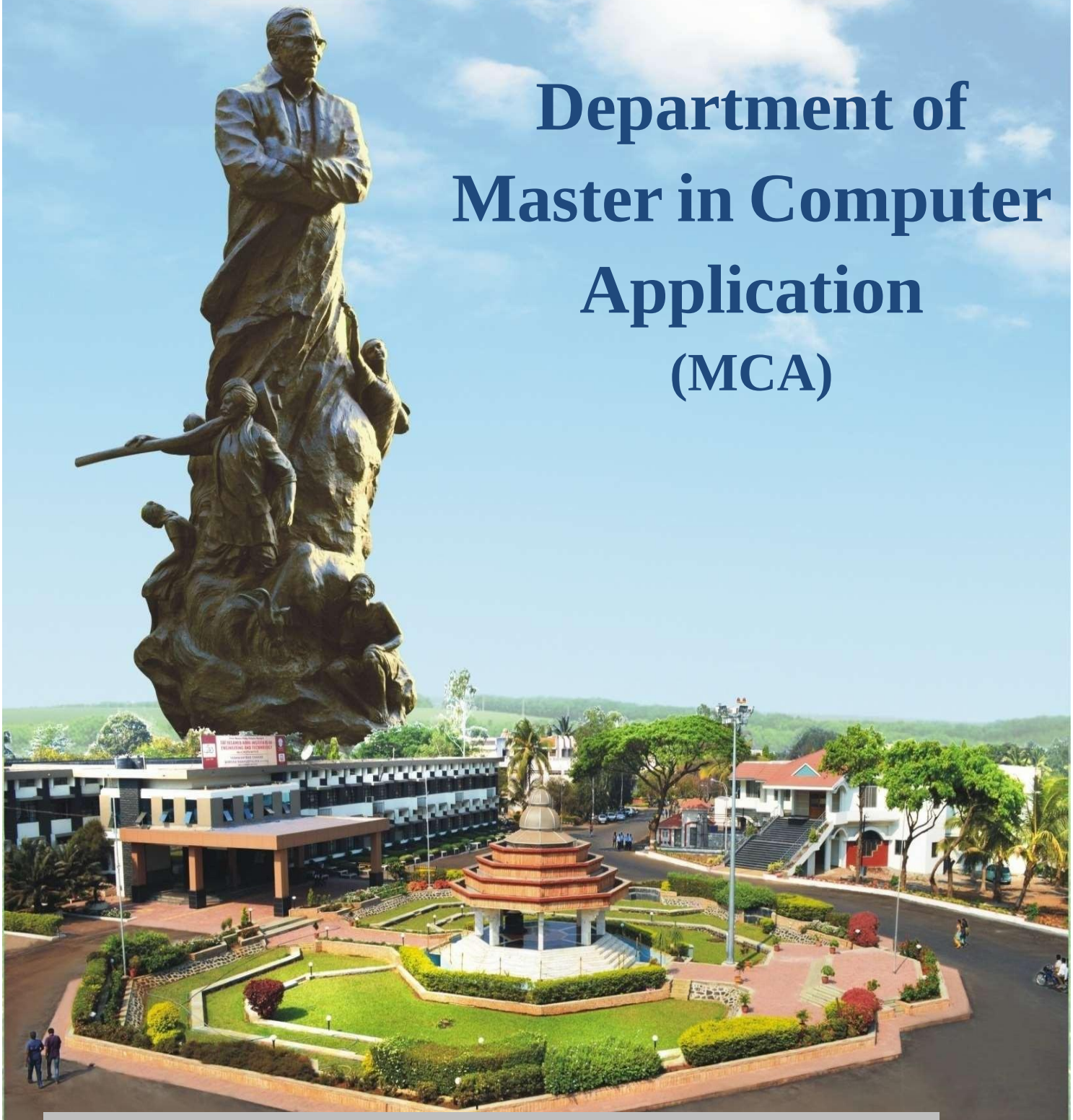
*An Autonomous Institute

Shree Warana Vibhag Shikshan Mandal's

Tatyasaheb Kore Institute of Engineering And Technology, Warananagar

Department of Master in Computer Application (MCA)



Master in Computer Application (MCA)

Syllabus Structure and Curriculum under Autonomy

SWVSM's

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

(An Autonomous Institute)

Department of Master in Computer Application (MCA)

Vision

To become a center of excellence in computer applications and develop competent IT professionals.

Mission

- To develop IT professionals with a high degree of expertise in computer applications, business, and information systems.
- To excel in academics and industry by addressing contemporary and real-world challenges in computer applications.
- To enhance graduate employability through work-based learning in social entrepreneurship
- To foster collaboration with industries and nationally recognized institutions.
- To create an environment that promotes lifelong learning and innovation in computer applications and related fields.

Program Educational Objectives (PEOs)

Graduates will be able to,

- Able to analyze, design, and develop computing applications using modern programming languages to solve real-world problems.
- Able to build a strong foundation for higher education and research, showcasing critical thinking and innovative problem-solving skills.
- Able to demonstrate effective communication, teamwork, and leadership in diverse professional settings while upholding ethical standards.
- Able to exhibit adaptability and a commitment to continuous learning in the evolving field of computer science.
- Able to engage in practices that enhance societal well-being and sustainability, recognizing the ethical implications of their work.

Program Specific Outcomes (PSOs)

Graduate will be able to

- Identify, design, and develop solutions for real-world problems by implementing various phases of the software development lifecycle.
- Analyze and apply computing solutions in societal and human contexts, understanding their impact on individuals and communities.
- Demonstrate knowledge and skills in contemporary issues and emerging technologies in the field of Computer Applications.

Quality Policy

- To promote excellence in academic and practical training by inspiring students to become skilled IT professionals who meet industry demands and contribute to societal development.

Program Outcomes (POs)

Upon completion of the MCA program, graduates will be able to:

- **PO1: Computational Knowledge:**

Apply knowledge of computing fundamentals, specialization, mathematics, and domain knowledge suitable for computing to abstract and conceptualize computing models from defined problems and requirements.

- **PO2: Problem Analysis:**

Identify, formulate, research literature, and solve complex computing problems, reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

- **PO3: Design/Development of Solutions:**

Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs, considering public health and safety, and cultural, societal, and environmental factors.

- **PO4: Conduct Investigations of Complex Computing Problems:**

Use research-based knowledge and research methods, including design of experiments, data analysis and interpretation, and synthesis of information, to provide valid conclusions.

- **PO5: Modern Tool Usage:**

Create, select, adapt, and apply appropriate techniques, resources, and modern computing tools to complex computing activities, understanding their limitations.

- **PO6: Professional Ethics:**

Understand and commit to professional ethics, cyber regulations, responsibilities, and norms in professional computing practice.

- **PO7: Life-long Learning:**

Recognize the need for and have the ability to engage in independent learning for continuous development as a computing professional.

- **PO8: Project Management and Finance:**

Demonstrate knowledge and understanding of computing and management principles and apply these to one's work as a team member or leader to manage projects in multidisciplinary environments.

- **PO9: Communication Efficacy:**

Communicate effectively with the computing community and society at large about complex computing activities, with skills to comprehend and write reports, design documentation, make presentations, and give and understand clear instructions.

- **PO10: Societal and Environmental Concern:**

Understand and assess societal, environmental, health, safety, legal, and cultural issues in local and global contexts, and the related responsibilities relevant to professional computing practice.

- **PO11: Individual and Team Work:**

Function effectively as an individual and as a member or leader in diverse teams and multidisciplinary environments.

- **PO12: Innovation and Entrepreneurship:**

Identify timely opportunities and use innovation to pursue them, creating value and wealth for the betterment of individuals and society at large.

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

An Autonomous Institute

Department of Master in Computer Application (MCA)

Abbreviations

Sr. No.	Acronym	Definition
1	ISE	In-Semester Examination
2	ISE-I	In-Semester Examination-I
3	ISE-II	In-Semester Examination-II
4	ESE	End-Semester Examination
5	ISA	In-Semester Assessment (Term Work)
6	L	Lecture
7	T	Tutorial
8	P	Practical
9	CH	Contact Hours
10	C	Credit

Course/ Subject Categories

Sr. No.	Acronym	Definition
1	BSC	Basic Science Course
2	HSC	Humanity Science Course
3	ESC	Engineering Science Course
4	PCC	Professional Core Course
5	OEC	Open Elective Course
6	MC	Mandatory Course
7	PEC	Professional Elective Course
8	PW	Project Work (Mini and Major Project)
9	II	Industrial Internship

Course/ Subject Code

2	4	P	G	M	C	A	P	C	C	1	0	X
Adm Year		PG Course		Master in Computer Application			Course Sub Category			Course ID		

Course Term work and POE Code

2	4	P	G	M	C	A	P	C	C	1	0	X	T / P / A
Adm Year		PG Course		Master in Computer Application			Course Sub Category			Course ID			T- Term work P- POE A- Audit Course

SWVSM's

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

An Autonomous Institute

Department of Master in Computer Application (MCA)

Semester-wise Credit Distribution

for

Master in Computer Application (MCA) Programme

Year	**First Year**		**Second Year**		**Total**
Semester	**I**	**II**	**III**	**IV**	
Credits	27	27	27	23	104

Second Year
Master in Computer Application
(MCA)
Semester - III
Detailed Syllabus

SWVSM's

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar (Autonomous)

Second Year Master in Computer Application (MCA)

Semester-III

(Implemented from 2025 - 26)

Curriculum Structure, Credit Scheme and Evaluation Scheme

Sr. No.	Category	Course Cat.	Course Code	Course Title	L	T	P	CH	C	Examination and Evaluation Scheme			
										Component	Marks	Minimum for Passing	
1	Programming Core Course	PCC	24PGMCAPCC301	Software Engineering	4	-	-	4	4	ISE	40	16	40
										ESE	60	24	
2		PCC	24PGMCAPCC302	Mobile Application Development	3	-	-	3	3	ISE	40	16	40
										ESE	60	24	
3		PCC	24PGMCAPCC303	Machine Learning	2	-	-	2	2	ISE	40	16	40
										ESE	60	24	
4		PCC	24PGMCAPCC304	Internet of Things	4	-	-	4	4	ISE	40	16	40
										ESE	60	24	
5	Program Elective	PEC	24PGMCAPEC3051 24PGMCAPEC3052 24PGMCAPEC3053	Program Elective - IV	3	-	-	3	3	ISE	40	16	40
										ESE	60	24	
6	Programming Core Course	PCC	24PGMCAPCC302P	Laboratory Course - Mobile Application Development	-	-	4	4	2	ISA	25	10	30
										POE	50	20	
7		PCC	24PGMCAPCC303P	Laboratory Course – Machine Learning	-	-	4	4	2	ISA	50	20	40
										POE	50	20	
8	Program Elective	PEC	24PGMCAPEC3051T 24PGMCAPEC3052T 24PGMCAPEC3053T	Program Elective - IV	-	1	-	-	1	ISA	25	10	10
9	Ability Enhancement Course	AEC	24PGMCAAEC306	Seminar	-	-	4	4	2	ISA	25	10	10
10	On Job Training / Field Project	OJT	24PGMCAOJT307	Major Project - I	-	-	8	8	4	ISA	25	10	30
										POE	50	20	
	Total				16	01	20	36	27	------	800	-------	

SWVSM's

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar (Autonomous)

Second Year Master in Computer Application (MCA)

Semester-III

List of Program Elective Course (PEC)

Sr. No.	Course Code	Program Elective-IV
01	24PGMCAPEC3051	Advanced Database
02	24PGMCAPEC3052	R Programming
03	24PGMCAPEC3053	Reinforcement Learning

Member Secretary Board of Studies | **Chairman Board of Studies** | **Academic Dean T.K.I.E.T, Warananagar** | **Principal T.K.I.E.T, Warananagar**

24PGMCAPCC301: Software Engineering

Lectures	**:**	4 Hrs./Week	**Evaluation Scheme**	
Credit	**:**	4	**ISE**	**:** 40 Marks
			ESE	**:** 60 Marks

Course Objectives: The objective of the course is to

1. To introduce the principles and methodologies of software engineering.
2. To provide knowledge of software development life cycle models and their applications.
3. To develop skills in software requirements analysis and design
4. To understand software testing strategies and quality assurance processes.
5. To expose students to software project management concepts and tools.

Course Outcomes:

COs	At the end of the successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Apply software development life cycle models to design software systems.	Apply
CO2	Analyze and document software requirements effectively.	Analyze
CO3	Design modular and structured software solutions using standard practices	Apply
CO4	Implement appropriate software testing techniques for quality assurance.	Apply
CO5	Manage software projects using estimation, scheduling, and risk management tools.	Apply

Description:

Software Engineering covers the principles and practices for designing, developing, testing, and managing high-quality software systems using structured engineering methods.

Prerequisites:	Programming fundamentals, Algorithms, DBMS.

Unit 1	**Introduction to Software Engineering**	
	Introduction to Software Engineering, Software Development Life Cycle (SDLC), Software Process Models: Waterfall, Incremental, Spiral, Agile, Characteristics of Good Software, Software Engineering Ethics,	**7 Hrs**

Unit 2	**Requirement Analysis**	
	Types of Requirements: Functional and Non-functional, Requirements Elicitation Techniques, Requirements Analysis, Software Requirements Specification (SRS), Validation and Verification of Requirements	**7 Hrs**
Unit 3	**Software Design**	
	Objectives of Input Design, Input Validations, Design of output:- Objectives of Output, Design Types Of Output, Coupling & Cohesion User Interface design: Elements of good design, design issues, features of modern GUI, error messages	**8 Hrs**
Unit 4	**Software Testing and Quality Assurance**	
	Basics of Software Testing, Levels of Testing: Unit, Integration, System, Acceptance, Testing Techniques: Black-box, White-box, Test Planning and Test Case Design, Software Quality Assurance (SQA) Software Metrics and Measurement, Introduction to Automation Testing	**8 Hrs**
Unit 5	**Software Maintenance and Evolution**	
	Introduction to Software Maintenance, Types of Maintenance: Corrective, Adaptive, Perfective, Preventive, Challenges in Software Maintenance, Impact Analysis and Change Management, Software Configuration Management in Maintenance.	**8 Hrs**
Unit 6	**Advanced Software Engineering Concepts**	
	Component-Based Software Engineering (CBSE), Service-Oriented Architecture (SOA), Software Reuse, Software Reliability and Fault Tolerance, Introduction to Cloud-based Software Engineering, DevOps and Continuous Integration/Continuous Deployment (CI/CD)	**8 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	-	2	3	2	-	-	-	-	-	-	-	-	2	2	-
CO3	-	3	2	2	3	-	-	-	-	-	-	-	-	3	2
CO4	2	1	2	-	-	-	-	2	-	-	-	-	2	-	2
CO5	2	3	3	2	2	1	-	3	-	-	-	-	3	2	3

References:

Text Books	
1	Software Engineering by R.S. Pressman, Tata McGraw-Hill

Reference Books	
1.	An Integrated Approach to Software Engineering by Pankaj Jalote, Tata McGraw-Hill

2.	Fundamentals of Software Engineering by Rajib Mall, PHI Learning
3.	Software Engineering by Martin Shooman, McGraw-Hill
4.	System Analysis and design and Introduction to Software Engineering by Parthsarathi, B.W. Khalkar, Everest Publishing House

24PGMCAPCC303: Machine Learning

Lectures	**: 3**	**Evaluation Scheme**	
Credit	**: 3**	**ISE**	**: 40**
		ESE	**: 60**

Course Objectives: The objective of the course is to

1. To introduce the fundamentals of Machine Learning
2. To Understand various Machine Learning Algorithms
3. To expose students to real world problems where machine learning can provide solutions

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Analyze and Implement Regression techniques	Analyze
CO2	Design and Implement solutions for Classification problem	Design
CO3	Understand and Apply Unsupervised learning algorithms	Understand
CO4	Develop efficient and reproducible R scripts, while engaging with the R community for ongoing learning and collaboration.	Evaluate

Description:

This course specifically make student able to learn algorithms used in machine learning techniques for solving real world problems and developing new applications based on Machine Learning

Prerequisites:	1	Basics of computer science including algorithms, data structure, Basic Linear algebra and Probability theory

Unit 1	**Introduction to Machine Learning**	
	Introduction to Machine Learning Process, Data Visualization: Line Chart, Bar Chart, Pie Chart, Histograms, Scatter Plots, Box Plots	**6 Hrs**
Unit 2	**Regression**	
	Simple Regression, Multiple Regression, Model assessment, Non-Parametric Regression: K-Nearest Neighbor Regression, Kernel Regression	**6 Hrs**
Unit 3	**Classification**	
	Linear Classifiers, Logistic regression, Decision Tress: Tree Terminology, Decision Tree Learning, Decision Boundaries.	**6 Hrs**
Unit 4	**Unsupervised Learning**	

	Difference between Supervised and Un Supervised Learning, Clustering, K Means Clustering: Problem with Random assignment of Cluster centroid, Finding value of K, Hierarchical Clustering: Distance Matrices, Linkage	**6 Hrs**
Unit 5	**Text Analysis**	
	Basic Text Processing with Python, Regular Expression, Natural Language Processing, Text Classification.	**6 Hrs**
Unit 6	**Neural Network and Recommendation System**	
	Vectorization, Neural Network: Gradient Descent, Activation function, Parameter Initialization, Optimizer, Loss Function. Recommendation System: Popularity based Recommender Engines, Content Based Recommendation Engine, and Classification Based Recommendation Engine.	**9 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	-	2	-	-	-	-	-	-	-	-	1			
CO2	2	3	2	1	1	-	-	-	-	-	-	-			
CO3	-	1	1	3	2	-	-	-	-	-	-	-			
CO4	-	-	-	2	3	2	-	-	-	-	-	-			

References:

Text Books	
1	Machine Learning with Python- An Approach to Applied ML, by Abhishek Vijayvargia, (First Ed.) BPB Publication
Reference Books	
1.	Machine Learning (McGraw-Hill International Editions Computer Science Series) by Tom M. Mitchell
2.	Machine Learning Using Python, Manaranjan Pradhan and U Dinesh Kumar.(First Edition: 2019) WILEY

24PGMCAPCC302: Mobile Application Development

Lectures	**:**	3 Hrs./Week	**Evaluation Scheme**
Credit	**:**	3	**ISE** **:** 40 Marks
			ESE **:** 60 Marks

Course Objectives: The objective of the course is to

1. To understand Mobile Development Platforms and Architecture.
2. To develop Proficiency in Mobile Programming Languages and Tools
3. To design and Build User-Centric Mobile Applications
4. To implement Backend Integration and Data Handling.
5. To apply Testing, Deployment, and Maintenance Techniques.

Course Outcomes:

COs	At the end of the successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand fundamentals of Android Application Development Environment	Understand
CO2	Identify various components of Android Framework for developing mobile Applications.	Analyze
CO3	Apply Android Application Framework for developing mobile Applications.	Apply
CO4	Integrate mobile applications with backend services using web APIs, databases, and cloud platforms	Apply
CO5	Analyze different security threats for android mobile applications.	Analyze

Description:

This course introduces the fundamentals of mobile application development, focusing on design, coding, and deployment across popular platforms like Android.

Prerequisites:	Basic programming knowledge, database fundamentals, Web technologies.

Unit 1	**Introduction to Mobile Operating Systems & Android Overview**	
	Introduction to Mobile Operating Systems, Overview of Android OS: Versions, Features, and Evolution, Characteristics of Mobile Applications, Comparison between Android, Windows, and iOS, Android System Architecture: Overview, Introduction to SDK and Android Development Tools (ADT)	**7 Hrs**

Unit 2	**Android Development Environment & Components**

	Setting up Android Studio, AVD, and Emulator, Dalvik Virtual Machine and Android Runtime (ART), Android Project Structure and Directory Layout, Basic Android App Structure and Lifecycle, Creating and Running a Simple Android App.	**7 Hrs**
Unit 3	**User Interface Design in Android**	
	UI Components: TextView, EditText, Buttons, CheckBox, RadioGroup, Spinner. Pickers: DatePicker, TimePicker. Layout Managers: LinearLayout, RelativeLayout, TableLayout, GridLayout. Views: ScrollView, WebView, GridView	
Unit 4	**Menus, Activities, and Intents**	
	Android Menus: Options Menu, Context Menu, Popup Menu. Activity Lifecycle: Methods and Examples. Intent Fundamentals: Explicit Intents, Implicit Intents. Passing Data Between Activities. Launching Activities using Intents	**8 Hrs**
Unit 5	**Data Storage and Device Features**	
	SQLite Database in Android: Creation, CRUD Operations, Managing Database Connections. Introduction to Shared Preferences and File Storage. Telephony API: Accessing Call State, Sending SMS, Making Calls. Sending Emails through Android Apps.	**8 Hrs**
Unit 6	**Location-Based Services and Android Security**	
	Location API: Basics and Implementation. Working with Google Maps API in Android. Mobile Application Security: Client-side & Server-side Vulnerabilities, Common Mobile App Threats and Risks. Android Security Mechanisms: System-level and Application-level Security, Security Best Practices and Tools for App Security Scans.	**8 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	-	2	2	3	-	-	-	-	-	-	-	-	2	-	-
CO2	2	2	3	2	2	-	-	-	-	-	-	-	2	2	-
CO3	-	2	3	2	2	-	-	-	-	-	-	-	-	3	3
CO4	1	2	3	3	2	-	-	-	-	-	-	-	2	-	2
CO5	2	2	2	3	2	-	-	-	-	-	-	-	2	2	3

References:

Text Books	
1	Android Application Development – BlackBook Pradip Kotari, Dreamtech

Reference Books

1.	Android, P.K. Dixit, Vikas Publication
2.	Composing Mobile Apps Learn, Explorer, Apply using Android Anubhav Pradhan, Anil Deshpande, Wiley.
3.	Android Wireless Application Development By Lauren Darcey and Shane Conder, Pearson Education, 2 nd Edition
4.	Unlocking Android Developer's Guide By Frank Ableson and Charlie Collins and RobiSen, Manning Publication Co.
5.	Android Security Internals: An In-Depth Guide to Android's Security Architecture 1st Edition, ElenkovNikolay, No Starch Press.

24PGMCAPCC304: Internet of Things

Lectures	**:** 4 Hrs./Week	**Evaluation Scheme**	
Credit	**:** 4	**ISE**	**:** 40 Marks
		ESE	**:** 60 Marks

Course Objectives: The objective of the course is to

1. Understand the architecture and key components of IoT systems.
2. Learn the protocols and communication models used in IoT.
3. Explore platforms and tools used to develop IoT applications.
4. Analyze security, privacy, and ethical aspects of IoT.
5. Understand real-world IoT applications in various domains.

Course Outcomes:

COs	**At the end of the successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Explain the architecture, design principles, and components of IoT systems.	Understand
CO2	Analyze IoT protocols and communication models.	Analyze
CO3	Apply development tools and platforms for IoT-based solutions.	Apply
CO4	Evaluate the security and privacy aspects in IoT systems.	Evaluate
CO5	Critically analyze real-world IoT applications and propose domain-specific solutions.	Analyze/Evaluate

Description:

This course provides a comprehensive overview of the Internet of Things (IoT), covering its architecture, protocols, platforms, security concerns, and real-world applications across various domains.

Prerequisites:	Computer Networks, Programming Fundamentals

Unit 1	**Introduction to IoT**	
	Definition, characteristics, IoT architecture, enabling technologies, IoT levels, deployment templates.	**7 Hrs**

Unit 2	**IoT Communication Models**	
	Communication models: device-to-device, device-to-cloud, cloud-to-cloud, and back-end data sharing.	**7 Hrs**
Unit 3	**IoT Protocols**	
	IoT protocols: MQTT, CoAP, HTTP, XMPP, DDS, AMQP, ZigBee, Bluetooth, LoRaWAN.	**8 Hrs**
Unit 4	**IoT Platforms & Tools**	
	Arduino, Raspberry Pi, NodeMCU; Cloud platforms: Google IoT Core, AWS IoT, ThingSpeak; IoT operating systems.	**8 Hrs**
Unit 5	**Security, Privacy, and Ethics**	
	IoT security threats and attacks, secure communication, access control, data encryption, privacy challenges, ethical implications.	**8 Hrs**
Unit 6	**Applications and Case Studies**	
	Smart Home, Smart City, Industrial IoT, Healthcare, Agriculture: challenges and future research directions.	**8 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-	2	2	-
CO3	-	2	3	3	3	-	-	-	-	-	-	-	-	3	2
CO4	2	-	-	3	-	2	2	-	-	-	-	-	2	-	2
CO5	2	2	3	3	2	1	-	1	1	-	-	-	3	2	3

References:

Text Books	
1	Arshdeep Bahga, Vijay Madisetti, *Internet of Things – A Hands-on Approach*, Universities Press

Reference Books	
1.	Rajkumar Buyya, Amir Vahid Dastjerdi, *Internet of Things: Principles and Paradigms*, Morgan Kaufmann.
2.	Cuno Pfister, *Getting Started with the Internet of Things*, O'Reilly Media, 2011.
3.	Adrian McEwen, Hakim Cassimally, *Designing the Internet of Things*, Wiley, 2014.
4.	Honbo Zhou, *The Internet of Things in the Cloud: A Middleware Perspective*, CRC Press, 2012
5.	Donald Norris, *The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi, and BeagleBone Black*, McGraw-Hill Education, 2015.

24PGMCAPEC3051: Advanced Database

Lectures	**:** 3 Hrs./Week	**Evaluation Scheme**	
Credit	**:** 3	**ISE**	**:** 40 Marks
		ESE	**:** 60 Marks

Course Objectives: The objective of the course is to

1. Provide an in-depth understanding of advanced database concepts, including query processing and optimization.
2. Familiarize students with distributed, object-oriented, and NoSQL databases.
3. Introduce database security, transaction management, and concurrency control mechanisms.
4. Develop skills for working with large-scale data and emerging database technologies.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Explain advanced query processing, optimization techniques, and indexing methods	Understand
CO2	Analyze transaction management, concurrency control, and recovery mechanisms	Analyze
CO3	Design and manage distributed databases with optimized query performance	Create
CO4	Apply object-oriented and object-relational concepts in database design	Apply
CO5	Compare and evaluate emerging database technologies such as NoSQL and NewSQL	Evaluate

Description:

This course covers the design and implementation of distributed and object-oriented databases and introduces emerging technologies like NoSQL, NewSQL, and big data systems.

Prerequisites:	Fundamental knowledge of RDBMS, SQL, and basic programming

Unit 1	**Query Processing and Optimization**	
	Overview, Steps, Parsing, Translation, Evaluation, Heuristics, Cost-Based Optimization, Indexes, Materialized Views, Caching	**10 Hrs**

Unit 2	**Transaction Management and Concurrency Control**	
	ACID, Transaction States, Schedules, Serializability, Recoverability, Locking, Timestamps, Deadlocks, Recovery.	**9 Hrs**
Unit 3	**Distributed Databases**	
	Architecture, Fragmentation, Replication, Allocation, Distributed Query Optimization, CAP, BASE, Transactions.	**8 Hrs**
Unit 4	**Object-Oriented and Object-Relational Databases**	
	Need, Classes, Inheritance, Encapsulation, OQL, Object-Relational Mapping (ORM), ORDBMS Features	**6 Hrs**
Unit 5	**Emerging Database Technologies**	
	NoSQL Databases (Key-Value, Column, Document, Graph), Big Data, Hadoop, NewSQL, Database as a Service (DBaaS)	**7 Hrs**
Unit 6	**Case Studies & Industry Applications**	**7 Hrs**
	Real-world case studies involving distributed, NoSQL, and cloud databases; Comparative analysis	

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	3	2	2	1	1	1	1	1	2	2	2	3	2	2
CO2	3	3	2	2	1	1	1	1	2	2	2	2	3	2	3
CO3	3	2	3	2	2	1	1	2	2	2	3	2	3	3	3
CO4	2	2	2	2	2	1	1	2	1	2	2	1	2	3	2
CO5	2	2	3	2	3	2	1	2	2	2	3	3	2	3	3

References:

Text Books	
1	Elmasri & Navathe – Fundamentals of Database Systems, Pearson
2	Silberschatz, Korth & Sudarshan – Database System Concepts, McGraw-Hill

Reference Books	
1.	C. J. Date – An Introduction to Database Systems, Addison-Wesley
2.	Rick Cattell – Object Data Management
3.	Pramod J. Sadalage & Martin Fowler – NoSQL Distilled, Addison-Wesley

24PGMCAPEC3052: R Programming

Lectures	**: 2**	**Evaluation Scheme**	
Credit	**: 2**	**ISE**	**: 40**
		ESE	**: 60**

Course Objectives: The objective of the course is to

1. To introduce participants to the R programming language and its environment.
2. To equip learners with the skills to manipulate data, perform statistical analyses, and create visualizations using R.
3. To provide insights into advanced data analysis techniques, including machine learning algorithms within the R ecosystem.
4. To foster the ability to tackle real-world data problems and derive actionable insights using R.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	**Understand and apply R programming fundamentals**, including data types, functions, and control structures.	Understand
CO2	**Perform data manipulation, analysis, and visualization** using key R packages such as dplyr, tidyr, and ggplot2.	Analyze
CO3	**Utilize statistical and machine learning techniques** for data analysis and predictive modeling using R tools like caret and random Forest.	Apply
CO4	**Develop efficient and reproducible R scripts**, while engaging with the R community for ongoing learning and collaboration.	Evaluate

Description:

This course is designed to guide the learners through the fundamentals of R programming to advanced analytics techniques. Designed to cater to both beginners and those with some programming experience, the course offers a deep dive into R's powerful capabilities for statistical analysis, data visualization, and predictive modeling.

Prerequisites:	1	Basics of Programming Concepts

Unit 1	**Introduction to R Programming**	
	Overview of R and its IDEs (RStudio), Basics of R syntax and programming concepts, Data types, variables, and operations in R.	**4 Hrs**
Unit 2	**Handling Packages in R**	
	Installing a R Package, Few commands to get started: installed.packages(), package Description(), help(), find.package(), library() - Input and Output – Entering Data from keyboard – Printing fewer digits or more digits – Special Values functions : NA, Inf and –inf.	**6 Hrs**
Unit 3	**Data Manipulation and Preparation**	

	Importing and exporting data in R, Data cleaning and preparation with dplyr, Data transformation using tidyr.	**6 Hrs**
Unit 4	**Data Analysis and Statistics**	
	Descriptive statistics and exploratory data analysis, Hypothesis testing and inferential statistics, Regression analysis and ANOVA**.**	**4 Hrs**
Unit 5	**Data Visualization with R**	
	Principles of effective data visualization, Introduction to ggplot2 and advanced visualization techniques, Creating interactive visualizations with packages like plotly.	**6 Hrs**
Unit 6	**Advanced Analytics and Machine Learning**	
	Overview of machine learning in R, Classification, regression, and clustering techniques, Model evaluation and tuning.	**6 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	-			
CO2	3	-	-	1	1	-	-	-	-	-	-	-			
CO3	-	3	2	2	2	-	-	-	-	1	-	-			
CO4	-	-	-	2	3	2	-	-	-	-	-	-			

References:

Text Books	
1	N. Metzler, " R Programming for Beginners: An Introduction to Learn R Programming with Tutorials and Hands-On Examples," Independently Published, 2019.
2	Fischetti, Tony, " R: Data Analysis and Visualization," Packt Publishing, 2016.

Reference Books	
1.	Lander, Jared. "R for Everyone: Advanced Analytics and Graphics," Pearson Education, 2017.
2.	Singh, Ajit. "R Programming: Simply In Depth," Amazon Digital Services LLC - Kdp, 2020.
3.	G. Grolemund, " R Programming An Approach to Data Analytics," Mjp Publisher, 2021.

24PGMCAPEC3053: Reinforcement Learning

Lectures	**: 3**	**Evaluation Scheme**	
Credit	**: 3**	**ISE**	**: 40**
		ESE	**: 60**

Course Objectives: The objective of the course is to

1. Gain a historical perspective of AI and its foundation
2. Become familiar with basic principles of AI toward problem-solving
3. Get to know approaches of inference, perception, Uncertain Knowledge, and Reasoning

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand the core concepts and terminology of reinforcement learning	Understand
CO2	Analyze and formalize real-world problems into the framework of RL.	Analyze
CO3	Apply RL techniques to solve engineering problems.	Apply
CO4	Critically evaluate and compare different RL algorithms.	Evaluate

Description:

In this course, students will learn what Artificial Intelligence (AI) is, explore use cases and applications of AI, and understand AI concepts and terms like machine learning, deep learning, and neural networks.

Prerequisites:	1	Basic knowledge of Machine Learning.

Unit 1	**Introduction to Reinforcement Learning**	
	Basics of reinforcement learning, Markov decision processes (MDPs), Components of RL: agent, environment, state, action, reward	**4 Hrs**
Unit 2	**Dynamic Programming and Monte Carlo Methods**	
	Policy evaluation and iteration, Value iteration and policy iteration, Monte Carlo prediction and control, Exploration vs. exploitation trade-off	**6 Hrs**

Unit 3	**Temporal Difference Learning and Function Approximation**	
	TD prediction, SARSA algorithm, Q-learning algorithm, Linear function approximation, Nonlinear function approximation (e.g., neural networks), Deep Q-Networks (DQN)	**6 Hrs**
Unit 4	**Policy Gradient Methods and Exploration Strategies**	
	Policy approximation, Policy gradient theorem, REINFORCE algorithm, Epsilon-greedy strategy, Upper Confidence Bound (UCB), Thompson Sampling	**4 Hrs**
Unit 5	**Advanced RL Algorithms**	
	Deep Deterministic Policy Gradient (DDPG), Proximal Policy Optimization (PPO), Trust Region- -Policy Optimization (TRPO)	**6 Hrs**
Unit 6	**RL Applications, Ethical Considerations, and Limitations**	
	RL in robotics and control, Imitation learning, Transfer learning, RL applications in engineering - autonomous vehicles, energy management, Ethical considerations in RL, Bias and fairness in RL, Safety considerations in RL applications	**6 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	1	-	-	-			
CO2	1	2	2	-	-	-	1	-	1	-	-	-			
CO3	1	3	1	-	-	-	-	-	-	-	-	-			
CO4	2	1	-	-	-	-	-	-	1	-	-	-			
CO5	2	2	1	2	1	-		-	-	3					

References:

Text Books	
1	"Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto
Reference Books	
1.	"Deep Reinforcement Learning" by Pieter Abbeel and John Schulman
2.	"Reinforcement Learning and Optimal Control" by Dimitri P. Bertsekas

Practicals : 4 hrs/ week
Credits : **2**

Examination Scheme
ISA : 25 Marks
POE : 50 Marks

Course Objectives: The objective of the course is to
1. To develop skills in building mobile apps using modern tools and frameworks. 2. To understand the mobile app lifecycle from design to deployment. 3. To implement platform APIs and local data storage in apps. 4. To integrate web services and optimize app performance.

Course Outcomes:

COs	**At the end of successful completion of the course the student will be able to**	**Blooms Taxonomy**
CO1	Develop functional mobile applications using appropriate tools and languages.	Apply
CO2	Design user-friendly interfaces and implement app navigation.	Apply
CO3	Use platform APIs and manage local data effectively.	Apply
CO4	Integrate web services and debug apps for better performance.	Apply

Description:		
This lab course provides practical experience in designing, developing, and testing mobile applications using modern tools and frameworks.		
Prerequisites:	1	HTML, CSS, and JavaScript fundamentals, software development concepts and IDE usage, database concepts

Practicals:

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1	Create a simple "Hello World" mobile app.	2	Understand
2	Design a basic login screen with input validation.	2	Apply
3	Build a multi-screen app using intents/navigation.	2	Apply
4	Implement a list view to display dynamic data.	2	Apply
5	Store user data using SharedPreferences.	2	Apply
6	Create a local database using SQLite or Room.	2	Apply
7	Use device sensors (e.g., accelerometer or GPS).	2	Apply
8	Fetch data from a REST API and display it.	2	Apply
9	Integrate Firebase for user authentication.	2	Apply
10	Create a media player app for audio playback.	2	Apply

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	1	3	-	-	-	-	-	-	-	-	-	-	-

References:

Text Books	
1.	Android Programming: The Big Nerd Ranch Guide By Bill Phillips, Chris Stewart, and Kristin Marsicano
Reference Books	
1	Learning Android Application Development By Reto Meier, O'Reilly Media
2	Beginning Flutter: A Hands-On Guide to App Development By Marco L. Napoli, Apress

Practicals : 4 hrs/ week
Credits : **2**

Examination Scheme
ISA : 50 Marks
POE : 50 Marks

Course Objectives: The objective of the course is to
1. Understand the fundamental concepts and techniques of machine learning. 2. Apply mathematical and statistical methods to machine learning models. 3. Implement algorithms to solve practical problems using ML tools. 4. Evaluate model performance and address real-world challenges

Course Outcomes:

COs	**At the end of successful completion of the course the student will be able to**	**Blooms Taxonomy**
CO1	Apply machine learning algorithms to real-world datasets.	Apply
CO2	Analyze and compare model performance using appropriate metrics.	Analyze
CO3	Design and implement predictive models using ML frameworks.	Apply
CO4	Demonstrate problem-solving skills with ethical and practical considerations.	Apply

Description:

This course introduces core machine learning concepts, algorithms, and tools to develop intelligent systems for real-world problem solving..

Prerequisites:	1	Basic knowledge of probability, statistics, and linear algebra.

Practicals:

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1	Scikit Learn Introduction and Installation What is Scikit Learn, Origin of Scikit, and Installation	2	Analyze
2	Modeling Process in ML Demonstrate the following using Boston House Prices Dataset. 1. Dataset loading. 2. Splitting the dataset and 3. Train the model.	2	Analyze
3	Data Representation in ML Demonstrate data as Table by downloading iris dataset in form of a panda's data frame with the help on python Seaborn library	2	Understand
4	Linear Regression Write a Python program to implement Simple Linear Regression. Select appropriate data set for your experiment and draw graphs.	2	Understand
5	Multiple Linear Regression Write a Python program to implement Multiple Linear Regression for House Price Prediction using sklearn.	2	Analyze
6	K- Nearest Neighbor Regression Write a Python program to implement k-Nearest Neighbor algorithm to classify the data from data set. Print both correct and wrong predictions	2	Analyze
7	Logistic Linear Regression Write a Python program to implement Logistic Linear Regression algorithm to classify the data from data set Select appropriate data set for your experiment and draw graphs	2	Understand
8	Decision Tree Learning Write a Python program to demonstrate the working of the decision tree. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample	2	Understand
9	K Means Clustering Write a Python program to demonstrate the working of the K Means clustering. Use an appropriate data set for building the decision tree and apply this knowledge to cluster a new sample	2	Understand
10	Neural Network Write a Python program to demonstrate a predictive system using Neural Network. Use an appropriate data set.	2	Understand & Apply

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	1	3	-	-	-	-	-	-	-	-	-	-	-

References:

Text Books	
1.	"Pattern Recognition and Machine Learning" by Christopher M. Bishop, Springer, 2006.
Reference Books	
1	"Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy, MIT Press, 2012
2	"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron, O'Reilly, 2019.

24PGMCAPEC3051T: Advanced Database

Teaching Scheme
Credits : 1

Evaluation Scheme
ISA : 25 Marks

Term Work & Tutorial
Complete 8-10 assignments covering core topics from each unit. The assignments should be practical and focus on understanding fundamental concepts and their real-world applications.
Students will analyze through theoretical insights and practical applications, also they will gain the skills necessary to manage and innovate within modern data-intensive environments.
Students should complete exercises on core topics from each unit: • **Unit 1: Query Processing and Optimization**. • **Unit 2: Transaction Management and Concurrency Control**. • **Unit 3: Distributed Databases**. • **Unit 4: Object-Oriented and Object-Relational Databases**. • **Unit 5: Emerging Database Technologies**.

Tutorials : 1

24PGMCAPEC3052T: Machine Learning

Teaching Scheme
Credits : 1

Evaluation Scheme
ISA : 25 Marks

Term Work & Tutorial
Complete 8-10 assignments covering core topics from each unit. The assignments should be practical and focus on understanding fundamental concepts and their real-world applications.
Students will analyze through theoretical insights and practical applications, also they will gain the skills necessary to manage and innovate within modern data-intensive environments.
Students should complete exercises on core topics from each unit: • **Unit 1: Machine Learning Concepts, Setting Up Python and scikit-learn** • **Unit 2: Loading and Preprocessing Datasets, Linear Regression with scikit-learn** • **Unit 3: Logistic Regression for Classification, Implementing K-Nearest Neighbors (KNN)** • **Unit 4: Decision Trees and Random Forests, Support Vector Machines (SVM).** • **Unit 5: Clustering with K-Means Algorithm, Model Evaluation and Cross-Validation**

Tutorials : 1

24PGMCAPEC3053T: Reinforcement Learning

Teaching Scheme
Credits : 1

Evaluation Scheme
ISA : 25 Marks

Term Work & Tutorial
Complete 8-10 assignments covering core topics from each unit. The assignments should be practical and focus on understanding fundamental concepts and their real-world applications.
Students will analyze through theoretical insights and practical applications, also they will gain the skills necessary to manage and innovate within modern data-intensive environments.
Students should complete exercises on core topics from each unit:

- **Unit 1: Reinforcement Learning Concepts, Understanding Markov Decision Processes (MDPs)**
- **Unit 2: Implementing a Simple Gridworld Environment, Exploration vs. Exploitation**
- **Unit 3: Value Iteration Algorithm, Policy Iteration and Policy Evaluation**
- **Unit 4: Q-Learning Algorithm Implementation, SARSA Algorithm in Action**
- **Unit 5: Deep Q-Networks (DQN) Basics, Training an Agent in OpenAI Gym**

Tutorials : 1

24PGMCAAEC306 - Seminar

Practicals : 8 hrs/ week
Credits : 4

Examination Scheme
ISA : 25 Marks
POE : 50 Marks

Course Objectives: The objective of the course is to

1. To develop skills in researching and analyzing advanced topics in computer applications.
2. To enhance technical writing and documentation abilities.
3. To improve oral communication and presentation skills in a professional setting.
4. To encourage independent learning and awareness of recent technological trends.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Identify and explore current topics or emerging trends in computer applications.	Apply
CO2	Prepare a well-structured technical report based on thorough literature review.	Apply
CO3	Deliver an effective seminar presentation using appropriate tools and techniques.	Apply
CO4	Respond confidently to questions and engage in technical discussions.	Apply

Nature of Seminar

The aim of this seminar is to make the students to study regarding industrial project. They are expected to go through the latest trend pertaining to computer and allied fields, to do the literature survey and deliver the seminar on their work done in an industrial project. The other important aim of the seminar is to encourage and develop the personality, aptitude and knowledge of the students

- Seminar work should be continually evaluated based on the contributions of an individual student, originality of the work, innovations brought in, research and developmental efforts, depth and applicability, etc.
- Three mid-term evaluations should be done, which includes presentations and demos of the work done.

Project Report Format:

1. Page Size: Trimmed A4
2. Top Margin: 1.00 Inch
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inch
6. Para Text: Times New Roman 12 Point Font
7. Line Spacing: 1.5 Lines
8. Page Numbers: Right Aligned at Footer. Font 12 Point. Times New Roman
9. Headings: Times New Roman, 14 Point Bold Face
10. Certificate: All students should attach standard format of Certificate as described by the department. Certificate should be awarded to batch and not to individual student. Certificate should have signatures of Guide, Head of Department and Principal/ Director.
11. Index of Report:
    a. Title Sheet
    b. Certificate
    c. Acknowledgement
    d. Table of Contents
    e. List of Figures
    f. List of Tables

12. References: References should have the following format

For Books: “Title of Book”, Authors, Publisher, Edition

For Papers: “Title of Paper”, Authors, Journal/Conference Details, Year

24PGMCAOJT307 - Major Project I

Practicals : 8 hrs/ week
Credits : 4

Examination Scheme
ISA : 25 Marks
POE : 50 Marks

Course Objectives: The objective of the course is to

5. To apply theoretical knowledge to solve real-world problems through software development
6. To enhance skills in system design, coding, testing, and documentation.
7. To encourage teamwork, project planning, and time management.
8. To develop the ability to present and defend technical solutions effectively.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Design and develop a complete software application or system.	Apply
CO2	Apply software engineering principles to real-world project development.	Apply
CO3	Collaborate effectively in teams and manage project workflows.	Apply
CO4	Present technical work clearly through documentation and oral presentation.	Apply

Guide Lines for Projects:

Project Selection
- Choose a relevant and feasible project that aligns with your specialization and current industry trends.
- The project must be original; plagiarism will lead to disqualification.

Project Proposal Submission
- Submit a project proposal including the title, objectives, scope, technology stack, and expected outcomes.
- The proposal must be approved by the assigned faculty guide.

Team Formation
- Projects can be done individually or in teams (preferably 2–3 members).
- Team members must contribute equally and document individual responsibilities.

Regular Progress Reviews
- Attend all scheduled review meetings and present progress updates.
- Maintain a project diary or logbook signed weekly by the faculty guide.

Technical Documentation
- Prepare proper documentation including system requirements, design diagrams, implementation, testing, and user manuals.
- Follow standard formatting and citation styles as instructed.

Final Submission Requirements
- Submit the source code, executable files, project report, and presentation slides.
- Ensure the report includes screenshots, test results, and references.

Viva Voce and Demonstration
- Demonstrate the working of the project and be prepared to answer technical questions during the final viva.
- Each team member must be able to explain the complete project.

Ethical Conduct
- Ensure ethical use of data and technology; avoid using copyrighted material without permission.
- Acknowledge all external tools, APIs, or frameworks used.