Attitudes:** • Willingness to continuously learn and adapt to new developments in neural networks, machine learning, and sentiment analysis technologies.
4	**Model-Based Decision Making**	**Knowledge:** • Knowledge of different types of models used in DSS, such as mathematical, statistical, and heuristic models, and how they are applied to specific decision contexts. **Skills:** • Ability to develop and refine mathematical models for decision support, ensuring that they accurately represent the decision problem and its constraints. **Attitudes:** • Questioning the reliability and fairness of decisions made by ADS and ES. Recognizing the impact of ADS and ES on society and the importance of responsible AI development.
5	**Automated Decision Systems and Expert Systems**	**Knowledge**: • Familiarity with different types of decision systems, including rule-based, model-based, and machine learning-based systems. Awareness of the legal frameworks, ethical concerns, and regulations surrounding automated decisions. **Skills:** • Proficiency in languages commonly used in AI and expert systems, such as Python, Prolog, and LISP. Skills in analyzing and processing data to feed into ADS and expert systems for decision-making. **Attitudes:** • Carefully evaluating the inputs, processes, and outputs of these systems to ensure they meet the desired criteria.

3. **Syllabus**

BUSINESS INTELLIGENCE SEMESTER – III			
Course Code	**M23MCA306D**	CIE Marks	**50**
Number of Lecture Hours/Week(L: T: P: S)	**(3:0:0:0)**	SEE Marks	**50**
Total Number of Lecture Hours	**40 hours Theory**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Course Objectives:
- Explain the Business Intelligence, Analytics and Decision Support system
- List the technologies for Decision making, Automated decision systems
- Explain sentiment analysis techniques
- Illustrate Multi-criteria Decision making systems, predictive modelling techniques

Module -1
An Overview of Business Intelligence, Analytics, and Decision Support Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics.

Module -2
Decision Making Introduction and Definitions, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.

Module -3
Neural Networks and Sentiment Analysis Basic Concepts of Neural Networks, Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process, Sentiment Analysis, Speech Analytics.

Module -4
Model-Based Decision Making Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spreadsheets, Mathematical programming optimization, Decision Analysis with Decision Tables and Decision Trees, Multi-Criteria Decision Making With Pairwise Comparisons.

Module -5
Automated Decision Systems and Expert Systems Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems.

Text Books:
1. Ramesh Sharda, Dursun Delen, EfraimTurban, J.E.Aronson,Ting-Peng Liang, David King, "BusinessIntelligence and Analytics: System for Decision Support", 10th Edition, Pearson Global Edition, 2013

Reference books:
1. Data Analytics: The Ultimate Beginner's Guide to Data Analytics Paperback – 12 November 2017by Edward Mize.

Skill Development Activities Suggested

The students with the help of the course teacher can take up technical –activities which will enhance their skill or the students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/testing/projects, and for creative and innovative methods to solve the identified problem. The prepared report shall be evaluated for CIE marks.

4. Syllabus Timeline

S/L	Syllabus Timeline	Description
1	Week 1-3: An Overview of Business Intelligence, Analytics, and Decision Support	Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics.
2	Week 4-6: Decision Making	Introduction and Definitions, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.
3	Week 7-8: Neural Networks and Sentiment Analysis	Basic Concepts of Neural Networks, Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process, Sentiment Analysis, Speech Analytics.
4	Week 9-11: Model-Based Decision Making	Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spreadsheets, Mathematical programming optimization, Decision Analysis with Decision Tables and Decision Trees, Multi-Criteria Decision Making With Pairwise Comparisons.
5	Week 12-14: Automated Decision Systems and Expert Systems	Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems.

5. Teaching-Learning Process Strategies

S/L	TLP Strategies:	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
6	Laboratory Learning	Utilize the facilities available in the laboratories to understand the behavior of the materials by performing few experiments.

6. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation:
The minimum CIE marks requirement is 50% of maximum marks in each component.

CIE Split up

	Components	Number	Weightage	Max. Marks	Min. Marks
(i)	Internal Assessment-Tests (A)	2	50%	25	12.5
(ii)	Assignments/Quiz/Activity (B)	2	50%	25	12.5
	Total Marks			**50**	**25**

Final CIE Marks = (A) + (B)

Average internal assessment shall be the average of the 2 test marks conducted.

Semester End Examination:

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

7. Learning Objectives

S/L	Learning Objectives	Description
1	**Understand**	Describe how business intelligence, analytics, and decision support systems aid in effective decision-making within organizations.
2	**Decision-Making Process**	Identify and explain the phases of the decision-making process and how decision support systems (DSS) enhance each phase.
3	**Explore Neural Networks and Sentiment Analysis**	Understand the fundamental concepts of neural networks and sentiment analysis, and their applications in predicting outcomes and analysing sentiment.
4	**Apply Model-Based Decision Making Techniques**	Utilize decision support system models, including mathematical programming, decision trees, and multi-criteria decision-making methods, to solve complex problems under conditions of certainty, uncertainty, and risk.
5	**Examine Automated Decision Systems and Expert Systems**	Analyse the structure and applications of automated decision systems and expert systems, and understand the role of artificial intelligence in developing these systems.

8. Course Outcomes (COs) and Mapping with POs

Course Outcomes (COs)

COs	Description
M23MCA306D.1	Able to analyse Business Intelligence, Analytics and Decision Support
M23MCA306D.2	Explain the technologies for Decision making
M23MCA306D.3	Apply predictive modelling techniques(can be attained through assignment or CIE)
M23MCA306D.4	Apply sentiment analysis techniques(can be attained through assignment or CIE)

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA306.1	3	-	-	-	-	-	-	-

M23MCA306.2	-	3	-	-	-	-	-	-
M23MCA306.3	-	-	3	3	-	-	-	-
M23MCA306.4	-	-	-	3	-	-	-	-
M23MCA306	**3**	**3**	**3**	**3**	-	-	-	-

9. **Assessment Plan**

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	CO4	Total
Module 1	10				10
Module 2		10			10
Module 3			10		10
Module 4			05	10	15
Module 5				05	05
Total	**10**	**10**	**15**	**15**	**50**

Semester End Examination (SEE)

	CO1	CO2	CO3	CO4	Total
Module 1	20				20
Module 2		20			20
Module 3			20		20
Module 4			10	20	30
Module 5				10	10
Total	**20**	**20**	**30**	**30**	**100**

10. **Future with this Subject:**

- **Advanced AI and Machine Learning Integration**: AI and machine learning will increasingly be embedded into BI tools, enabling more sophisticated data analysis, pattern recognition, and predictive analytics. This will allow businesses to gain deeper insights and make more informed decisions.

- **Natural Language Processing (NLP) and Conversational BI**: As NLP technologies improve, users will be able to interact with BI systems using natural language queries, making data analysis more accessible to non-technical users.

- **Big Data and Cloud-Based BI**: As data volumes continue to grow, cloud-based BI solutions will become more prevalent, offering scalable and flexible analytics capabilities.

- **Personalized and Predictive Insights**: BI systems will provide more personalized insights tailored to individual users' roles and preferences, leveraging predictive analytics to offer recommendations and foresight based on historical data trends.

3rd Semester	PROFESSIONAL CORE COURSE LABORATORY (PCL) MACHINE LEARNING LABORATORY	M23MCAL307

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Mathematics and Statistics:	• **Linear Algebra**: Familiarity with vectors, matrices, eigenvalues, and matrix decompositions, as these are crucial for understanding algorithms and data representations. • **Probability and Statistics**: Understanding probability theory, statistical inference, distributions, and basic concepts such as expectation, variance, and hypothesis testing.
2	Fundamentals of Machine Learning:	• **Machine Learning Concepts**: Understanding core concepts like supervised and unsupervised learning, over-fitting and under-fitting, bias-variance tradeoff, and evaluation metrics. • **Common Algorithms**: Familiarity with fundamental machine learning algorithms such as linear regression, logistic regression, decision trees, and clustering methods.
3	Programming and Data Handling:	• Programming **Skills**: Proficiency in a programming language commonly used in machine learning, such as Python or R. Ability to implement algorithms and handle data efficiently. • **Data Manipulation**: Experience with libraries and tools for data processing and manipulation, such as NumPy, pandas, and Scikit-learn in Python.
4	Artificial Intelligence and Knowledge Representation:	☐ AI Basics: Basic understanding of artificial intelligence concepts, including search algorithms, optimization techniques, and foundational AI theories. • Knowledge Representation: Familiarity with concepts like propositional logic, predicate logic, and basic knowledge representation techniques relevant to Explanation-Based Learning and rule-based systems.

2. Competencies

S/L	Competency	KSA Description
1	Expertise in Machine Learning Concept and Decision Tree Analysis	**Knowledge:** • **Understanding Learning Problems:** Deep comprehension of various learning systems and issues related to designing them • **Concept Learning:** Knowledge of concept learning theories, the role of version spaces, and the Candidate Elimination Algorithm for representing and refining hypotheses. **Skills:** • **Algorithm Implementation:** Ability to implement concept learning algorithms such as the Candidate Elimination Algorithm and decision tree algorithms from scratch. **Attitudes:** • **Analytical Curiosity:** A proactive approach to understanding and dissecting complex learning problems and systems. This involves a willingness to explore and question different aspects of machine learning methods to continually improve system design. • **Problem-Solving Orientation:** An attitude focused on solving real-world problems through effective application of concept learning and decision tree techniques, always striving to refine algorithms and adapt solutions to new challenges.
2	Advanced Computational Intelligence	**Knowledge:** • **Neural Networks**: Understand the principles of neural network architectures, including perceptrons, multilayer networks, and back

		propagation algorithms.
		• **Genetic Algorithms**: Familiar with the theory and implementation of genetic algorithms, including hypothesis space search and genetic programming.
		Skills:
		• **Neural Networks**: Ability to design, implement, and train neural network models using various frameworks and tools. Proficient in handling problems related to neural network optimization, such as over-fitting, under-fitting, and convergence issues..
		• **Genetic Algorithms**: Competent in configuring and applying genetic algorithms to solve optimization problems..
		Attitudes:
		• **Neural Networks**: Demonstrate a proactive and analytical mindset towards problem-solving using neural networks. Embrace challenges and complexities associated with deep learning.
		• **Genetic Algorithms**: Exhibit creativity and resilience in applying genetic algorithms to diverse and complex problems.
3	**Advanced Bayesian and Computational Learning**	**Knowledge:** • **Computational Learning Models**: Familiar with advanced algorithms and models, including the Gibbs Algorithm, Naïve Bayes Classifier, Bayesian Belief Networks (BBNs), and the Expectation-Maximization (EM) Algorithm. **Skills:** • **Bayesian Methods**: Proficient in applying Bayes' Theorem and related techniques to develop probabilistic models. • **Computational Learning**: Ability to apply computational learning theories and algorithms, such as the Gibbs Algorithm, to real-world problems. **Attitudes:** • **Bayesian Learning**: Demonstrate a rigorous and analytical mindset towards probabilistic models and Bayesian methods. • **Computational Learning**: Show a critical and innovative approach to computational learning challenges.
4	**Advanced Instant-Based Learning and Rule-Based Learning**	**Knowledge:** • **Instant-Based Learning**: Understand K-Nearest Neighbor (KNN) learning, Locally Weighted Regression, and Radial Basis Functions (RBFs). • **Learning Rule Sets**: Familiar with Sequential Covering Algorithms, Learning Rule Sets, Learning First Order Rules, and Learning Sets of First Order Rules **Skills:** • **Instant-Based Learning**: Skilled in applying Case-Based Reasoning to solve complex problems by leveraging historical cases. • **Learning Rule Sets**: Ability to develop and apply Sequential Covering Algorithms to learn and refine rule sets. **Attitudes:** • **Instant-Based Learning**: Demonstrate a practical and empirical approach to problem-solving using instance-based learning methods. • **Learning Rule Sets**: Show a methodical and detail-oriented attitude towards learning and refining rule-based systems.
5	**Evaluating Hypothesis And**	**Knowledge:** • **Evaluating Hypothesis**: Comprehend the Estimating hypothesis

	Reinforced Learning	accuracy, Basics of sampling theorem. Difference in error of two hypothesis, Comparing learning algorithms
		Skills:
		• **Evaluating Hypothesis**: Proficient in applying Explanation-Based learning to improve learning efficiency by leveraging domain knowledge. Skilled in using Inductive-Analytical Approaches and implementing the Algorithm for concept learning and rule extraction.
		Attitudes:
		• **Evaluating Hypothesis**: Estimating hypothesis accuracy, Basics of sampling theorem. Difference in error of two hypothesis, Comparing learning algorithms

3. **Syllabus**

MACHINE LEARNING LABORATORY
SEMESTER – III

Course Code	M23MCAL307	CIE Marks	50
Number of Lecture Hours/Week(L: T: P: S)	(0:0:3:0)	SEE Marks	50
Credits	02	Exam Hours	03

Course Objectives:

- Provide students with practical experience in implementing machine learning algorithms and models across a variety of domains.
- Equip students with the skills to use popular machine learning libraries and tools for data analysis, model training, and evaluation.
- Enable students to understand and apply techniques for cleaning, transforming, and engineering features from raw data, preparing datasets for effective model building.

Sl. No	Experiments
1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
5	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

4. Syllabus Timeline

S/L	Syllabus Timeline	Description
1	**Week 1-2**	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples
2	**Week 3-4:**	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
3	**Week 5-6:**	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
4	**Week 7-8:**	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
5	**Week 9-10:**	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

5. Teaching-Learning Process Strategies

S/L	TLP Strategies:	Description
1	**Lecture Method**	Utilize various teaching methods within the lecture format to reinforce competencies.
2	**Video/Animation**	Incorporate visual aids like videos/animations to enhance understanding of concepts.
3	**Collaborative Learning**	Encourage collaborative learning for improved competency application.
4	**Real-World Application**	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	**Flipped Class Technique**	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
6	**Laboratory Learning**	Utilize the facilities available in the laboratories to understand the behavior of the materials by performing few experiments.

6. **Assessment Details (both CIE and SEE)**
   - CIE marks for a practical course shall be 50 marks.
   - The split up of CIE marks for record/journal and test to be split in the ratio 60:40
   - Record write up for individual program/experiment will be evaluated for 10 Marks
   - Total marks scored for record writing and conduction shall be scaled downed to 30 marks **(60% of**

the CIE Lab Marks (50))

> 1 (one) test for 100 marks after the completion of the experiments at the end of the semester. The Test marks should be scaled down to 20marks **(40% of the CIE Lab Marks (50))Test**

Marks distribution for Laboratory based Practical Course for TEST

Sl. No.	Description	% of Marks	In Marks
1	Write-up, Conduction, result and Procedure	60%	60
2	Viva-Voce	40%	40
Total		**100%**	**100**

Marks distribution for Laboratory based Practical Course for Final CIE

Sl. No.	Description	% of Marks	In Marks
1	Scaled Down marks of Record	60% of the maximum	30
2	Scaled Down marks of Test	40% of the maximum	20
Total		**100%**	**50**

SEE for Practical Course (Laboratory based):

Marks distribution for Laboratory based Practical Course for Final SEE

SL. No.	Description	% of Marks	Marks
1	Write-up, Procedure	20%	20
2	Conduction and result	60%	60
3	Viva-Voce	20%	20
Total		**100%**	**100**

1. SEE marks for practical course shall be 50 marks
2. See for practical course is evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
3. Change of experiment/program is allowed only once and 20% marks allotted to the procedure/write-up part to be made zero.
4. Duration of SEE shall be 3 hours.

7. **Learning Objectives**

S/L	Learning Objectives	Description
1	Understand Machine Learning Concepts and Techniques	Students will be able to comprehend core machine learning principles, including supervised and unsupervised learning, model selection, and performance metrics.
2	Apply Data Pre-processing and Feature Engineering Techniques	Students will demonstrate the ability to clean, preprocess, and transform raw datasets, including techniques such as normalization, handling missing data, and feature extraction.
3	Evaluate and Validate Models	Students will learn how to assess the performance of models using appropriate evaluation metrics and validation techniques.
4	Identify and Mitigate Bias in Machine Learning Models:	Students will learn to identify potential biases in data and models and apply fairness-aware techniques to improve model transparency and ethical considerations.

8. **Course Outcomes (COs) and Mapping with POs**
   Course Outcomes (COs)

COs	Description
M23MCAL307.1	**Understand** the fundamentals of concept learning, algorithms, and associated procedures of machine learning.
M23MCAL307.2	**Apply** machine learning techniques Supervised, unsupervised and reinforcement learning algorithms to train, test, and deploy machine learning models on real datasets.
M23MCAL307.3	**Analyze** the performance of machine learning models to assess model effectiveness, identify strengths and weaknesses, and make improvements based on analysis of Neural networks, Bayes classifier and K-Nearest Neighbor for given problem.
M23MCAL307.4	**Evaluate** the statistics to infer the correctness of the written machine learning algorithm for a given real-world problems that address specific business or research challenges.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCAL307.1	2	-	-	-	-	-	-	-
M23MCAL307.2	-	3	-	-	-	-	-	-
M23MCAL307.3	-	-	3	-	-	-	-	-
M23MCAL307.4	-	-	-	3	-	-	-	-
M23MCAL307	2	3	3	3	-	-	-	-

9. **Assessment Plan**

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	CO4	Total
Laboratory Programs	10				10
		10			10
			15		15
				15	15
Total	**10**	**10**	**15**	**15**	**50**

Semester End Examination (SEE)

	CO1	CO2	CO3	CO4	Total
Laboratory Programs	20				20
		20			20
			30		30
				30	30
Total	**20**	**20**	**30**	**30**	**100**

10. **Future with this Subject:**
    1. Advanced Deep Learning Techniques: Implementing custom neural networks, fine-tuning large pre trained models, and building generative models.
    2. Explainable AI and Model Interpretability: Implementing tools for interpreting black-box models, exploring fairness metrics, and debugging model predictions.
    3. Natural Language Processing (NLP): Training NLP models for sentiment classification, text summarization, and entity recognition.
    4. Time Series Forecasting: Implementing time series forecasting models for real-world data.

3rd Semester	Professional Core Course laboratory (PCL) INTERNET OF THINGS LABORATORY	M23MCAL308

1. **Prerequisites**

S/L	Proficiency	Prerequisites
1	Basic Science	• **Basic understanding of electronic components**: Knowledge of resistors, capacitors, transistors, diodes, and inductors. Ability to analyze basic circuits and understand their applications in real-world scenarios. • **Fundamental physics concepts**: Understanding of electricity, magnetism, electromagnetic waves, and the behavior of materials under different physical conditions. Grasp the principles behind circuits, sensors, and communication systems. • **Energy conversion and signal processing**: Familiarity with converting energy forms (e.g., electrical to mechanical) and basic signal processing techniques like filtering and amplification. Ability to interpret and process signals from sensors.
2	Mathematics	• **Algebra proficiency**: Ability to solve linear and quadratic equations, work with inequalities, and simplify complex expressions. Understanding of algebraic manipulation in the context of system modeling and analysis. • **Calculus**: Understanding of differentiation and integration, their applications in real-world problems like rate of change, optimization, and area under curves. Proficiency in solving differential equations and applying calculus in signal processing. • **Probability, statistics, and matrices**: Knowledge of probability distributions, random variables, statistical inference, and matrix operations. Ability to apply these concepts in modeling and analyzing data, especially for IoT and machine learning applications
3	Computer Science	• **Programming languages**: Proficiency in Python or C/C++ for developing algorithms, writing efficient code, and automating tasks. Understanding of object-oriented programming, modular design, and debugging techniques. • **Data structures and algorithms**: Knowledge of common data structures (e.g., arrays, linked lists, trees, graphs) and algorithms (e.g., sorting, searching, dynamic programming). Ability to analyze the efficiency of algorithms and apply them to real-world problems. • **Networking fundamentals**: Understanding of networking protocols (e.g., TCP/IP, HTTP, FTP), addressing schemes, and basic concepts in cybersecurity. Ability to design and troubleshoot simple network systems, focusing on IoT connectivity and data transfer.
4	Embedded Systems	• **Microcontroller platforms**: Familiarity with Arduino, Raspberry Pi, or similar platforms. Understanding of microcontroller architecture, programming, and interfacing with peripheral devices such as sensors, actuators, and displays. • **Interfacing sensors and actuators**: Experience in connecting sensors (e.g., temperature, motion, gas) and actuators (e.g., motors, LEDs, relays) to hardware platforms. Knowledge of analog and digital signal processing for accurate data acquisition and control. • **Embedded software development**: Basic knowledge of embedded C/C++ or Python for writing firmware, using integrated development environments (IDEs), and debugging tools like oscilloscopes and logic analyzers.

| 5 | Communication Systems | • **Wireless communication technologies**: Understanding of Wi-Fi, Bluetooth, Zigbee, and other wireless technologies. Knowledge of frequency bands, modulation techniques, and wireless networking for efficient and reliable IoT communication.
• **IoT communication protocols:** Familiarity with MQTT, CoAP, and other lightweight communication protocols optimized for IoT applications. Understanding of message queuing, data serialization, and energy-efficient communication.
• **Networking and communication theory**: Basic knowledge of communication principles such as signal propagation, noise, channel capacity, and error detection/correction. Ability to apply these concepts in the design of IoT communication systems. |

2. Competencies

S/L	Competency	KSA Description
1	**Introduction to IoT**	**Knowledge:** ➤ Understanding the evolution of IoT, enabling technologies, and key networking components. **Skills:** ➤ Ability to identify and describe IoT components and addressing strategies. **Attitudes**: ➤ Curiosity about the interdependence of technologies and a willingness to explore new concepts in IoT.
2	**IoT Sensing and Actuation**	**Knowledge:** ➤ In-depth knowledge of various sensors and actuators, including their characteristics and types. **Skills:** ➤ Proficiency in selecting and interfacing sensors and actuators with IoT hardware platforms. **Attitudes:** ➤ Precision in sensor calibration and a problem-solving approach to handling sensorial deviations.
3	**IoT Processing Topologies**	**Knowledge:** ➤ Understanding of IoT processing topologies, data formats, and processing requirements. **Skills:** ➤ Ability to design and optimize IoT device processing strategies and make decisions on processing offloading. **Attitudes:** ➤ Attention to efficiency and optimization in processing design.
4	**IoT Connectivity Technologies**	**Knowledge:** ➤ Comprehensive knowledge of various IoT connectivity technologies (e.g., Zigbee, LoRa, NB-IoT, Wi-Fi, Bluetooth). **Skills:** ➤ Proficiency in selecting and configuring appropriate communication technologies for IoT applications. **Attitudes:** ➤ Proactiveness in learning and implementing emerging communication protocols and standards.
5	**IoT Case Studies and Future**	**Knowledge:** ➤ Familiarity with the application of IoT in sectors like agriculture and transportation, and an understanding of future IoT trends.

	Trends	**Skills:** ➢ Ability to analyze case studies and draw insights for practical IoT applications. **Attitudes:** ➢ Open-mindedness toward new IoT trends and a desire to innovate.	
6	**IoT Hardware Projects**	**Knowledge:** ➢ Understanding of basic IoT hardware components, including Arduino boards and sensors like the MQ-2 Gas sensor. **Skills:** ➢ Ability to build and program simple IoT projects, interfacing sensors with microcontrollers like Arduino and NodeMCU. **Attitudes:** ➢ Hands-on approach to learning, with persistence in troubleshooting and debugging hardware issues.	

3. Syllabus

<div align="center">

INTERNET OF THINGS LABORATORY
SEMESTER – III

</div>

Course Code	**M23MCAL308**	CIE Marks	**50**
Number of Lecture Hours/Week(L: T: P: S)	**(0:0:3:0)**	SEE Marks	**50**
Credits	**02**	Exam Hours	**03**

Course Objectives:

● To Understand IoT basics and components.
● To learn the Interface sensors and actuators with IoT devices.
● To analyze IoT processing and manage data.
● To Explore and apply IoT connectivity technologies.
● To Study IoT applications and future trends.
● To Build and implement practical IoT projects using hardware.

Sl.no	Experiments
1	Study the fundamentals of IOT software's and components.
2	Familiarization with the detailed concepts of Arduino/Raspberry Pi.
3	i. Controlling the Light Emitting Diode (LED) with a push button ii. Interfacing the RGB LED with the Arduino Traffic Signal light Simulation
4	i. Controlling the LED blink rate with the potentiometer interfacing with Arduino ON/OFF control based on light Intensity – using light sensors, monitor the surrounding light intensity – threshold. Or Controlling relay state based on ambient light levels using LDR sensor.
5	i. Interfacing of temperature sensor LM35 with Arduino ii. Interfacing Servo Motor with the Arduino ii. Interfacing of the Active Buzzer with Arduino Interfacing of the Relay with Arduino.
6	Dice Game Simulation Calculate the distance to an object with the help of an ultrasonic sensor and display it on an LCD
7	Controlling LEDs, relay & buzzer using Blynk app
8	Interfacing the regular USB webcam with the device and turn it into fully functional IP webcam and text the functionality
9	Build a circuit using Raspberry pi based weather reporting over IOT
10	Upload humidity & temperature data to Thing Speak, periodically logging ambient light level to Thing Speak

4. Syllabus Timeline

S/L	Syllabus Timeline	Description
1	Week 1-2 Introduction to IoT	Introduction, evolution of IoT, enabling technologies, complex interdependence of technologies, IoT networking components, addressing strategies in IoT.
2	Week 3-4 IoT Sensing and Actuation	Introduction, sensors, sensor characteristics, sensorial deviations, sensing types, sensing considerations, actuators, actuator types, actuator characteristics.
3	Week 5-6 IoT Processing Topologies	Data formats, importance of processing in IoT, processing topologies, IoT device design and selection considerations, processing offloading.
4	Week 7-8 IoT Connectivity Technologies:	Introduction, IEEE 802.15.4, Zigbee, Thread, ISA100.11A, Wireless HART, RFID, NFC, DASH7, Z-Wave, Weightless, Sigfox, LoRa, NB-IoT, Wi-Fi, Bluetooth.
5	Week 9-10 IoT Case Studies and Future Trends:	Introduction, components of agricultural IoT, advantages of IoT in agriculture, smart irrigation management system, and introduction to vehicular IoT, components and advantages of vehicular IoT.

5. Teaching-Learning Process Strategies

S/L	TLP Strategies:	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation /Simulation	Incorporate visual aids like videos/animations/simulation to enhance understanding of basic concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Higher Order Thinking (HOTS) Questions:	Pose HOTS questions to stimulate critical thinking related to each competency.
5	Problem-Based Learning (PBL)	Implement PBL to enhance analytical skills and practical application of competencies
6	Multiple Representations	Introduce topics in various representations to reinforce competencies
7	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
8	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
9	Programming Assignments	Assign programming tasks to reinforce practical skills associated with competencies.

6. Assessment Details

CIE for Practical Courses (Laboratory Based):

➤ CIE marks for a practical course shall be 50 marks.
➤ The split up of CIE marks for record/journal and test to be split in the ratio 60:40
➤ Record write up for individual program/experiment will be evaluated for 10 Marks
➤ Total marks scored for record writing and conduction shall be scaled downed to 30 marks **(60% of the CIE Lab Marks (50))**
➤ 1 (one) test for 100 marks after the completion of the experiments at the end of the semester. The Test marks should be scaled down to 20 marks **(40% of the CIE Lab Marks (50))Test**

Marks distribution for Laboratory based Practical Course for TEST

Sl. No.	Description	% of Marks	In Marks
1	Write-up, Conduction, result and Procedure	60%	60
2	Viva-Voce	40%	40
	Total	**100%**	**100**

Final CIE in Practical Course:

Marks distribution for Laboratory based Practical Course for Final CIE

Sl. No.	Description	% of Marks	In Marks
1	Scaled Down marks of Record	60% of the maximum	30
2	Scaled Down marks of Test	40% of the maximum	20
	Total	**100%**	**50**

SEE for Practical Course (Laboratory based):

Marks distribution for Laboratory based Practical Course for Final SEE

SL. No.	Description	% of Marks	Marks
1	Write-up, Procedure	20%	20
2	Conduction and result	60%	60
3	Viva-Voce	20%	20
	Total	**100%**	**100**

1. SEE marks for practical course shall be 50 marks
2. See for practical course is evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
3. Change of experiment/program is allowed only once and 20% marks allotted to the procedure/write-up part to be made zero.
4. Duration of SEE shall be 3 hours.

7. Learning Objectives

S/L	Learning Objectives	Description
1	**Understand IoT Fundamentals**	Understand the fundamentals of IoT, including its evolution, enabling technologies, key components, and addressing strategies.
2	**Integration of Sensors and Actuators**	Develop practical skills in interfacing various sensors and actuators with IoT hardware platforms like Arduino and Raspberry Pi, laying the foundation for building functional IoT projects.
3	**Analyze IoT Processing Techniques**	Analyze different IoT processing topologies, data formats, and processing strategies, including processing offloading.
4	**Explore IoT Connectivity Technologies**	Explore various IoT connectivity technologies and communication protocols, and understand their application in IoT systems.
5	**Study IoT Applications and Trends**	Study case studies and future trends in IoT, focusing on agricultural and vehicular applications to understand practical uses and emerging developments
6	**Build and Implement IoT Projects**	Build and implement practical IoT projects using hardware components, such as Arduino boards and sensors, to apply theoretical knowledge in real-world scenarios.

8. Course Outcomes and Mapping with POs

Course Outcome

CO's	DESCRIPTION OF THE OUTCOMES

M23MCAL308.1	Present comprehensive on the fundamentals of IoT, including its evolution, architecture, and key components.
M23MCAL308.2	Apply skills to interface various sensors and actuators with IoT hardware platforms.
M23MCAL308.3	Analyze and evaluate different IoT processing topologies and data management techniques.
M23MCAL308.4	Evaluate and select appropriate IoT connectivity technologies and communication protocols.

Course Outcomes mapping to Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCAL308.1	3	-	-	-	-	-	-	-
M23MCAL308.2	-	3	-	-	-	-	-	-
M23MCAL308.3	-	-	3	-	-	-	-	-
M23MCAL308.4	-	-	3	3	-	-	-	-
M23MCAL308	3	3	3	3	-	-	-	-

9. **Assessment Plan**

Continuous Internal Evaluation (CIE)					
	CO1	**CO2**	**CO3**	**CO4**	**TOTAL**
Lab Programs	10				10
		10			10
			15		15
				15	15
TOTAL	10	10	15	15	50

Semester End Examination (SEE)					
	CO1	**CO2**	**CO3**	**CO4**	**TOTAL**
Lab Programs	20				20
		20			20
			30		30
				30	30
TOTAL	20	20	30	30	100

10. **Future with this Subject**

- **Embracing Advanced Tools**: Future IoT courses will integrate advanced computational tools and software for simulating and designing IoT systems. This will enhance your ability to experiment and refine IoT projects, building on the foundational knowledge of IoT architecture and hardware.
- **Incorporating Edge Computing and AI**: As IoT evolves; there will be a stronger focus on edge computing and AI. This means developing systems that can process data at the edge and make real-time decisions, expanding your understanding of IoT processing and connectivity technologies.
- **Exploring Interdisciplinary Applications**: IoT applications will increasingly intersect with smart cities, healthcare, and industrial automation. Expect to see how IoT sensing and actuation, along with connectivity technologies, can be applied to these areas to address real-world challenges.

3rd Semester	MINI PROJECT (MP)	M23MCA309

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Project Planning and Management	Basic understanding of project management principles, acquired from earlier project work and theoretical courses.
2	Experimental Design and Analysis	Knowledge of experimental techniques and data analysis from core and elective courses.
3	Technical Documentation	Competence in technical writing and report drafting.
4	Application of Theoretical Knowledge	Strong foundation in the relevant engineering principles.
5	Team Collaboration	Experience in group projects and collaborative learning environments.

2. Competencies

S/L	Competency	KSA Description
1	Project Execution	**Knowledge:** • Understanding of project planning, scheduling, and resource management. **Skill:** • Ability to carry out practical work systematically and efficiently. **Attitude:** • Proactive and solution-oriented approach to problem-solving.
2	Data Analysis	**Knowledge:** • Advanced knowledge of data analysis techniques. **Skill:** • Proficiency in interpreting and analyzing experimental data. **Attitude:** • Analytical mindset with a focus on accuracy.
3	Technical Communication	**Knowledge:** • Mastery of technical documentation standards. **Skill:** • Ability to draft comprehensive project reports. **Attitude:** • Precision and clarity in communication.
4	Presentation Skills	**Knowledge:** • Understanding of audience engagement techniques. **Skill:** • Ability to deliver clear and impactful presentations. **Attitude:** • Confidence and professionalism in public speaking.
5	Collaboration	**Knowledge:** • Awareness of effective teamwork strategies. **Skill:** • Ability to work collaboratively in multidisciplinary teams. **Attitude:** • Respect and openness to diverse perspectives.

3. Mini Project Timeline

S/L	Timeline	Description
1	Week 1-2	Review of problem statement and project plan; setting milestones.
2	Week 3-4	Experimental setup and initial trials.

3	**Week 5-6**	Data collection and analysis; troubleshooting.
4	**Week 7-8**	Progress review and mid-term evaluation.
5	**Week 9-10**	Refinement of experiments and final data analysis.
6	**Week 11-12**	Presentation preparation and practice.
7	**Week 13-14**	Final project presentation and submission of the report.

MINI PROJECT (MP) **SEMESTER – III**			
Course Code	**M23MCA309**	CIE Marks	**50**
Number of Lecture Hours/Week(L: T: P: S)	**(0:0:3:0)**	SEE Marks	**50**
Total Number of Lecture Hours	**40 hours**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Course objectives:
- Build creative solutions for development problems of current scenario in the Society.
- Utilize the skills developed in the curriculum to solve real life problems.
- Improve understanding and develop methodology for solving complex issues.
- The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.

Some of the domains to choose for Mini projects: • Infrastructure • Health Care • Social security • Security for women • Transportation • Business Continuity • Remote working and Education • Digital Finance • Food Security • Rural employment • Water and land management • Pollution • Financial Independence • Agricultural Finance • Primary Health care • Nutrition • Child Care • E-learning • Distance parenting • Mentorship Etc

4. **Assessment Details (both CIE and SEE)**

CIE procedure for Mini Project:
The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work, shall be based on the evaluation of the mini project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

Continuous Internal Evaluation:

Identifying the real life problems and producing literature report	**20marks**
Data sampling and Cleaning	**10marks**
Establishing the right Objective	**10marks**
Developing the solution	**10 marks**

Mini Project Report: **20 marks.**
The basis for awarding the marks shall be the involvement of the student in the project and in the preparation of project report. To be awarded by the internal guide in consultation with external guide if any. Certified by stake holders and authorized by concerned government authorities.

Mini Project Presentation: 10 marks.
The presentation marks of the mini project work Phase shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

Evolution: 10 marks.
The student shall be evaluated based on the ability in the Question and Answer session for 10 marks.

Each student, under the guidance of a Faculty, is required to

> ➤ Choose, preferably through peer reviewed journals, a recent topic of his/her interest relevant to the Course of Specialization.
> ➤ Carryout literature survey, organize the Course topics in a systematic order.
> ➤ Prepare the report with own sentences.
> ➤ Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
> ➤ Present the seminar topic orally and/or through power point slides.
> ➤ Answer the queries and involve in debate/discussion.
> ➤ Submit two copies of the typed report with a list of references.

Semester End Examination

SEE marks for the mini project report (20 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the department.

5. Learning Objectives

S/L	Learning Objectives	Description
1	**To execute the project plan effectively.**	Students will apply their theoretical knowledge to practical tasks, managing the project from start to finish.
2	**To analyze data and refine project outcomes.**	Students will enhance their skills in data interpretation and problem-solving.
3	**To document and present the project work comprehensively**	Students will develop a final report and presentation that reflects their project work accurately.

6. Course Outcomes (COs) and Mapping with POs

Course Outcomes (COs)

COs	Description
M23MCA309.1	Apply the knowledge acquired within and beyond the curriculum
M23MCA309.2	Formulate and investigate a problem which is of current trend
M23MCA309.3	Apply software engineering methodologies and implementation of problems in real world

7. CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA309.1	3	-	-	-	-	-	-	-
M23MCA309.2	-	3	-	-	-	-	-	-
M23MCA309.3	-	-	3	-	-	-	-	-
M23MCA309	3	3	3	-	-	-	-	-

8. Future with this Subject

- **Web Development**
  > ➤ **Personal Portfolio Website**: Create a responsive portfolio showcasing your projects, skills, and experiences.
  > ➤ **E-Commerce Website**: Develop a basic online store with features like product listings, shopping cart, and payment integration.
  > ➤ **Blog Platform**: Build a blogging website where users can create, edit, and comment on posts.
- **Mobile App Development**
  > ➤ **Health Tracker App**: An app that helps users track their fitness goals, diet, and health metrics.
  > ➤ **Event Management App**: An app for users to create and manage events, invite participants, and RSVP.
  > ➤ **Recipe App**: Users can search for, save, and share recipes, with a grocery list feature.

- **Data Science and Machine Learning**
  - ➢ **Sentiment Analysis Tool**: Analyze social media posts or reviews to determine public sentiment using NLP techniques.
  - ➢ **Predictive Analytics Dashboard**: A web app that uses historical data to predict trends (e.g., sales forecasting).
  - ➢ **Recommendation System**: Build a simple recommendation engine for movies, books, or products.
- **Software Development**
  - ➢ Library Management System**: A system to manage book loans, returns, and user registrations for a library.**
  - ➢ Inventory Management System**: Develop software to manage stock levels, orders, and suppliers.**
  - ➢ Quiz Application**: A platform** for creating and taking quizzes with score tracking.

- **Cloud Computing and IoT**
  - ➢ **Smart Home Automation:** An IoT project to control home appliances via a web or mobile interface.
  - ➢ **Cloud File Storage:** Create a basic cloud storage application with user authentication and file upload/download features.
  - ➢ **Weather Monitoring System:** Use sensors and cloud computing to monitor and display weather data.

4th Semester	PROFESSIONAL CORE COURSE (PC) RESEARCH LEARNING AND PROBLEM FORMULATION	M23MCA401

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Basic Understanding of Research	Familiarity with what research entails, including its purpose, importance, and different types (e.g., qualitative vs. quantitative).
2	Critical Thinking Skills	The ability to analyze, evaluate, and form reasoned conclusions based on evidence is essential for conducting and interpreting research.
3	Knowledge of Statistics	A foundational understanding of statistics is crucial for data analysis, including concepts like mean, median, variance, and basic probability.
4	Writing Skills	Research involves documenting findings clearly, so good writing skills are important for structuring reports, papers, and proposals.
5	Familiarity with Academic Sources	Knowing how to find and cite reliable academic sources, such as journals, articles, and books, is necessary for literature reviews and referencing.

2. Competencies

S/L	Competency	KSA Description
1.	Understand the objectives of scientific research	**Knowledge**: • This is about understanding the facts, concepts, and principles related to a specific area of study. In scientific research, the objective is to acquire deep and accurate knowledge about the topic you're investigating. **Skills**: • These are the practical abilities needed to carry out research effectively. • This includes things like designing experiments, collecting data, analyzing results, and using tools or techniques specific to your field. **Attitudes**: • This refers to the mindset and behaviors that a researcher should have. It includes being curious, open-minded, critical, and ethical. It also means being persistent and careful in your work, and being willing to question and verify your findings.
2.	Understand the various research methods and methodologies of the given use case	**Knowledge:** • **Research Methods:** These are the specific techniques or procedures used to gather and analyze data. Examples include surveys, interviews, experiments, and observations. **Research Methodologies:** This is the broader strategy or plan of action that underpins the choice and use of research methods. It includes the theoretical analysis of the methods, and it guides how the research should be conducted. • **Types of Research:** Understanding different types like qualitative (exploring phenomena) and quantitative (measuring phenomena). **Skills:** • **Data Collection:** Being able to design and conduct surveys, interviews, or experiments. • **Data Analysis:** Skillfully analyzing data using statistical tools or thematic analysis, depending on the research type. • **Critical Thinking:** Evaluating the appropriateness of methods and methodologies for a given research question. **Attitudes:**

		• **Ethical Awareness:** Being mindful of ethical issues in research, such as consent and confidentiality. • **Curiosity and Open-Mindedness:** Maintaining a genuine interest in discovering new information and being open to unexpected findings. • **Rigorousness:** Having a commitment to accuracy, thoroughness, and integrity in research processes.
3.	Understand the importance of literature study in the course of doing research	**Knowledge:** • **Background Information:** Knowing that literature study provides a foundation by offering insights into what has already been researched. • **Gap Identification:** Understanding how literature helps identify gaps or areas that have not been fully explored, guiding where your research can contribute. • **Theoretical Framework:** Recognizing that literature provides the theories and concepts that can be applied or tested in your own research. **Skills:** • **Search and Retrieval:** Being skilled in using databases, libraries, and other resources to find relevant literature. • **Critical Analysis:** Developing the ability to critically evaluate the credibility, relevance, and quality of the literature you review. • **Synthesis:** Combining insights from multiple sources to form a coherent understanding or argument that supports your research objectives. • **Citation:** Properly citing literature to acknowledge sources and avoid plagiarism. **Attitudes:** • **Respect for Prior Work:** Valuing the contributions of previous researchers and understanding the importance of building upon existing knowledge rather than duplicating it. • **Curiosity:** Approaching literature study with a genuine interest in discovering new perspectives and understanding different viewpoints. • **Open-Mindedness:** Being open to changing your research direction based on what you learn from the literature, even if it challenges your initial ideas.
4.	Understand the research design and applying the suitable research design for the given problem.	**Knowledge:** • **Research Design:** It is the overall plan or blueprint for conducting research, guiding how to collect, measure, and analyze data. • **Types of Research Design:** • **Descriptive Design:** Focuses on describing characteristics of a population or phenomenon. • **Experimental Design:** Involves manipulating one variable to determine its effect on another. • **Correlational Design:** Examines the relationship between two variables without manipulation. • **Qualitative Design:** Explores phenomena in-depth through interviews, case studies, etc. • **Selecting a Design:** Knowing which design fits your research question (e.g., use experimental design for cause-and-effect studies). **Skills:** • **Identifying the Problem:** Skillfully defining the research question or problem, which is the first step in selecting a suitable design. • **Matching Design to Problem:** Being able to match the research design to the problem. For instance, using a descriptive design when you want to

		gather information about current conditions or opinions. • **Implementing the Design:** Executing the research plan correctly, from data collection to analysis, following the chosen design's principles. • **Problem-Solving:** Adapting or modifying the design if challenges arise during the research process. **Attitudes:** • **Critical Evaluation:** Being open to critically evaluating different designs and selecting the one that best fits the research problem. • **Ethical Considerations:** Ensuring that the research design chosen adheres to ethical standards, such as fairness and transparency in data collection and analysis. • **Flexibility:** Being willing to adjust the research design if initial choices don't work well or if new information comes to light. • **Confidence in Decision-Making:** Trusting your ability to select and apply the right research design based on your knowledge and skills.
5.	**Understanding the writing of research reports and articles.**	**Knowledge** **Structure of Research Reports and Articles:** Knowing the standard sections, such as: • **Abstract:** A concise summary of the research. • **Introduction:** Background, research question, and objectives. • **Methodology:** Detailed description of how the research was conducted. • **Results:** Presentation of findings. • **Discussion:** Interpretation of the results and their implications. • **Conclusion:** Summary of the research and its significance. • **References:** Citing sources used in the research. **Skills** • **Clear and Concise Writing:** Ability to convey complex ideas and findings in a straightforward, understandable manner. • **Logical Organization:** Skillfully organizing content in a coherent structure that flows logically from one section to the next.. • **Critical Analysis:** Analyzing data and presenting arguments or findings with appropriate evidence and reasoning. • **Editing and Proofreading:** Ensuring the final document is free of errors, well-structured, and polished. • **Use of Visual Aids:** Effectively incorporating tables, charts, graphs, and other visuals to support and enhance the written content. • **Adhering to Guidelines:** Skillfully following specific formatting and submission guidelines required by journals or academic institutions. **Attitudes** • **Attention to Detail:** A meticulous approach to writing, ensuring accuracy in presenting data, citations, and formatting. • **Integrity:** Upholding ethical standards, such as avoiding plagiarism, accurately reporting results, and giving proper credit to sources. • **Perseverance:** Being committed to refining and improving the writing through multiple drafts and revisions. • **Receptiveness to Feedback:** Willingness to accept and incorporate constructive criticism from peers, mentors, or reviewers. • **Commitment to Clarity:** Ensuring that the writing is not only technically correct but also accessible and clear to the intended audience.

3. **Syllabus**

<table>
<tr><td colspan="5" align="center">RESEARCH LEARNING AND PROBLEM FORMULATION
SEMESTER – IV</td></tr>
<tr><td>Course Code</td><td>M23MCA401</td><td>CIE Marks</td><td colspan="2">50</td></tr>
<tr><td>Number of Lecture Hours/Week(L: T: P: S)</td><td>(3:0:0:0)</td><td>SEE Marks</td><td colspan="2">50</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>30 hours</td><td>Total Marks</td><td colspan="2">100</td></tr>
<tr><td>Credits</td><td>02</td><td>Exam Hours</td><td colspan="2">03</td></tr>
</table>

Course objectives: This course will enable students to:

- Understand the concepts of research, methodologies, identify and define appropriate research problem
- Develop skills in qualitative and quantitative data analysis and presentation.
- Develop skills for different data collection methods and significant writing skills.

Module -1

Introduction to Research Methodology and Defining Research problem

Introduction, Meaning of research, Objectives of research, Types of research with real time examples, Research approaches, Significance of research, research methods v/s methodology, research and scientific methods, Importance of know how research is done, research process, criteria for good research, Problems, Problems encountered by researchers in INDIA.

What is research problem, Selecting the research problem, technique involved in defining the problem, an illustration, Importance of literature review in defining a problem, survey of literature, primary and secondary sources

Module -2

Research Design and Sampling design

Research Design: Meaning of research design, Need for research design, features of good design, different research designs, and basic principles of experimental designs. Introduction, Sample design, Steps in sample design, Sampling and non-sampling errors, types of sampling designs – Non-probability sampling, Probability Sampling and Complex random sampling designs. Measurement & Scaling techniques: quantitative and qualitative data, Classification of measurement scales, Goodness of measurement scales, Sources of error in measurement, Techniques of developing measurement tools, scaling, scale classification base, scaling techniques, multidimensional scaling, Deciding the scale.

Module -3

Methods of Data Collection and Interpretation, Report Writing

Introduction, experiments and surveys, Collection of Primary Data: Observation Method, Interview Method, Collection of Data through Questionnaires, Difference between Questionnaires and Schedule guidelines for constructing questionnaire/schedule , Some Other Methods of Data Collection, Collection of Secondary Data Selection of Appropriate Method for Data Collection, Case Study Method.

Meaning of Interpretation, Why Interpretation?, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report.

Module -4

Introduction to latex, Formatting: Lengths in LaTeX, Headers and footers, Page numbering, Paragraph formatting, Line breaks and blank spaces, Text alignment, Page size and margins, Single sided and double sided documents, Multiple columns, Counters, Footnotes, Margin notes: **Fonts:** Font sizes, families, and styles, Font typefaces, Supporting modern fonts with XƎLaTeX. **Presentations:** Beamer, Powerdot, Posters.

Plagiarism checker tools -Drillbit

Text Books

1. C. R. Kothari and gaurav garg, Research Methodology: methods & techniques, 4th edition, new age international publications, 2019.
2. "LaTeX: A Document Preparation System" by Leslie Lamport

Reference Books

1.   Ranjith kumar, Research Methodology: a step-by-step guide for beginners, 5rd Edition, Sage publications Ltd.2022.
2.   "Beginning LaTeX" by Peter Flynn

Journals/Magazines:

1. https://www.eajournals.org/journals/international-journal-of-interdisciplinary-research-methods-ijirm/.
2. https://www.scirp.org/journal/paperinformation.aspx?paperid=71775.

4.   **Syllabus Timeline**

S/L	Syllabus Timeline	Description
1	Week 1-3: **Introduction to Research Methodology and Defining Research problem**	Understanding the fundamentals of research, its purpose, and different types (qualitative, quantitative). Exploring how to identify and articulate research problems, including criteria for selecting a good research problem. Developing research questions, hypotheses, and objectives based on the defined research problem.
2	Week 4-6: **Research Design and Sampling design**	Understanding different types of research designs (e.g., exploratory, descriptive, experimental). Learning how to choose an appropriate design for a research study. Exploring specific research design methods (e.g., case studies, surveys, experiments). . Learning about different sampling techniques (e.g., random sampling, stratified sampling).
3	Week 7-9: **Methods of Data Collection and Interpretation, Report Writing**	Exploring various data collection methods (e.g., surveys, interviews, observations). Understanding the advantages and challenges of each method. Learning how to analyze and interpret collected data. Understanding statistical tools and techniques for data analysis. Structuring and writing a research report. Learning best practices for presenting findings, conclusions, and recommendations.

5.   **Teaching-Learning Process Strategies**

S/L	TLP Strategies:	Description
1	**Lecture Method**	Utilize various teaching methods within the lecture format to reinforce competencies.
2	**Video/Animation**	Incorporate visual aids like videos/animations to enhance understanding of concepts.
3	**Collaborative Learning**	Encourage collaborative learning for improved competency application.
4	**Higher Order Thinking (HOTS) Questions:**	Pose HOTS questions to stimulate critical thinking related to each competency.
5	**Problem-Based Learning (PBL)**	Implement PBL to enhance analytical skills and practical application of competencies
6	**Multiple Representations**	Introduce topics in various representations to reinforce competencies
7	**Real-World Application**	Discuss practical applications to connect theoretical concepts with real-world competencies.

| 8 | **Flipped Class Technique** | Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies |
| 9 | **Programming Assignments** | Assign programming tasks to reinforce practical skills associated with competencies. |

6. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation:

The minimum CIE marks requirement is 50% of maximum marks in each component.

CIE Split up

	Components	Number	Weightage	Max. Marks	Min. Marks
(i)	Internal Assessment-Tests (A)	2	50%	25	12.5
(ii)	Assignments/Quiz/Activity (B)	2	50%	25	12.5
	Total Marks			**50**	**25**

Final CIE Marks = (A) + (B)

Average internal assessment shall be the average of the 2 test marks conducted.

7. Learning Objectives

S/L	Learning Objectives	Description
1	**Understand the concepts of research methodology**	Research methodology refers to the systematic approach used to conduct research and gather information. It involves selecting the right methods, tools, and techniques to investigate a research question or hypothesis. This process includes defining the problem, choosing a research design (like surveys, experiments, or case studies), collecting data, analyzing it, and drawing conclusions. The goal is to ensure that the research is valid, reliable, and can be replicated by others.
2	**Qualitative and quantitative data analysis and presentation.**	Qualitative analysis involves examining non-numerical data, like interviews or observations, to identify patterns, themes, and insights. Quantitative analysis, on the other hand, focuses on numerical data, using statistical methods to identify trends, relationships, and differences. By mastering these analysis techniques, students will learn how to present their findings clearly and accurately, using graphs, charts, and reports, to support decision-making and research conclusions.
3	**Data collection methods and significant writing skills.**	Students will learn various data collection techniques, such as surveys, interviews, and observations, to ensure they can obtain the necessary data for their research. Additionally, they will develop strong writing skills to clearly and persuasively present their research results, ensuring that their work is well-organized, logical, and impactful. This combination of skills is essential for conducting rigorous research and effectively conveying the results.

8. Course Outcomes (COs) and Mapping with POs

Course Outcomes (COs)

COs	Description
M23MCA401.1	Explain the different concepts of research methodology and Define research problems.
M23MCA401. 2	Exploring the different sampling techniques
M23MCA401. 3	Analyze and the development of different data collection techniques and designing of reports.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA401.1	3	-	-	-	-	-	-	-
M23MCA401. 2	-	3	-	-	-	-	-	-
M23MCA401. 3	-	-	3	-	-	-	-	-
M23MCA401	3	3	3	-	-	-	-	-

9. **Assessment Plan**

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	Total
Module 1	6	4	5	15
Module 2	6	5	4	15
Module 3	8	6	6	20
Total	20	15	15	50

Semester End Examination (SEE)

	CO1	CO2	CO3	Total
Module 1	12	8	10	30
Module 2	12	10	8	30
Module 3	16	12	12	40
Total	40	30	30	100

10. **Future with this Subject**

❖ **Increased Use of Technology and Automation**: The integration of advanced technologies like artificial intelligence (AI) and machine learning will automate data collection, analysis, and interpretation, making research more efficient and reducing human error.

❖ **Emphasis on Interdisciplinary Approaches**: As complex global challenges require diverse perspectives, research methodology will increasingly incorporate interdisciplinary approaches, combining methods from different fields to address multifaceted problems.

❖ **Focus on Data Ethics and Privacy**: With the growing availability of big data, there will be a stronger emphasis on ethical considerations, ensuring that data is collected, analyzed, and stored responsibly while protecting individuals' privacy.

❖ **Adoption of Mixed-Methods Research**: The future will see a greater adoption of mixed-methods research, which combines qualitative and quantitative approaches, allowing researchers to gain a more comprehensive understanding of their subjects.

4th Semester	SEMINAR (SR) TECHNICAL SEMINAR	M23MCA402

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Research and Information Gathering	Familiarity with academic research and access to digital libraries or databases.
2	Content Organization and Report Writing	Basic knowledge of report writing, including the use of Microsoft Word, equation editors, and drawing tools.
3	Technical Presentation Skills	Experience with PowerPoint or other presentation software, as well as fundamental public speaking skills.
4	Critical Thinking and Discussion	Experience in group discussions and the ability to analyze and critique technical content.
5	Originality and Integrity in Work	Understanding the importance of originality in academic work.

2. Competencies

S/L	Competency	KSA Description
1	Effective Research and Literature Review	**Knowledge:** • Familiarity with technical literature, research databases, and citation practices. **Skill:** • Ability to conduct a thorough literature review and identify key sources of information. **Attitude:** • Curiosity and a proactive approach to learning.
2	Report Writing and Documentation	**Knowledge:** • Understanding of technical writing formats, structure, and referencing. **Skill:** • Proficiency in using word processors, equation editors, and drawing tools to create clear and concise reports. **Attitude:** • Attention to detail and commitment to producing high-quality, original work.
3	Presentation and Communication	**Knowledge:** • Understanding of effective communication techniques and presentation design. **Skill:** • Ability to deliver clear, engaging presentations using visual aids. **Attitude:** • Confidence and professionalism in public speaking.
4	Critical Engagement and Discussion	**Knowledge:** • Familiarity with group discussion dynamics and debate techniques. **Skill:** • Ability to engage with peers, ask relevant questions, and respond thoughtfully to feedback. **Attitude:** • Openness to different viewpoints and willingness to engage in constructive criticism.
5	Ethical Standards and Academic	**Knowledge:** • Understanding of the principles of academic honesty and the

	Integrity	consequences of plagiarism.
		Skill:
		• Ability to produce original work and properly cite all sources.
		Attitude:
		• Integrity and responsibility in academic work.

3. Timeline

S/L	Timeline	Description
1	**Week 1-2:** Topic Selection and Literature Review	Students will select a seminar topic relevant to their specialization and conduct a literature review to gather information.
2	**Week 3-4:** Content Organization and Report Drafting	Organize the gathered information into a coherent structure and begin drafting the seminar report.
3	**Week 5:** Report Writing and Formatting	Focus on refining the report, ensuring proper formatting, citation, and use of tools like equation editors and drawing tools.
4	**Week 6:** Presentation Preparation	Prepare the PowerPoint slides and practice the oral presentation, focusing on clarity and engagement.
5	**Week 7:** Seminar Presentation and Discussion	Deliver the seminar presentation, engage in a Q&A session, and participate in group discussions.
6	**Week 8:** Report Submission and Final Evaluation	Submit the final report and undergo a comprehensive evaluation by the faculty committee.

4. Course objectives & Learning Objective

Course Code	**M23MCA402**	CIE Marks	**50**
Number of Lecture Hours/Week(L: T: P: S)	**(0:0:0:2)**	SEE Marks	**-**
Total Number of Lecture Hours	**2 hours / Week**	Total Marks	**50**
Credits	**1**	Exam Hours	**03**

Course objectives:

• Encouraging advanced technical study.

• Preparing and presenting technical reports.

• Improving technical skills.

• Developing presentation skills.

S/L	Learning Objectives	Description
1	**Conduct In-Depth Research on a Technical Topic**	Students will learn to independently research a technical topic, gather and analyse information, and synthesize it into a coherent understanding.
2	**Develop and Deliver a Technical Presentation**	Students will gain experience in creating and delivering professional technical presentation, enhancing their communication skills.
3	**Engage in Technical Discussions and Debates**	Students will enhance their critical thinking and discussion skills by engaging with peers in technical debates.
4	**Prepare a Detailed Technical Report**	Students will learn to write a detailed, well-organized technical report, ensuring proper citation and originality.

5. Technical Seminar Guidelines

Technical Seminar is one of the heads of passing.

1. Select a broad area of your interest (E.g. Computer Networks, Machine Learning/Data mining,

Databases, etc.)

2. Select a specific area in the broad area chosen. (E.g. In Data mining, one can choose cluster analysis or Classification or Association rule mining). Subsequently you can choose a more narrowed topic like Density based clustering or Grid based clustering, etc.

3. Further search at least 10 recent papers (e.g. last 2-5 years) related to your specific topic in IEEE explore or Science direct or ACM digital library, etc.. From these papers, select best 5 papers, preferably Journal papers or reputed conferences. (E.g. Machine Learning Journals: IEEE PAMI, Knowledge and Data Engg.,Elsevier – Pattern recognition, Pattern Recognition Letters, Data and Knowledge engineering, Springer- Pattern Analysis and Applications, Data mining and Knowledge discovery, Reputed conferences .

4. Read these 5 papers thoroughly. For each paper: Write down a summary based on their contributions (ideas), Improvements claimed, Parameters used for comparison, Experiments carried out, Tools used, Limitations, YOUR IDEAS for improving the work proposed, etc.

   Write a report in the following format:
   ➢ Title, Abstract, keywords,
   ➢ Introduction,
   ➢ Review of the literature (related to 5 papers chosen),
   ➢ Comparison of the methods (5 papers) w.r.t the parameters identified e.g. classification rate, time complexity, F1 score, etc.)
   ➢ Conclusion
   ➢ References,

6. Rubrics for technical seminar evaluation

S/L	Course Outcomes	Rubric	Excellent	Good	Average	Partially Acceptable	Unacceptable
		Percentage Weight age	81-100%	61-80%	41-60%	21-40%	0-20%
1	CO1	Correctness of Topic and Comprehension/ Usage of Presentation Tools / Technical Reporting	It includes all of the following; Selected topic is relevant to cutting edge technology/ ethical/ environmental/social context. The report is free from formatting errors. Wholesome information in logical sequence.	It includes most of the following: Select topic is relevant to cutting edge technology /ethical /social context. The report is free from formatting errors. Wholesome information in logical sequence.	It includes some of the following Selected topic is Relevant to cutting Edge technology /ethical/ Environmental/ social context. Speaker's voice is clear and audible / PPT is well organized. The report is free from formatting errors. Wholesome information in logical sequence.	It includes very few of the following Selected topic is relevant to cutting edge technology /ethical/ environmental /social context. Speaker's voice is clear and audible /PPT is well organized. The report is free from formatting errors. Wholesome information in logical sequence.	It includes none of the following Selected topic is relevant to cutting edge technology /ethical/ environmental /social context. Speaker's voice is clear and audible /PPT is well organized. The report is free from formatting errors. Wholesome information in logical sequence.

			It includes all of the following	It includes most of the following	It includes some of the following	It includes very few of the following	It includes none of the following
2	CO2	**Comprehension of the Technological concepts/ethical/environmental and social**	Student is able to express the understanding of technological concepts concern to ethical, environment social contents to uplift the professional potential	Student is able to express the understanding of technological concepts with concern to ethical environmental and social contents to uplift the professional Potential.	Student is able to express the understanding of technological concepts with concern to ethical environmental and social contents uplift the professional Potential.	Student is able to express the understanding of technological concepts with concern to ethical environmental and social contents uplift the professional Potential.	Student is able to express the understanding of technological concepts with concern to ethical environmental and social contents uplift the professional Potential.

			It includes all of the following.	It includes most of the following.	It includes some of the following.	It includes very few of the following.	It includes none of the following.
3	CO3	**Time Management/ Answering Queries**	Student is able to answer any queries raised by the evaluator / proper body language/speaker maintains eye contact with Audience with Confidence. Ensures effective Utilization of allotted time.	Student is able to answer any queries raised by the evaluator / proper body language/ contact with Audience with Confidence. Ensures effective Utilization of allotted time.	Student is able to answer any queries raised by the evaluator / speaker maintains eye contact audience Confidence. Ensures effective Utilization of allotted time.	Student is able to answer any queries raised by the evaluator / speaker maintains eye contact audience Confidence. Ensures effective Utilization of allotted time.	Student is able to answer any queries raised by the evaluator / proper body language/speaker with audience with Confidence. Ensures effective utilization Allotted time.

7. Course Outcomes (COs) and Mapping with POs

Course Outcomes (COs)

COs	Description
M23MCA402.1	Understand current trends in specific area of interest
M23MCA402. 2	Perform literature survey related to the specific topics of interest
M23MCA402. 3	Appreciate the results of technical work
M23MCA402. 4	Summarize and present the technical contents

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA402.1	3	-	-	-	-	-	-	-
M23MCA402. 2	-	3	-	-	-	-	-	-
M23MCA403. 3	-	-	-	3	-	-	-	-
M23MCA403. 4				-	-	-	-	3

M23MCA403	3	3	-	3	-	-	-	3

- ➢ The CIE marks awarded for Seminar shall be based on the evaluation of the technical seminar Report, Presentation skill, and Viva-voce (Question & Answer session) in the ratio of 50:25:25.
- ➢ Panel of three members will evaluate the presentation of the seminar as per the rubrics.

4th Semester	PROJECT WORK (PR)	M23MCA403

1. Prerequisites

S/L	Proficiency	Prerequisites
1	Project Planning and Management	Basic understanding of project management principles, acquired from earlier project work and theoretical courses.
2	Experimental Design and Analysis	Knowledge of experimental techniques and data analysis from core and elective courses.
3	Technical Documentation	Competence in technical writing and report drafting.
4	Application of Theoretical Knowledge	Strong foundation in the relevant engineering principles.
5	Team Collaboration	Experience in group projects and collaborative learning environments.

2. Competencies

S/L	Competency	KSA Description
1	Project Execution	**Knowledge:** • Understanding of project planning, scheduling, and resource management. **Skill:** • Ability to carry out practical work systematically and efficiently. **Attitude:** • Proactive and solution-oriented approach to problem-solving.
2	Data Analysis	**Knowledge:** • Advanced knowledge of data analysis techniques. **Skill:** • Proficiency in interpreting and analyzing experimental data. **Attitude:** • Analytical mindset with a focus on accuracy.
3	Technical Communication	**Knowledge:** • Mastery of technical documentation standards. **Skill:** • Ability to draft comprehensive project reports. **Attitude:** • Precision and clarity in communication.
4	Presentation Skills	**Knowledge:** • Understanding of audience engagement techniques. **Skill:** • Ability to deliver clear and impactful presentations. **Attitude:** • Confidence and professionalism in public speaking.
5	Collaboration	**Knowledge:** • Awareness of effective teamwork strategies. **Skill:** • Ability to work collaboratively in multidisciplinary teams. **Attitude:** • Respect and openness to diverse perspectives.

3. Project Timeline

S/L	Timeline	Description
1	Week 1-2	Review of problem statement and project plan; setting milestones.
2	Week 3-4	Experimental setup and initial trials.

3	Week 5-6	Data collection and analysis; troubleshooting.
4	Week 7-8	Progress review and mid-term evaluation.
5	Week 9-10	Refinement of experiments and final data analysis.
6	Week 11-12	Drafting the final report.
7	Week 13-14	Presentation preparation and practice.
8	Week 15	Final project presentation and submission of the report.

4. Course objectives and Guidelines

Course Code	M23MCA403	CIE Marks	100
Number of Lecture Hours/Week(L: T: P: S)	(0:0:15:0)	SEE Marks	200
Total Number of Lecture Hours	5 hours / Week	Total Marks	300
Credits	15	Exam Hours	03

Course objectives: This course will enable students to:
- To provide students for 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.
- To Design and development of web based and research oriented projects on software systems

Guidelines:

a. Introduction

Department of Computer Applications aims to impart value based technical education with right blend of computation skills, analyzing, designing and managing projects. The Project work constitutes a major component in most of the professional programmers. The project work not only aims at the partial fulfillment of the MCA requirements, but also provides a mechanism to demonstrate the student's skills, abilities and specialization of interest.

As the program covers a wide range of theoretical and practical subjects related to computer applications, it is an opportunity for a student to showcase the combined practical implementation of all the courses covered in the earlier 3 semesters effectively and efficiently. The project work should compulsorily include the software development life cycle, documentation and demonstration of the same within the stipulated period of 16weeks.

b. Aim

The main aim of the project is to make students aware of the process of project implementation using their domain knowledge and to provide computer based solutions/applications for the industry, academic & research oriented real time problems.

c. Objective

The objective of the project is in such way that it helps the student in developing the ability to apply theoretical knowledge and practical tools/techniques.

d. Outcome

At the end of implementation of project, student is capable of,
- Understanding and applying Systems Development Life Cycle (SDLC).
- Identifying systems requirements.
- Applying different data gathering and analyzing techniques.
- Performing and evaluating feasibility studies like cost-benefit analysis, technical feasibility, time feasibility and operational feasibility for the project.
- Designing and developing of system architectures and data flow diagrams.
- Evaluating methods of process description to include structured, decision tables and decision trees.
- Creating and evaluating such alternative graphical tools as systems flow charts andstate transition diagrams.
- Decide the software requirement specifications and hardware requirement specifications.

> ➢ Plan the systems design phase of the SDLC.
> ➢ Distinguish between logical and physical design requirements.
> ➢ Designing and evaluating system inputs and outputs.
> ➢ Estimate storage requirements.
> ➢ Explain the various file update processes based on the standard file organizations.
> ➢ Construct and evaluate Entity-Relationship (ER) diagrams for RDBMS related projects.
> ➢ Perform normalization for the un-normalized tables for RDBMS related projects.

e. **Project Selection Process**

Students can implement projects in two streams

Application Stream

These projects aim at developing an application for attaining a specific or group of tasks in respective domains. The student has to understand the applicability of the project thoroughly and should develop application based on the required features and functionalities. The following are some important application domains. These projects could be done in college or industry. Student can take up any one the following application domains, but not limited to these:

> ➢ Database, Data mining and Data warehousing applications
> ➢ Networking applications [Mobile, SAN, Security, MANet etc…]
> ➢ Business / Enterprise applications [Supply Chain, ERP, CRM etc…]
> ➢ Web based applications
> ➢ Multimedia applications
> ➢ Software Engineering applications
> ➢ Grid and Cloud computing applications
> ➢ Parallel and distributed computing applications
> ➢ E-learning and e-commerce applications
> ➢ Gaming applications
> ➢ Hardware driver applications
> ➢ Mobile applications
> ➢ Healthcare applications
> ➢ Banking and Finance applications
> ➢ Insurance applications

Research Stream

The problem formulation should made it clear to everyone, students should aim to address whom and where it is relevant. Chosen areas can be any of the following or any area of research.

1. Public health, Epidemiology & Health Services
2. Bio medical.
3. Clinical sciences and health practice.
4. Neurosciences & Behavioral sciences.
5. Cloud services
6. Big data
7. Data science
8. Image processing
9. Internet(IOT)
10. Agricultural Services Technology
11. Environment Protection Technology
12. Any engineering topics where software plays vital role.

One of the most important early step in a research projects is the literature survey. A literature survey is done to identify related research done already and to set the

current research work within a conceptual and theoretical context.

Problem Formulation

Students should follow the following steps (Respective guides to encourage students to follow these steps while formulating the problem for the project).

➢ Tailoring the idea to the targeted topic of the work programme.
➢ Describe the objectives and applications of the project – setting the specific objectives of the topic.
➢ Set up the project implementation phases and structure of the project – what activities youneed to achieve the objectives and what expertise/knowledge is needed.
➢ Describe the end results (project outputs) and the impact of the project outcome.
➢ Highlight the added value, the innovative element of your project.
➢ Chosen project concept should address the main questions: WHY? WHAT? HOW? WHO?
➢ WHERE?

• Statement of Problem : the "Why"

Summary of the original problem statement

Background: Brief description of company and their business relevance or importance of problem. Background information to educate the reader previous related work by others—literature review with credible sources patent search on related problem.

• Objectives: the "What?"

In the Objectives section, student should translate the customer's quantitative and qualitative needs into clear, objective design specifications. Define the scope of workand clearly state the project objectives.

• Technical Approach: the "How?"

Although you may not know all the details of the problem solution, you should know a first design on how you will solve the problem, and you should have some design concepts.

• Intended users: Who?

This should address who is the user of the system/beneficiary of the work.

• Environment: Where?

This should address area of domain, your application or work will be useful.

Evaluation Process

The project duration is 16 weeks; 14 weeks for development and 2 weeks for preparation of the project report. Student's needs to maintain the project dairy, consult their internal guide and update the status of the work and get it reviewed every week. Students are be required to provide their project implementation details, methodology and results to the department. Otherwise students will forfeit the claim for having done the project work.

Evaluation process has following steps.

1) **Project Screening and Finalization**

Student activity: Submission synopsis and finalization.

2) **Evaluation of system study and analysis**

Student activity: Submission of system requirement specification

3) **Evaluation of project design**

Student activity: Submission of design document

4) **Evaluation of coding, testing and implementation.**

Student activity: Submission of draft final project report

5) **Final report submission.**

Project screening

Student projects will be screened based on following points

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a) Relevance to current technology
b) Gauging whether project work involves 16 week man hours of work.
c) Place of execution: Industry/Research organization/College
d) Project relevance to Computer Science and Applications
e) Understanding of the project work y the student Format of the Synopsis can be referred in **Annexure-I**

Finalization of Synopsis

a) Finalization of Synopsis is done based on the previous stage of evaluation
b) Based on recommendation of the panel comprising of all the staff members of the department.
c) Verifying whether suggestions of the previous evaluation incorporated or not. Format of the synopsis can be referred in **Annexure-I**

Evaluation of system study and requirement analysis

Evaluation criteria in this step as follows.
a) Whether student understood the problem in depth.
b) Whether scope and objective of the project defined properly.
c) Whether student studied and understands the system thoroughly/completely.
d) Whether functional requirements and non-functional

requirements defined properly. SRS document can be referred in

Annexure-II

Evaluation of project design

In this level evaluated for
a) Architectural Design
b) Detailed Design
c) Database Design
d) External Interface Design
e) Algorithm Design

Design document format as per in **Annexure-III**

Evaluation of coding, testing and implementation

Evaluation of coding, testing and implementation criteria as follows.
a) Pseudo code
b) Test case generation
c) Actual Testing
d) User manual
e) Implementation strategy
f) Draft report submission
g) Checking whether the implementation has meet requirements specified in SRS document or not.
h) Demo of the final working model of the system.

Final report format should be followed according **Annexure-VI**

Annexure I: Format of the Format of the Synopsis Application stream

➢ Title of the Project.
➢ Problem statement.
➢ Objective.
➢ Scope of the project.
➢ Brief description.
➢ Project Category (RDBMS/OOPS/Networking/E-learning. Etc.).
➢ Software requirements.

> ➢ Hardware requirements

Research stream

> ➢ Title of the Project.
> ➢ Problem statement.
> ➢ Objective of the project.
> ➢ Related work done(list of literature)
> ➢ Brief description of proposed work.
> ➢ Software requirements.

Note: Students doing internship program outside the college need to submit the following details.

- ✓ Name and address of the company
- ✓ External guide name and designation
- ✓ Email and contact number of the external guide.

Annexure II: Format of the SRS document
Application stream
- ❖ Introduction:
  - Scope of SRS document
  - Definitions, acronyms and abbreviations
    - Definitions, acronyms and abbreviations used.
  - References.
  - Overview.
- ❖ Overall description:
  - Product perspective
    - About your project work.
  - Product functions
  - User characteristics
    - Characteristics of the intended user.
  - General constraints
  - Assumptions and Dependencies
- ❖ Specific requirements:
  - External Requirements
    - (User Interface/Hardware/Software)
  - Functional Requirements
  - Non-functional requirements
  - Other requirements.
- ❖ Architectural overview
- ❖ Data flow diagrams
- ❖ Design constraints

Research stream

- ❖ Introduction.
- ❖ Detailed literature review of related work.
- ❖ Detailed analysis of the proposal work
- ❖ Conclusion.

Annexure III: Format of Design
Document Application-stream
- ❖ Introduction

- o Scope of the design document
- o Definitions, acronyms and abbreviations references
- o References
- o Overview
- ❖ System architecture
  - o Architectural design
  - o User interface design
  - o Forms design
  - o Database or file design
  - o Reports design
  - o Workflows and algorithms design
  - o Detailed design of DFDs.
  - o Activity diagrams
  - o Use case diagrams
  - o Sequence diagrams
- ❖ Component interfaces
  - o Component design description
  - o Software requirements mapping Critical requirements

Research stream

- ❖ Introduction
- ❖ Algorithms/logic used in the related work.
- ❖ Algorithms/logic steps involved in the proposed method.
- ❖ Conclusion

Annexure IV: Coding detail
Application and Research
stream:

- ❖ Introduction coding convention.
- ❖ Pseudo code of the important algorithms of the project.

Annexure V: Testing report
Application and Research
stream:

- ❖ Introduction
- ❖ Test process done for the project.
- ❖ Test cases.

Test case no	Positive scenario	Required input	Expected output	Actual output	Test pass/fail

Test case no	Negative scenario	Required input	Expected output	Actual output	Test pass/fail

Annexure VI: Report Format

- ✓ TITLE PAGE

- ✓ CERTFICATE by the Department
- ✓ CERTIFICATE by the EXTERNAL ORGANIZATIONDECLARATION
- ✓ ACKNOWLEDGEMENTSABSTRACT
- ✓ CONTENT PAGE LIST OF FIGURESLIST OF TABLES CHAPTER 1:
- ✓ Introduction to the Topic of the Project Problem definition and Premises Objectives of the Study / Project Methodology

Organization of the Dissertation

CHAPTER 1:
  History of the Organization (If carried out in an organization)
CHAPTER 2:
   Justification for doing this project
CHAPTER 3:
    Requirements analysis and specifications document. Refer Annexure II
CHAPTER 4:
    Design
    Document
    Refer
    Annexure III
CHAPTER 5:
    Coding
    Refer Annexure IV
CHAPTER 6:
    Testing
    Refer Annexure V
CHAPTER 7:
    Experimental
    results/findings. Conclusion
    Scope for future work (If
    any) Limitations of the
    study (If any)
    References [Papers, books, thesis web references (urls)] List of
    Publications (if any)
    Attach hard copy of the publication.
Note:

- ✓ Page numbers from "Abstract" to "List of Tables" to be given in Roman Numerals
- ✓ Page numbers to be given in numerals from Chapter 1 to Chapter 7.
- ✓ All pages should contain a footer indication the Department of Master of Computer Applications, MITM, Mandya and header indicated the title of the project and Month- Year of submission.

Font size should be:

- ✓ 16 bold for chapter no and chapter title.
- ✓ 14 bold times new roman for sub headings.
- ✓ 12 bold times new roman for sub-sub headings.
- ✓ 12 times new roman normal for running text.
- ✓ Table numbers, figure numbers and photograph numbers should be according to Chapter with appropriate title. Caption should contain figure no and title below the figure. Table no and title should be above the table.
- ✓ Spacing should be 1.5 between lines and 2.0 between paragraphs.
- ✓ Cross references should be clearly indicated and proper citation should be given wherever references have been made.

✓ Project report should be hard bound in Blue color to be submitted. Make 2 Copies. Submit one to Department and one to yourself.

Marks allotment in evaluation process according to rubrics

S/L	Course Out comes	Rubrics	Excellent	Good	Average	Partially Acceptable	Unacceptable
		Percentage weightage	81·100%	61·80%	41·60%	21·40%	0·20%
1	CO1	Domain Knowledge / Data Collection	It includes all of the following	It includes most of the following	It includes some of the following	It includes very few of the following	It includes none of the following
			Chooses appropriate engineering tools for data collection/ design fabrication work and it includes completion Literature summary, identification defines certain problem, arrive at Viable objectives, methodology, expected outcomes	Chooses appropriate engineering tools for data collection/ design fabrication work and it includes completion Literature summary, identification defines certain problem, arrive at Viable objectives, methodology, expected outcomes	Chooses appropriate engineering tools for data collection/ design fabrication work and it includes completion Literature summary, identification defines certain problem, arrive at Viable objectives, methodology, expected outcomes	Chooses appropriate engineering tools for data collection/ design fabrication work and it includes completion Literature summary, identification defines certain problem, arrive at Viable objectives, methodology, expected outcomes	Chooses appropriate engineering tools for data collection/ design fabrication work and it includes completion Literature summary, identification defines certain problem, arrive at Viable objectives, methodology, expected outcomes

CO2	Analyze appropriate tools/segregate work/Experimentation/program or algorithm	It includes all of the following	It includes most of the following	It includes some of the following	It includes very few of the following	It includes none of the following
		The student has to achieve objectives and contribute in an appropriate way to the project.	The student has to achieve objectives and contributed in an appropriate way to the project.	The student has to achieve objectives and contributed in an appropriate way to the project.	The student has to achieve objectives and contributed in an appropriate way to the project.	The student has to achieve objectives and contributed in an appropriate way to the project.

		Program/ experiment was developed to meet the objective by appropriate tools. Results are analyzed.	Program/ experiment was developed to meet the objective by appropriate tools. Results are analyzed.	Program/ experiment was developed to meet the objective by appropriate tools. Results are analyzed.	Program/ experiment was developed to meet the objective by appropriate tools. Results are analyzed.	Program/ experiment was developed to meet the objective by appropriate tools. Results are analyzed.
CO3	Critical thinking	**It includes all of the following.** Understanding defined problem and evaluate the complex Problems through critical thinking and decision making capabilities fulfillment objectives and also suggest new ideas.	**It includes most of the following** Understanding defined problem and evaluate the complex Problems through critical thinking and decision making capabilities fulfillment objectives and also suggest new ideas.	**It includes some of the following.** Understanding defined problem and evaluate the complex Problems through critical thinking and decision making capabilities fulfillment objectives and also suggest new ideas.	**It includes very few of the following** Understanding defined problem and evaluate the complex Problems through critical thinking and decision making capabilities fulfillment objectives and also suggest new ideas. .	**It includes none of the following.** Understanding defined problem and evaluate the complex Problems through critical thinking and decision making capabilities fulfillment objectives and also suggest new ideas.

First Evaluation:

Evaluation is conducted at the time of acceptance of the project i.e., during synopsis submission. Students need to prepare and present the selected project before the panel. Evaluation carries 20 marks. The main components to be evaluated are,

Sl. No	Evaluation of Synopsis	Panel Marks	Guide Marks
1	Role of Innovation / Creativity, Research Element, challenges in the Problem.	2	2
2	Literature survey / Existing system analysis.	2	2
3	Clarity about the problem	2	2
4	Attendance	2	2
5	Question and Answer	2	2

Note:

If total marks is less than 50% of the maximum mark, then after a week student need to re- present the project before the panel for reconsideration of the project or may propose a different project. After the panel clearance students can start the project.

Second Evaluation:

Evaluation is conducted after one month of submission of the synopsis. Students need to prepare and present on the methodology, analysis and possible outcome of the problem in front of the panel. Evaluation carries 20 marks. The main components to be evaluated are, understanding of the problem, system study and analysis done.

Sl.No	Evaluation of SRS	Panel Marks	Guide Marks

1	Analysis of the Problem and understanding	2	2
2	Specification of the requirements	2	2
3	Progress of the project	2	2
4	Attendance	2	2
5	Question and Answer	2	2

Third Evaluation:

Evaluation is conducted after one month of second evaluation. Students need to present the design concepts of the project in front of the panel. Evaluation carries 20 marks. The main components to be evaluated are,

Sl.No	Evaluation of SRS	Panel Marks	Guide Marks
1	Architectural Design	2	2
2	Detailed Design	2	2
3	Work implementation status	2	2
4	Attendance	2	2
5	Question and Answer	2	2

Final Evaluation:

Evaluation is conducted after one month of third evaluation to check coding, testing and implementation stages. Students need to prepare draft final report with demo of the project for the presentation.

Sl.No	Evaluation of SRS	Panel Marks	Guide Marks
1	Coding and implementation efficiency	4	4
2	Work completion	4	4
3	Testing efficiency	4	4
4	Attendance	4	4
5	Question and Answer	4	4

Overall marks distribution:

Total Internal Assessment Marks	Panel Member	Guide
100	50	50

Total Marks Distribution:

Project Work IA + Total Marks	Internal Assessment (Guide (50%) +Panel (50%)) (IA)	Report Evaluation (RE)		Report Evaluation	Viva Voce	Total Marks
		Internal (I)	External (E)	Average (Internal & External) (RE)	Combined (Internal and External) (VV)	RE + VV
300	50+50 =100	125	125	125	75	200

Credits distribution for the evaluation for major project:

Evaluation Steps	Credits
First evaluation	2
Second evaluation	2
Third evaluation	2
Final evaluation	2

Report Evaluation.{Average of internal and external examiners}	5
Viva Voice	2
Total	15

Course Outcomes (COs) and Mapping with POs

Course Outcomes (COs)

COs	Description
M23MCA403.1	Apply the knowledge acquired within and beyond the curriculum
M23MCA403. 2	Formulate and investigate a problem which is of current trend
M23MCA403. 3	Apply software engineering methodologies and implementation of problems in real world

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA403.1	3	-	-	-	-	-	-	-
M23MCA403. 2	-	3	-	-	-	-	-	-
M23MCA403. 3	-	-	3	-	-	-	-	-
M23MCA403	3	3	3	-	-	-	-	-

Future with the subject

- ❖ **Artificial Intelligence and Machine Learning:** Developing AI models, creating ML algorithms, working on natural language processing tasks, or applying AI in real-world scenarios like healthcare, finance, or autonomous systems.
- ❖ **Data Science and Big Data Analytics:** Analyzing large datasets, creating predictive models, working with data visualization tools, or exploring big data technologies like Hadoop or Spark.
- ❖ **Sustainable Development and Environmental Engineering:** Working on renewable energy systems, waste management solutions, water conservation techniques, or sustainable urban planning.
- ❖ **Cyber security and Information Assurance:** Developing encryption techniques, securing networks, ethical hacking, or creating frameworks for data protection and privacy.
- ❖ **Robotics and Automation:** Building autonomous robots, designing automation systems for manufacturing, or integrating IoT devices for smart environments.

4th Semester	ABILITY ENHANCEMENT COURSE(AE) ONLINE MOOC COURSE	M23MCA404

On-Line Courses
BOS Recommended Online MOOC course Guidelines

These mandatory online courses are ability enhancement courses or skill development courses or emerging technology courses or bridge courses or advanced learning courses. These courses are suggested by the concerned board of studies. These courses are notified on the Institute portal. These courses are designed to help students enhance their skills in communication, language, and personality development. These are the ONLINE courses; recommended course list session wise will be published in advance for the information of students. These courses are not counted for the vertical progression, however the students have to study and pass these courses before completion of the program. As ONLINE courses are available for the particular session, for failed student the particular course if it is not available in the next session, he/she shall be permitted to select the different course from ongoing session. Those, who do not take-up/complete shall be declared as fail degree will not be awarded to such students.

❖ A student shall exercise his /her option in respect of the course and register for the same before the beginning of the respective semester or during respective session.
❖ Students shall be allowed to finish the course whose content does not overlap more than 50% with any of the courses the student has taken towards their degree.
❖ A student has to register and complete the MOOC course individually.
❖ Students shall take up any online courses which is chosen from any platform like NPTEL, Swayam, onlinevtu, etc. in the areas Technical Writing, Aptitude skills, personality development, etc., or
any other course.
❖ The course duration must be of 2 Credits / Minimum 8 Weeks.
❖ This course does not have any CIE or SEE; however, student must produce the completion certificate for the course taken up in this semester / period.
❖ The result is declared either pass or fail, based on the completion of the course in the stipulated time.
❖ Award of Degree will be denied in case of not completing the course with certification, even if the student has completed all the courses of the Program.

Course Outcomes (COs) and Mapping with POs
Course Outcomes (COs)

COs	Description
M23MCA404.1	Work effectively to engage in a lifelong learning

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
M23MCA403.1	3	3	3	3	3	3	3	3
M23MCA403	3	3	3	3	3	3	3	3