M.Sc. COMPUTER SCIENCE

Course Structure and Syllabus

(For the candidates admitted from the academic year **2025-2026** onwards)

CHOICE BASED CREDIT SYSTEM- LEARNING OUTCOMES BASED CURRICULUM FRAME WORK (CBCS-LOCF)

THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)

(Nationally Re-Accredited by NAAC with B^{++})

(Affiliated to Bharathidasan University, Tiruchirappalli)

ELAMBALUR, PERAMBALUR – 621 220

VISION:

- To be a Centre of excellence in education and research in the frontier areas of Computer Science

MISSION:

- To facilitate quality transformative education in Computer Science
- To promote quality research and innovation in technology for meeting global challenges
- To transform students to competent professionals to cater to the needs of the society

Programme Outcomes (POs)

Programme Outcomes (POS) for M. Sc Computer Science are as follows

PO1 Computational Knowledge: Build a strong foundation in computer science theory, computing principles and basic mathematics.

PO2 Problem Analysis: Identify and analyze customer needs across various domains and design and implement reliable software solutions using modern technologies.

PO3 Research and Innovation: Conduct independent research, apply scientific methods and develop innovative computing solutions to real-world challenges.

PO4 Entrepreneurship: Recognize and seize entrepreneurial opportunities to create meaningful value for individuals and society.

PO5 Teamwork and Leadership: Collaborate effectively in diverse teams and demonstrate leadership in the execution of computing and interdisciplinary projects.

PO6 Ethics and Social Responsibility: Apply ethical principles and understand the impact of computing solutions in a global, economic, environmental and societal context.

PO7 Keep learning throughout life: Acknowledge the importance of learning throughout life and stay adaptable to evolving technologies, tools and methodologies in the field of computing.

PO8 Advanced Computing and Data Intelligence: Use smart technologies like AI, machine learning, and data science to build helpful systems and fix real-life problems.

Program Specific Outcomes (PSOs)

PS01: Basic fundamental knowledge in Mathematical problem solving and to identify, analyze, design, optimize and implement system solutions using appropriate algorithms of varying complexity.

PS02: Ability to demonstrate understanding of the working principles of the hardware and software aspects and development methodologies of the software systems

PS03: Communicate computer science concepts, designs, and solutions effectively and professionally

PS04: An ability to apply profound knowledge to analyze and design software and systems containing hardware and software components of varying complexity.

PS05: An ability to apply mathematical model, algorithmic principles, and computer science theory in the design of real-time applications.

Thanthai Hans Roever College (Autonomous), Elambalur, Perambalur – 621 220.

M.Sc. Computer Science

Choice-Based Credit System – Learning Outcome-Based Curriculum Framework

(For the candidate admitted from the academic year 2025 -2026)

Semester	Course Code	Title of the Course	Int. Hrs /Week	Credits	End Sem. Exam Hrs	Max. Marks		
						CIA	ESE	Total
I	25PCS1CC1	Design and Analysis of Algorithms	6	5	3	25	75	100
	25PCS1CC2	Advanced Python Programming	6	5	3	25	75	100
	25PCS1EC11 25PCS1EC12	Data Visualization / OOAD and UML	6	4	3	25	75	100
	25PCS1CP1	Advanced Python Programming Lab	3	2	3	40	60	100
	25PCS1EP11 25PCS1EP12	Data Visualization Lab / OOAD and UML Lab	3	2	3	40	60	100
	25PCS1EC21 25PCS1EC22	Software Project Management / Internet of Things	6	4	3	25	75	100
	25PCS1VAC	Introduction to Cyber Security	--	2*	3	50	50	100*****
		Total	**30**	**22**	**-**	**-**	**-**	**600**
II	25PCS2CC3	Artificial Intelligence and Machine Learning	6	5	3	25	75	100
	25PCS2CC4	Research Methodology	5	5	3	25	75	100
	25PCS2EC31 25PCS2EC32	Data Mining and Data Warehousing/ Mobile Application Development	5	4	3	25	75	100
	25PCS2CP2	Artificial Intelligence and Machine Learning Lab	3	2	3	40	60	100
	25PCS2EP31 25PCS2EP32	Data Mining Lab using R / Mobile Application Development Lab	3	2	3	40	60	100
	25PCS2EC41 25PCS2EC42	Open Source Technologies / Social Network and Law	5	4	3	25	75	100
	25PCS2NME 1	Introduction to Data Science	3	2	3	25	75	100
	25PCS2OC	SWAYAM / NPTEL / MOOC / Online Certificate (Minimum 4-week course)	-	2*	-	-	-	-
	25PCS2VAC	Natural Language Processing	--	2*	3	50	50	100*****
		Total	**30**	**24**	**-**	**-**	**-**	**700**
III	25PCS3CC5	Compiler Design	5	5	3	25	75	100
	25PCS3CC6	Advanced Database Management System	6	5	3	25	75	100
	25PCS3EC51 25PCS3EC52	Network Security and Cryptography Digital Image Processing	5	4	3	25	75	100
	25PCS3CP3	Advanced Database Management System Lab	3	2	3	40	60	100
	25PCS3EP51 25PCS3EP52	Network Security and Cryptography Lab Digital Image Processing Lab	3	2	3	40	60	100
	25PCS3EC61 25PCS3EC62	Cyber Security Blockchain Technologies	5	4	3	25	75	100
	25PCS3NME 2	E-Commerce Basics	3	2	3	25	75	100
	25PCS3VAC	Advanced Full Stack Frameworks	--	2*	3	50	50	100*****

	25PCSSI	Internship	--	2*	3	--	--	100*
			30	**24**	**-**	**-**	**-**	**700**
Semester	**Course Code**	**Title of the Course**	**Int. Hrs /Week**	**Credits**	**End Sem. Exam Hrs**	**Max. Marks**		
						CIA	**ESE**	**Total**
IV	25PCS4CC7	Cloud Computing	6	5	3	25	75	100
	25PCS4CC8	Mongo DB	6	5	3	25	75	100
	25PCS4CC9	Entrepreneurship and Innovation in Information Technology	6	5	3	25	75	100
	25PCS4PW	Project Work with Viva-Voce	12	5	-	-	-	100
	25PCS4VAC	Introduction to Workplace Ethics	--	2*	3	50	50	100*
			30	20				**400**
			120	90				**2400**

*** Internship/Industrial Activity-Internship after 2nd semester during summer vacation -30 Hours and 2 credits will be included in the 3rdsemester.

* The value added course credit will not be included in the total CGPA.These courses are extra- credit courses. Instruction hours for these courses is 30 hours

** SWAYAM/NPTEL Online Course -Extra Credit Course. Not considered for grand total &CGPA

Credit Distribution for PG Course

S.No	Course Details	Credit
1	Core Course	49
2	Elective Course	30
3	NME	4
4	Project	5
5	Internship	2

List of Core Courses:

1. Design and Analysis of Algorithms
2. Advanced Python Programming
3. Advanced Python Programming Lab
4. Artificial Intelligence and Machine Learning
5. Research Methodology
6. Artificial Intelligence and Machine Learning Lab
7. Compiler Design
8. Advanced Database Management System
9. Advanced Database Management System Lab
10. Cloud Computing
11. MongoDB
12. Entrepreneurship and Innovation in Information Technology

List of Elective Courses:

1. Data Visualization (or) OOAD and UML
2. Data Visualization Lab (or) OOAD and UML Lab
3. Software Project Management (or) Internet of Things
4. Data Mining and Data Warehousing (or) Mobile Application Development
5. Data Mining Lab using R (or) Mobile Application Development Lab
6. Open Source Technologies (or) Social Network and Law
7. Network Security and Cryptography (or) Digital Processing
8. Network Security and Cryptography Lab (or) Digital Processing Lab
9. Cyber Security (or) Blockchain Technologies

List of NME Courses:

1. Introduction to Data Science
2. E-Commerce Basics

List of Value Added Courses:

1. Introduction to Cyber Security
2. Natural Language Processing
3. Advanced Full Stack Frameworks
4. Introduction to Workplace Ethics

Question Paper Pattern

PG Programme		
Maximum Marks : 75		**Duration: 3 Hours**
Section - A	**i) a-** (5 Questions for Multiple Choice) One question from each unit	5 x 1 = 5 Marks
	b- (5 Questions for Fill in the Blanks) One question from each unit	5 x 1 = 5 Marks
	ii) (5 short answer questions) One question from each unit	5 x 2 = 10 Marks
Section - B	**5 Questions** (Internal Choice: Either or) One set of questions from each unit	5 x 5 = 25 Marks
Section - C	**3 Questions**(Answer any 3 out of 5 Questions) One question from each unit	3 x10 = 30 Marks

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Sem. Exam Hrs	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
I	25PCS1CC1	5	**Design and Analysis of Algorithms**	Core Course	4	1	-	**3 Hrs.**	**25**	**75**	**100**

Pre-Requisite: Basic knowledge of programming, recursion, data structures, algorithm analysis, fundamental problem-solving strategies and backtracking.

Course Objectives: The purpose of learning this course is:

1. Enable the students to learn the Elementary Data Structures algorithms.
2. Presents an introduction to the algorithms, their an Analysis and design Discuss various methods like
3. Basic Traversal and Search Techniques, dividend conquers method.
4. Dynamic programming, backtracking.
5. Under stood the various design and analysis of the algorithms.

Course Outcomes:

CO1: Understand and apply foundational algorithm concepts, space/time complexity, and basic data structures ssuch as stacks, queues, trees, heaps, and graphs.

CO2: Analyze and implement traversal, search, and divide-and-conquer strategies such as binary search, merge sort, and quick sort.

CO3: Apply greedy algorithmic methods to solve optimization problems like knapsack, MST, and shortest path.

CO4: Employ dynamic programming approaches for solving complex problems such as multistage graphs, TSP, and optimal BST.

CO5: Design solutions using backtracking and branch-and-bound techniques for constraint satisfaction and combinatorial problems.

Unit-I	**Introduction**	12 Hrs.

Algorithm Definition and Specification – Space complexity-Time complexity- Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree - Binary Search Tree - Heap – Heap sort- Graph.

Unit-II	**Traversal and search techniques**	12 Hrs

Basic Traversal And Search Techniques: Techniques for Binary Trees-Techniques for Graphs -Divide and Conquer: - General Method – Binary Search – Merge Sort – Quick Sort.

Unit-III	**Greedy method**	12 Hrs

The Greedy Method:-General Method–Knapsack Problem– Minimum Cost Spanning Tree– Single Source Shortest Path.

Unit-IV	**Dynamic programming**	12 Hrs

Dynamic Programming-General Method– Multistage Graphs–All Pair Shortest Path–Optimal Binary Search Trees – 0/1 Knapsacks – Travelling Salesman Problem – Flow Shop Scheduling.

Unit-V	**Backtracking**	12 Hrs

Backtracking: -General Method–8-QueensProblem–SumOfSubsets–Graph Coloring– Hamiltonian Cycles – Branch And Bound: - The Method – Travelling Salesperson.

Text Book(s):

1. S. K. Basu, Design Methods and Analysis of Algorithms, 2nd Edition, PHI Learning, 2021, ISBN: 978-9353069314
2. Udi Manber, Introduction to Algorithms: A Creative Approach, Dover Publications, Reprint 2021, ISBN: 978-0486838520
3. S. Sridhar, Design and Analysis of Algorithms, 1st Edition, Oxford University Press, 2022, ISBN: 978-0199492800
4. S. Dasgupta, C.H. Papadimitriou, U.V. Vazirani, Algorithms, McGraw-Hill Education, Reprint 2021, ISBN: 978-0073523408

Reference Book(s):

1. Karumanchi Narasimha, "Algorithm Design Techniques: Recursion, Backtracking, Greedy, Divide & Conquer, and Dynamic Programming", 1st edition, CareerMonk Publications, 2020, ISBN: 978-8193245283
2. Mukhopadhyay A., "Design and Analysis of Algorithms", 1st edition, Universities Press, 2020, ISBN: 978-9389211956
3. Maheshwari Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 4th edition, Pearson, 2020, ISBN: 978-9332575317
4. Sahni Sartaj, "Data Structures, Algorithms and Applications in C++", 2nd edition, Universities Press, 2021, ISBN: 978-8173719779

Web Resources:

1. https://nptel.ac.in/courses/106/106/106106131/
2. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
3. https://www.javatpoint.com/daa-tutorial
4. https://www.geeksforgeeks.org/fundamentals-of-algorithms
5. https://www.coursera.org/specializations/algorithms

Course Outcomes (COs)	Program Outcomes (**POs**)								Program Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	1	2	2	2	1	2	3	2	2	2	2
CO2	3	3	2	2	1	1	1	2	3	3	2	2	2
CO3	3	3	2	1	2	2	2	1	3	3	3	2	2
CO4	3	3	3	1	1	1	2	2	3	3	3	3	3
CO5	3	3	3	2	1	2	2	2	3	3	3	3	3
	Overall CO – PO Mapping index = 2.0								**Overall CO – PSO Mapping index = 2.6**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course code	Credits	Title of the Course	AC / CC / DE / ES / GS / NME / PF / PW / VAC / VE / SE / WK	Category			Sem. Exam	Max. Marks		
					Lect. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
I	25PCS1CC2	5	**Advanced Python Programming**	Core Course	4	1	-	**3 Hrs.**	**25**	**75**	**100**

Pre-Requisite: Basic knowledge of programming concepts and familiarity with any high-level programming language.

Course Objectives: The purpose of learning this course is:

1. To Understand the Core Concepts of Python Programming
2. To Apply Control Flow and Decision-Making Constructs
3. To Explore Functions and Modular Programming
4. To Manipulate Strings, Files, and Data Structures
5. To Interact with Databases Using Python

Course Outcomes:

CO1: Understand and apply the fundamental concepts of Python programming

CO2: Apply iterative control structures, functions including recursion and modules

CO3: Develop Python programs using loop constructs, decision modifiers, and modular programming

CO4: Perform scientific computations and data analysis using NumPy and SciPy in Python

CO5: Implement basic server and client programs using socket methods and understand real-time data exchange.

Unit-I	**Python Introduction**	12 Hrs.

Basics of Python programming: Features of Python - History of python - Literals and Constants - Variables and Identifiers – Data types - Input Operation-Comments - Reserved Words – Indentation - Operators and Expressions - Type conversion. Decision Control Statements: Introduction to Decision Control Statements.

Unit-II	**Decision Making**	12 Hrs.

Basic Loop Structure/Iterative Statements - Nested loops - The Break Statement - The continue statement - The pass statement - The else statement used with loops. Functions and Modules: Introduction - Function Definition - Function call - Variable Scope and Lifetime - The return statement – Recursive functions Modules.

Unit-III	**Function and Modular**	12 Hrs

Python Strings: Introduction: Concatenating, Appending and multiplying Strings - Built-in String Methods and Functions - Slice operation - Comparing Strings. File handling: Introduction - File path - Types of Files-Opening and closing files - Reading and writing files - Renaming and deleting files - Directory Methods - Data Structures: Sequence – Lists - Tuple-Sets – Dictionaries

Unit-IV	**GUI Introduction**	12 Hrs

Introduction to Graphics programming - Introduction to GTK - PyGTK - Developing GUI applications using pyGTK - Scientific Programming using NumPy / SciPy Image Processing - Processing multimedia files. Network Programming, Web services using SOAP, Introduction to Graphics programming – PyGame-web services usages

Unit-V	**Mysql Database Connection**	12 Hrs

MySQL Database Access: What is MySQL – Database Connection – Creating Database Table – Performing Transactions –Disconnecting database. Network Programming: What is Socket – The Socket module – Server Socket Methods – Client Socket Methods – General Socket Methods – A Simple Server – A Simple Client. Introduction to Django – The basics dynamics web pages

Text Book(s):

1. Mangnus Lie Hetland "Beginning Python" Novice to Professional 4 nd Edition 2024 ISBN-978-1-4842-0028-5
2. Jeyabharathi, Jeganmohan, Amit Vajpayee, M. Tholkapiyan "Python Programming" 1 nd Edition 2024 ISBN-13**:** 978-81-959790-3-5
3. John Hunt "Advanced Guide to Python 3 Programming" 2nd Edition Springer 2023 978-3031403354

Reference Book(s):

1. Martin C.Brown " The Completer Reference" McGraw Hill Education 2024 ISBN 978-93-87572-94-2
2. Mark Lutz "Learning Python" 5th Edition O'Reilly Media 978-1449355739
3. Dr.R.Nageswara Rao "Core Python" 3 th Edition DreamTech

Web Resources:

1. https://www.w3schools.com/python/python_functions.asp
2. https://realpython.com/python-strings/
3. https://www.programiz.com/python-programming/exception-handling
4. https://docs.djangoproject.com/en/stable/intro/
5. https://www.geeksforgeeks.org/python-programming-language/

Course Outcomes (COs)	Program Outcomes (**POs**)								Program Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	2	2	2	3	2	3	3	3	2	3
CO2	3	3	3	2	2	1	2	3	3	3	3	2	3
CO3	3	2	3	2	2	1	3	3	3	3	3	3	3
CO4	3	2	3	2	2	2	3	3	3	3	2	2	3
CO5	2	3	2	3	3	2	3	3	3	3	3	3	3
	Overall CO – PO Mapping index = 2.4								**Overall CO – PSO Mapping index = 2.84**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE /	Category	Sem.	Max. Marks

				SE / GS / EVS/ VE / VAC	Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.	Exam	CIA	ESE	Total.
I	25PCS1EC11	4	**Data Visualization**	Core Course	4	-	-	**3 Hrs.**	**25**	**75**	**100**

Pre-Requisite: Basic knowledge of Data Handling and Database concepts is required.

Course Objectives: The purpose of learning this course is:

1. Understand the importance of data visualization in data analysis.
2. Choose appropriate visualization techniques for different types of data.
3. ,.Critically evaluate and improve existing visualizations
4. Create interactive and static visualizations
5. Communicate insights effectively through data visualization

Course Outcomes:

CO1: Apply advanced data transformation and modeling techniques using Power Query, DAX, and data intelligence principles.

CO2: Design and develop dynamic, interactive dashboards that support strategic business decision-making and data storytelling.

CO3: Formulate and analyze key performance indicators (KPIs) and use advanced measures to monitor trends and support predictive decision systems.

CO4: Implement secure, collaborative data reporting using Power BI services, workspaces, and role-based access for enterprise environments.

CO5: Communicate analytical insights clearly using best practices in data visualization, ethical data use, and professional reporting standards.

Unit-I	**Introduction to Data Visualization**	10 Hrs.

Gaining Data Literacy with Power BI – The Challenge facing organizations with low data literacy – Migrating Excel skills to Power BI. Preparing Data Sources – Query Folding – Query Design per Dataset Mode – Data Sources – SQL Views.

Unit-II	**Data Sources, Transforms and Design**	14 Hrs.

Connecting to Sources and Transforming Data with M – Types of Power Query M Queries – Creating Power Query M Queries – Examples – Data flows – Power Query M Editing Tools – Designing Import, Direct Query and Composite Data Models – Dataset Layers – Data Model – Relationships – Model Metadata – Column and Measure Metadata – Optimizing Data Model Performance.

Unit-III	**Security and Reports**	14 Hrs.

Developing Max Measures and Security Roles – DAX Measure Basics – Date Intelligence Metrics – Calculation Groups – Dimension Metrics – Ranking Metrics – Security Roles – Performance Testing. Planning Power BI Reports – Report Planning Process – Visual Interactions – Drill through Report Pages – Report Filter Scopes.

Unit-IV	**Visualization**	10 Hrs.

The Visualization Pane – Slicers – Single Value Visuals – Map Visuals – Waterfall Chart – Power Platform Visuals – Premium Visuals – Elements – Formatting Visualizations – AI Visuals – R and Python Visuals – ArcGIS Maps for Power BI – Custom Visuals.

Unit-V	**Application**	12 Hrs..

Deploying Paginated Reports – Paginated Reports in the Power BI Service – Migrating Reports to the Power BI Service – Planning the Power BI Report Server – PBRS Client Applications. Creating Power BI Apps and Content Distribution – Content Distribution Methods – Power BI Apps – Sharing Content – Embedding – Data Alerts – Email Subscriptions – Analyze in Excel.

Text Book(s):

1. Devin Knight, Erin Ostrowsky, Mitchell Pearson, Bradley Schacht, “Microsoft Power BI Quick Start Guide”, 3rd Edition, Packt Publishing, ISBN: 978-1804613498.
2. Dr. Shirshendu Roy “Data Visualization: Using Power BI, Orange and Excel”, 1st Edition, Notion Press, 2021, ISBN: 978-1638324997.
3. Chandraish Sinha “Mastering Power BI”, 2nd Edition, BPB Publications, 2024, ISBN: 978-9355517166.

Reference Book(s):

1. Claus O. Wilke, “Fundamentals of Data Visualization – A Premier on Marketing Informative and Compelling Figures”, 1st Edition, O’Reilly Media, 2019, ISBN: 978-1492031086.
2. Kieran Healy, “Data Visualization: A Practical Introduction”, 1st Edition, Princeton University Press, 2018, ISBN: 978-0691181622.
3. Cole Nussbaumer Knaflic, “Storytelling with Data: A Data Visualization Guide for Business Professionals”, 1st Edition, Wiley, ISBN: 978-1119002253.

Web Resources:

1. https://youtu.be/rPPxAj9mJO0?si=z1fAx6VSZgG3sfIA
2. https://youtu.be/s6n9vEyM1gY?si=H8Z0Povlr_1b6vlx
3. https://youtu.be/k7UEE64Je3g?si=sj3uNX2x0ZihL1zi

Course Outcomes (COs)	Programme Outcomes (POs)								Program Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2	2	2	3	3	3	2	3	3
CO2	2	3	3	3	3	2	2	3	3	3	3	2	3
CO3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO4	2	3	3	3	3	3	3	3	3	2	3	3	3
CO5	2	3	3	3	3	3	3	3	3	2	2	3	3
	Overall CO – PO Mapping index = 2.73								**Overall CO – PSO Mapping index = 2.8**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

				SE / GS / EVS VE / VAC				Exam			
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	TOTAL
I	25PCS1EC12	4	**OOAD and UML**	Core Course	4	-	-	**3 Hrs.**	**25**	**75**	**100**

Pre-Requisite Fundamental understanding of object-oriented programming, basic software engineering concepts, and familiarity with programming languages like Java or Python.

Course Objectives: The purpose of learning this course is:

1. To understand the object-oriented approach to software development and its life cycle.
2. To explore various object-oriented methodologies and the Unified Modeling Language (UML).
3. To learn systematic techniques for object-oriented analysis and modelling using use-cases.
4. To apply object-oriented design principles, axioms, and patterns for effective system design.
5. To gain hands-on experience in mapping UML models to programming languages like Java or Python.

Course Outcomes:

CO1: Demonstrate an understanding of the object-oriented systems development life cycle and use-case-driven analysis and design.

CO2: Apply object-oriented methodologies (Rumbaugh, Booch, and Jacobson) and use UML to model real-world software systems.

CO3: Identify use-cases, business processes, and object relationships using systematic analysis approaches.

CO4: Design object-oriented systems using design axioms, corollaries, and apply design patterns effectively.

CO5: Create UML-based models and map them into working Java/Python code for real-world software problems.

Unit-I	**Object-Oriented Systems Development Life Cycle:**	10 Hrs.

Introduction-The Software Development Process-Building High-Quality Software-Object-Oriented Systems Development - A Use-Case Driven Approach-Object-Oriented Analysis - Use-Case Driven Object-Oriented Design-Prototyping-Implementation: Component- Based Development Incremental Testing.

Unit-II	**Object-Oriented Methodologies and UML Introduction:**	14 Hrs.

Introduction-Rumbaugh Modeling Technique-The Booch Methodology-The Jacobson Methodologies-Patterns-Frameworks- The Unified Approach. Unified modeling language: Introduction-Static and Dynamic Models-Why Modeling Introduction to the unified modeling language-UML Diagrams-UML Class Diagram-UseCase Diagram-UML Dynamic Modeling-Model management: Packages and Model organization-UML Extensibility-UML Meta–Model.

Unit-III	**Object-oriented Analysis Processes:**	14 Hrs.

Object-oriented Analysis Processes: Identifying Use-Cases: Introduction-Why Analysis is Difficult Activity-Business Object Analysis-Use Case Driven Object-Oriented Analysis Business Process Modeling-Use-Case Model-Developing Effective Documentation. Object Analysis: Introduction-Classifications Theory-Approaches for identifying classes-Noun Phrase Approach. Identifying Object Relationships- Attributes- and Methods: Introduction-Associations-Super-Sub Class Relationships-A-Part-of Relationships Aggregation-Identifying Attributes and Methods-Defining Attributes by Analyzing Use Cases and Other UML Diagrams – Object responsibility: methods and messages.

Unit-IV	**Object oriented Process and Design:**	10 Hrs.

Object oriented Design Process and Design –Axioms: Introduction-Object-Oriented Design process - Object-oriented Design Axioms - Corollaries - Design Patterns. Designing Classes: Introduction-The Object-oriented Design Philosophy-UML Object Constraint Language-Designing Classes: The Process - Class Visibility - Designing Classes: Refining Attributes.

Unit-V	**UML Models and its Types:**	12 Hrs.

UML Examples on:Behavioual models, Structural Models-Architectural Models from real world problem-Mapping UML Models to Java/Python Code

Text Book(s):

1. Michael Blaha, James Rumbaugh," Object-Oriented Modeling and Design with UML", edition (3rd Ed), Publisher Pearson , 2023, ISBN: 9780131960310

2. Grady Booch, James Rumbaugh, Ivar Jacobson, *The Unified Modeling Language User Guide*, 3rd Ed, Addison-Wesley, 2022, ISBN: 9780135181789
3. Mahesh P. Matha," *Object-Oriented Analysis and Design Using UML",* 2nd Edition, PHI Learning Pvt. Ltd, 2019, ISBN-13**:** 9789389347205.

Reference Book(s):

1. Craig Larman, Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, 3rd Ed, Pearson, 2023

2. Martin Fowler, UML Distilled: A Brief Guide to the Standard Object Modeling Language, 3rd Ed, Addison-Wesley, 2022

3. Simon Bennett et al., Object-Oriented Systems Analysis and Design Using UML, 4th Ed, McGraw
   Hill, 2023
4. Bernd Bruegge and Allen H. Dutoit, Object-Oriented Software Engineering Using UML, Patterns,
   and Java, 3rd Ed, Pearson, 2022

5. Kendall & Kendall, Systems Analysis and Design, 11th Ed, Pearson, 2023

Web Resources:

1.https://www.omg.org/spec/UML/

2.https://www.visual-paradigm.com/tutorials/

3. https://www.lucidchart.com/pages/examples/uml-diagram

4. https://developer.ibm.com/articles/uml-overview/

5. https://www.geeksforgeeks.org/uml-unified-modeling-language/

Course Outcome (COs)	Program Outcomes (**POs**)								Program Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	2	1	1	1	1	1	3	2	1	1	1
CO2	3	3	2	2	2	1	1	1	3	3	1	1	1
CO3	2	3	2	2	1	1	1	1	2	2	2	1	1
CO4	3	3	2	2	2	1	1	1	3	3	2	1	1
CO5	3	3	2	2	2	1	1	1	3	2	2	1	1
	Overall CO – PO Mapping index = 1.94								**Overall CO – PSO Mapping index = 1.574**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

				ES / GS / NME / PF / PW / VAC / VE / SE / WK	Lect. Hrs.	Tutoria Hrs.	Lab. Hrs.	Exam	CIA	ESE	Total.
I	25PCS1CP1	2	**Advance Python Programming Lab**	Core Lab	-	-		**3 Hrs.**	**40**	**60**	**100**

Pre-Requisite: Fundamental knowledge of core Python programming and basic programming concepts.

Course Objectives: The purpose of learning this course is:

1. To Understand the foundational concepts of Python programming including variables, data types, constants, and I/O operations
2. To Apply various operators, decision-making structures, and loops in real-world problems
3. To Demonstrate modular programming using functions and recursion
4. To Manipulate strings effectively and understand Python's built-in string functions
5. To Utilize user-defined and built-in modules to organize and reuse code

Course Outcomes:

CO1: Understand and apply basic programming constructs in Python

CO2: Apply operators, conditional statements, loops, and jump statements effectively

CO3: Design modular Python programs using functions and recursion

CO4: Develop simple GUI applications using PyGTK

CO5: Use Python data structures for real-world problem solving

List of Programs

Sno	List of programs	Hrs.
1	Program using variables, constants, I/O statements in Python.	3 Hrs.
2	Program using Operators in Python.	3 Hrs.
3	Program using Conditional Statements and loop and Jump statement	3Hrs.
4	Program using Functions and Recursion	3 Hrs.
5	Program using Strings.	3 Hrs.
6	Program using Modules.	3 Hrs.
7	Program using Lists and Tuples and Dictionaries	3Hrs.
8	Program for File Handling.	3 Hrs.
9	Create a GUI program using pygtk	3 Hrs.
10	Connect with MySQL and create address book.	3 Hrs.

Course Outcomes (COs)	Program Outcomes (POs)								Program Specific Outcomes (PSOs)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	2	2	2	1	1	1	2	2	3	3	3	2	3
CO2	3	2	2	2	0	0	0	2	3	3	2	3	3
CO3	3	3	3	1	1	1	1	2	3	3	3	3	2
CO4	2	2	3	2	2	2	2	2	3	2	3	3	3
CO5	3	3	3	2	2	1	1	2	3	3	3	3	3
	Overall CO – PO Mapping index = 1.75								**Overall CO – PSO Mapping index = 2.8**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

				SE / GS / EVS/ VE / VAC	Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.	Exam	CIA	ESE	Total.
			Data Visualization Lab								
I	25PCS1EP11	2		Lab	-	-	3	**3 Hrs.**	**40**	**60**	**100**

Pre-Requisite: Knowledge of Excel, Data Analysis and Relational Databases.

Course Objectives: The purpose of learning this course is:

1. To provide practical expertise in Power Query and DAX for transforming raw data.
2. To enable students to design and implement interactive reports and visualizations.
3. To develop skills to integrate multiple data sources and perform relational data
4. To empower students to apply advanced visualization techniques to uncover patterns and trends.
5. To prepare graduates to publish, collaborate, and communicate data stories to stakeholders effectively.

Course Outcomes:

CO1: Import, clean, and transform raw data effectively.

CO2: Develop interactive reports and charts in Power BI.

CO3: Model relationships between multiple datasets accurately.

CO4: Apply DAX expressions to perform advanced calculations.

CO5: Publish and collaborate on Power BI solutions for decision support.

List of Programs:

Sno	List of programs	Hrs.
1	Import a flat file (CSV/Excel) into Power BI and perform data cleaning and transformation.	3 Hrs.
2	Perform table relationships and modelling to connect different datasets.	3 Hrs.
3	Create calculated columns and measures using DAX (SUM, AVERAGE, GROUP BY).	3 Hrs.
4	Develop a bar, column, and pie chart to visualize categorical data.	3 Hrs.
5	Build a time-series visualization (using a Line or Area Chart)**.**	3 Hrs.
6	Prepare a geographical map view to plot location-related data.	3 Hrs.
7	Design a dashboard by integrating multiple charts and adding slicers and filters**.**	3 Hrs.
8	Implement drill-down and drill-up techniques to explore data at different levels of granularity.	3 Hrs.
9	Format and customize visual elements (color, title, tooltips) to enhance readability.	3 Hrs.
10	Publish the finished report to Power BI Service and embed or share it.	3 Hrs.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Course Outcomes (COs)	Programme Outcomes (POs)								Program Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	2	2	2	3	3	3	2	2	3
CO2	2	2	2	3	3	2	2	3	2	2	3	2	2
CO3	3	3	2	2	2	2	2	3	3	3	3	3	3
CO4	3	3	2	2	2	2	2	3	3	3	3	3	3
CO5	2	2	3	3	3	3	3	3	3	3	3	3	3
	Overall CO – PO Mapping index = 2.45								**Overall CO – PSO Mapping index = 2.76**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	AC/CC/DE/	Category	Sem.	Max. Marks

				ES / GS / NME/ PF / PW / VAC/ VE / SE / WK	Lect. Hrs.	Tutorial Hrs.	Lab. Hrs.	Exam	CIA	ESE	Total.
I	25PCS1EP12	2	**OOAD and UML Lab**	Elective Lab	-	-	3	**3 Hrs.**	**40**	**60**	**100**

Pre-Requisite: Basic understanding of object-oriented programming and software design principles.

Course Objectives: The purpose of learning this course is:

1.To design POS systems using object-oriented ideas like class, object, inheritance

2.To find users and actions in ATM systems and draw use case diagrams to show how they interact with the system.

3.To explain workflows in Hospital Management Systems using use case diagrams and implement them

4.To build models showing object relationships for University Registration using class and object diagrams, and organize them into packages.

5.To use relationships like association, aggregation, and composition in Library systems

Course Outcomes:

CO1: Design class diagrams and develop object-oriented Python programs for real-time systems like Point of Sale (POS).

CO2: Construct use case diagrams and model actor-system interactions for ATM systems, and implement the use cases in Python.

CO3 Prepare use case documentation and simulate system workflows for hospital management applications using Python control structures.

CO4: Demonstrate class-object relationships and package-level design in university registration systems, with corresponding Python implementation.

CO5: Develop object-oriented applications using association, aggregation, and composition for systems like Library Management, using well-structured Python code.

Sno	List of programs	Hrs.
1.	POS System – Modeling and implementation using class diagrams and basic OOP in Python.	4 Hrs
2.	ATM System – Actor identification and use case modeling with implementation in Python.	4 Hrs
3.	Hospital Management System – Documenting scenarios and flow using use case diagrams with Python simulation.	5 Hrs
4.	University Registration System – Structural modeling using class/object diagrams and package Organization.	4 Hrs
5.	Library System – Relationship modeling (association, aggregation, composition) and implementati	4 Hrs
6.	Design Patterns in Python – Implementation of Singleton, Factory, and Observer patterns.	4 Hrs
7.	Library Management – Complete UML Flow – Full lifecycle development with Python code and diagrams.	5Hrs

Course Outcomes (COs)	Program Outcomes (POs)								Program Specific Outcomes (PSOs)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	2	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	2	3	3	2	3	2	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	2	3	2
CO4	3	2	3	3	3	2	3	3	3	3	3	2	3
CO5	3	3	3	2	3	3	2	3	3	2	3	3	3
	Overall CO – PO Mapping index = 2.8								**Overall CO – PSO Mapping index = 2.76**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Se	Course Code	Credits	Title of the Course	CC / AC/ DE /	Category	Sem.	Max. Marks

m.				SE / GS / EVS/ VE / VAC	The. Hrs	Tutoria Hrs.	Lab. Hrs.	Exam Hrs	CIA	ESE	Total.
I	25PCS1EC21	4	**SOFTWARE PROJECT MANAGEMENT**	Core Course	4	1	-	**3 Hrs.**	**25**	**75**	**100**

Pre-Requisite: Basic knowledge of Software Engineering principles.

Course Objectives: The purpose of learning this course is:

1.To introduce the core concepts and need for software project management.

2. To apply project estimation techniques such as Function Point and COCOMO.

3. To understand activity planning, scheduling, and risk management methods.

4. To provide insights into Agile methods and team organization in project execution.

5. To explain quality, configuration management, audits, and project closure processes.

Course Outcomes:

CO1: Understand and describe key principles and types of software projects.

CO2: Apply estimation models to evaluate effort, cost, and time in projects.

CO3: Create network schedules, identify risks, and allocate project resources.

CO4: Monitor project progress using earned value and manage Agile-based teams.

CO5: Conduct quality assurance, risk control, audits, and ensure successful project closure.

Unit-I	**Introduction to Software Project Management**	12 Hrs.

Software Projects – ways of categorizing software projects – problems with software projects – Project Life Cycle – Management – Setting objectives – Stakeholders – Project Team – Step Wise: An overview of project planning – Project evaluation – Selection of appropriate project approach. Software effort estimation – function point analysis – objects point – COCOMO.

Unit-II	**Activity planning**	14 Hrs.

project schedules – sequencing and scheduling projects – Network planning models – AON and AOA – identifying critical activities – crashing and fast tracking, Risk management: Categories, Risk planning, management and control – Evaluating risks to the schedule, PERT. Resource allocation – identifying resource requirements – scheduling resources – creating critical paths – publishing schedule – cost schedules – sequence schedule.

Unit-III	**Monitoring and control**	10 Hrs.

Monitoring and control – Visualizing progress, Earned value analysis – Managing people and organizing teams – organizational structures – Planning for small projects. Case Study: PMBOK. Agile Development.

Unit-IV	**Quality , Risk and Configuration Management**	13 Hrs.

Quality Management (Software Quality and Defects, Procedural Approach, Quantitative Approach). Quantitative Quality Management Planning. Introduction to Risk Management. Risk Assessment, Risk Control. Concepts in Configuration Management. Configuration management process, Document Control.

Unit-V	**Review Process, Project Monitoring, Audits and Closure**	11 Hrs.

Review Process. Data collection. Monitoring and control. Data Collection. Project Tracking, Audit Process. Audit Analysis, Project Closure Analysis. Archiving.

Text Book(s):

1.Mohapatra, Sanjay, "Software Project Management", 2nd Edition, Cengage Learning, 2019, ISBN: 9789387511344

2.Pressman, Roger S., Maxim, Bruce R., "Software Engineering: A Practitioner's Approach", 9th Edition, McGraw-Hill Education, 2019, ISBN: 9781259872976

3.Schwaber, Ken, "Agile Project Management with Scrum", Reprint Edition, Microsoft Press, 2019, ISBN: 9780735619937

Reference Book(s):

1.Schwalbe, Kathy, "Information Technology Project Management", 9th Edition, Cengage Learning, 2018, ISBN: 9781337101356

2.Kerzner, Harold, "Project Management: A Systems Approach to Planning, Scheduling, and Controlling", 12th Edition, Wiley, 2022, ISBN: 9781119805373

3.Sommerville, Ian, "Software Engineering", 11th Edition, Pearson Education, 2020, ISBN: 9780137035151

Web Resources:

1.https://www.pmi.org
2.https://www.agilealliance.org
3.https://www.tutorialspoint.com/software_project_management/index.htm
4.https://www.scrum.org/resources/scrum-guide
5.https://www.scrum.org/resources/scrum-guide

Course Outcomes (COs)	Program Outcomes (POs)								Program Specific Outcomes (PSOs)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	2	1	1	1	1	1	3	2	1	1	1
CO2	3	3	2	2	2	1	1	1	3	3	1	1	1
CO3	2	3	2	2	1	1	1	1	2	2	2	1	1
CO4	3	3	2	2	2	1	1	1	3	3	2	1	1
CO5	3	3	2	2	2	1	1	1	3	1	2	1	1
	Overall CO – PO Mapping index = 1.94								**Overall CO – PSO Mapping index = 1.57**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Sem. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
I	25PCS1EC22	4	**Internet of Things**	CC	4	1	-	**3 Hrs.**	**25**	**75**	**100**

Pre-Requisite: Basic knowledge of computer networks, embedded systems, and programming fundamentals.

Course Objectives: The purpose of learning this course is:

1. To provide students with a strong foundation in the principles and technologies of the Internet of Things
2. To prepare students to apply IoT concepts in real-time applications across domains like home automation, smart cities, agriculture, and healthcare.
3. To develop students' technical and analytical skills required to evaluate and apply IoT
4. To cultivate problem-solving abilities and foster innovation in the design of domain-specific IoT
5. To equip students with the knowledge and skills required to design, develop, and implement Internet of Things (IoT)

Course Outcomes:

CO1 Understand the fundamentals and physical architecture of IoT, including protocols and enabling technologies.

CO2: Analyze domain-specific IoT applications across different sectors such as home, city, agriculture, and logistics.

CO3: Differentiate IoT and M2M, and explain concepts like SDN, NFV, and IoT system management.

CO4: Apply IoT system design methodology for developing end-to-end IoT application.

CO5:Demonstrate the design and deployment of IoT solutions through case studies in various domains

Unit-I **Introduction to Internet of Things** 12 Hrs.

Introduction to Internet of Things: Introduction-Definition & characteristics of IoT- Physical design of IoT: Things in IoT, IoT protocols– IoT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, *Communication Protocols and Embedded Systems

Unit-II **Domain Specific IoTs** 12 Hrs.

Domain Specific IoTs: Introduction- Home Automation-Smart Lighting-Smart Appliances-Intrusion Detection, Cities- smart parking – smart lighting- smart roads Retail-Inventory Management- Smart Payments- Smart Vending Machines, Logistics-Route Generation and scheduling-shipment monitoring Agriculture Smart Irrigation-*Green house control*

Unit-III **IOT and M2M** 12 Hrs.

IOT and M2M- M2M- Difference between IoT and M2M- SDN and NFV for IoTSoftware Defined Networking- Network Function Virtualization, IoT System Management with Netconf-Yang- Need for IoT Systems Management- Simple Network Management Protocol(SNMP)-Limitations of SNMP- *Network Operator Requirements*

Unit-IV **IOT Design Methodology** 12 Hrs.

IOT Design Methodology: Introduction, Purpose And Require Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specification, IOT Level Specification, Functional View Specification, Operational View Specification, Device And Component Integration And Application Development, *Case study on IOT system for whether monitoring*.

Unit-V **Case studies illustrating IoT design** 12 Hrs.

Case studies illustrating IoT design: Introduction -Home Automation: Smart lighting, Home Intrusion Detection- Cities: Smart Parking, Environment: Whether Monitoring System, Whether reporting Bot, Air Pollution Monitoring, Forest Fire Detection. Agriculture- *Smart Irrigation*

Text Book(s):

1. ArshdeepBahga and Vijay Madisetti -Internet of Things: A Hands-On Approach1st Edition, Reprint 2021
2. Universities Press,ISBN: 9789386235657
3. **S.** Misra, A. Mukherjee, and M. S. Obaidat, *Internet of Things: Design and Applications*, Springer, 2021, ISBN: 978-3030679162
4. O. Vermesan and P. Friess (Eds.)**,** *Internet of Things: The Call of the Edge: Everything Intelligent Everywhere*, River Publishers, 2020, ISBN: 978-8770221994
5. B. Mukherjee, *Internet of Things (IoT): Architecture and Applications*, CRC Press, 2022, ISBN: 978-1032242393

Reference Book(s):

1. H. N. Pham and L. L. Bello, *Fundamentals of IoT and Wearable Technology Design*, Wiley, 2021, ISBN: 978-1119649947
2. J. C. Augusto (Ed.), *Handbook of Smart Homes, Health Care and Well-Being*, 2nd Edition, Springer, 2021, ISBN: 978-3030733000
3. P. Raj and A. C. Nayyar, *Internet of Things and Big Data Analytics Toward Next-Generation Intelligence*, Springer, 2020, ISBN: 978-3030021220
4. R. Buyya, A. S. Ranjan, and R. N. Calheiros, *Internet of Things: Principles and Paradigms*, 2nd Edition, Morgan Kaufmann, 2022, ISBN: 978-0128206050

Web Resources:

1. https://www.iotforall.com
2. https://iot.ieee.org
3. https://learn.microsoft.com/en-us/azure/iot-fundamentals/
4. https://www.ibm.com/internet-of-things
5. https://nptel.ac.in/courses/106105166

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Course Outcomes (COs)	Program Outcomes (**POs**)								Program Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	1	1	1	1	2	3	3	3	1	2	3
CO2	2	3	2	2	2	2	1	2	1	2	1	3	1
CO3	3	2	1	1	1	1	1	3	3	3	1	2	3
CO4	3	3	2	3	2	2	3	3	3	3	2	3	3
CO5	2	3	2	2	3	2	2	3	1	2	2	3	3
	Overall CO – PO Mapping index = 2.04								**Overall CO – PSO Mapping index = 1.82**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Sem. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	25PCS2CC3	5	**Artificial Intelligence and Machine Learning**	CC	5	1		**3 Hrs.**	**25**	**75**	**100**

Pre-Requisite: Basic Knowledge of Mathematics, Python Programming and Data Structure is required.

Course Objectives: The purpose of learning this course is:

1. Provide a deep understanding of Artificial Intelligence and Machine Learning concepts.
2. Develop skills to implement ML algorithms to solve real-world problems.
3. Foster ability to evaluate and compare different models for a given task.
4. Prepare graduates to handle large, complex, and unstructured datasets.
5. Encourage research, innovation, and application of AI techniques across various sectors.

Course Outcomes:

CO1: Apply AI principles, knowledge representation, and problem-solving techniques to real-world tasks using appropriate tools.

CO2: Design and implement machine learning algorithms for classification, prediction, and pattern discovery.

CO3: Develop intelligent systems capable of learning and adapting to changing environments using modern AI technologies.

CO4: Analyse, evaluate, and select appropriate algorithms and models to solve complex real-world problems across domains.

CO5: Engage in research and innovation by applying AI knowledge to develop novel solutions, encouraging lifelong learning and ethics.

Unit-I	**Introduction**	12Hrs.

AI Problems – AI Techniques. Problems, Problem spaces, and Search: Problem Characteristics – Issues in the Design of Search Program. Heuristic Search Techniques: Hill Climbing – Best-First Search – Problem Reduction – Constraint Satisfaction – Means-ends Analysis.

Unit-II	**Knowledge Representation**	12 Hrs.

Knowledge Representation Issues: Representations and Mappings – Approaches to Knowledge Representation – Issues in Knowledge Representation. Using Predicate Logic: Representing Simple Facts in Logic – Computable Functions and Predicates. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge – Logic Programming – Forward Versus Backward Reasoning – Matching – Control Knowledge.

Unit-III	**Machine Learning: Introduction**	12 Hrs.

Designing a Learning System – Perspectives and Issues in Machine Learning. Decision Tree Learning: Decision Tree Representation – The Basic Decision Tree Learning Algorithm – Hypothesis Space Search in Decision Tree Learning – Issues in Decision Tree Learning. Artificial Neural Networks: Introduction – Multilayer Networks and the Backpropagation Algorithm – Remarks on the Backpropagation Algorithm.

Unit-IV	**Bayesian Learning and Computational Learning**	12 Hrs.

Bayes Theorem – Concept Learning – Maximum Likelihood and Least-Squared Error Hypotheses – Maximum Likelihood Hypothesis for Predicting Probabilities – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Networks – The EM Algorithm – Probability Learning – Sample Complexity for Finite Hypothesis Spaces – Sample Complexity for Infinite Hypothesis Spaces – Mistake Bound Model of Learning.

Unit-V	**Instant Based Learning and Genetic Algorithm**	12 Hrs.

Introduction – k-Nearest Neighbour Learning – Locally Weighted Regression – Radial Basis Functions – Case-Based Reasoning. Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning – Parallelizing Genetic Algorithms.

Text Book(s):

1. Elaine Rich, Kevin Knight, Shivashankar B Nair, "Artifical Intelligence", 3rd Edition, McGraw Hill Education, 2017, ISBN: 978-0070087705.
2. Tom M. Mitchell, "Machine Learning", 1st Edition, McGraw-Hill Education Private Limited, 2017, ISBN: 978-1259096952.
3. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", 4th Edition, Pearson Education, 2022, ISBN: 978-9356063570.

Reference Book(s):

1. Melanie Mitchell, "Artificial Intelligence – A Guide for Thinking Humans", Pelican, 2020, ISBN: 978-0241404836.
2. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, "Machine Learning", 2nd Edition, Pearson Education, 2024, ISBN: 978-8119896738.
3. Reema Thareja, "Artificial Intelligence: Beyond Classical AI", Pearson Education, 2024, ISBN: 978-9356069329.

Web Resources:

1. https://www.ibm.com/think/topics/artificial-intelligence
2. https://www.elspub.com/journals/ai-materials/home
3. https://onlinecourses.nptel.ac.in/noc25_mm37/preview

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Course Outcomes (COs)	Programme Outcomes (POs)								Program Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2	2	2	3	3	3	2	3	3
CO2	3	3	3	2	2	2	2	3	3	3	2	3	3
CO3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO4	3	3	3	2	2	2	2	3	3	3	3	3	3
CO5	3	3	3	3	2	3	3	3	3	3	3	3	3
	Overall CO – PO Mapping index = 2.60								**Overall CO – PSO Mapping index = 2.88**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Exam Hrs	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total
II	25PCS2CC4	5	**Research Methodology**	Core Course	4	1	-	**3 Hrs.**	**25**	**75**	**100**

Pre-Requisite: Basic understanding of scientific principles and critical thinking skills.

Course Objectives: The purpose of learning this course is:

1. To understand the fundamentals and significance of research methodology and distinguish between different types of research.
2. To develop the ability to design effective research studies, including sampling strategies and planning techniques.
3. To gain knowledge of various primary and secondary data collection methods and their practical applications.
4. To apply statistical tools and techniques for analyzing and interpreting research data effectively.
5. To learn the structure and components of academic report writing, including formatting, ethics, and presentation skills.

Course Outcomes:

CO1 : Explain the concepts, objectives, and classifications of research.

CO2 : Design appropriate research models and sampling frameworks for specific problems.

CO3 : Identify and apply suitable data collection methods for different types of research.

CO4 : Analyze data using statistical tools such as correlation, regression, and measures of dispersion.

CO5 : Prepare and present research findings in a well-structured report using academic conventions.

Unit-I	Basics of Research Methodology	12 Hrs.

Research Methodology: An introduction – Meaning of Research – Objectives of Research – Motivation in Research – Types of Research – Research Approaches – Significance of Research – Research methods versus methodology.

Unit-II	Research Design	12 Hrs.

Research Design – Meaning –needs – features – Important topics related to Research Design Types-Principles-Sample Design: Steps – Criteria for selecting a sample design – criteria for good sample design.

Unit-III	Data Collection	12 Hrs.

Methods of Data Collection – Collection of primary data – Collection of data through questionnaires – Schedules – Differentiation between questionnaires and schedules – Other methods of data collection – Collection of secondary data – Selection of appropriate method for data collection– Data Collection using Journals.

Unit-IV	Analyzing of Data	12 Hrs.

Processing Operations - Some Problems in Processing - Elements/Types of Analysis - Statistics in Research - Measures of Central Tendency -Measures of Dispersion -Measures of Relationship - Simple Regression Analysis -Multiple Correlation and Regression – Partial Correlation.

Unit-V	Significance of Report Writing	12 Hrs.

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 – Precautions for writing a Research Reports – Conclusions.

Text Book(s):

1. Dr. C. R. Kothari & Dr. Gaurav Garg, Research Methodology – Methods and Techniques, 4th Edition, New Age International Publishers, New Delhi, 2019, ISBN: 978-9386649225
2. Dr. Maks Tempe, Writing Research Papers in Computer Science: How to Conduct and Write Up Research to Get Your Paper Accepted for Publication, 1st edition, Independently Published, August 2020, ISBN: 979-8677786082.
3. Sarah J. Tracy, Qualitative Research Methods: Collecting Evidence, Crafting Analysis, Communicating Impact, 2nd Edition, Wiley-Blackwell, USA, 2020, ISBN: 978-1119390787.

Reference Book(s):

1. Felice D. Billups, Qualitative Data Collection Tools: Design, Development, and Applications, 1st Edition, SAGE Publications, California, 2020, ISBN: 978-1544342584(Unit III).
2. Dr. Ivo D. Dinov, Data Science and Predictive Analytics: Biomedical and Health Applications using R, 2nd Edition, Springer International Publishing, Switzerland, 2023, ISBN: 978-3031174827 (Unit IV).
3. Dr. Harris Cooper (Editor), APA Handbook of Research Methods in Psychology, 2nd Edition, American Psychological Association, Washington D.C., 2023, ISBN: 978-1433838964(Unit V).

Web Resources:

1. C.R. Kothari – Research Methodology (New Age International)
   https://www.newagepublishers.com/servlet/nagetbiblio?bno=000102
2. SpringerLink – Data Science and Predictive Analytics by Ivo Dinov
   https://link.springer.com/book/10.1007/978-3-031-17483-4
3. SAGE Publications – Qualitative Data Collection Tools
   https://us.sagepub.com/en-us/nam/qualitative-data-collection-tools/book254068
4. Research Methodology – Explorable.com
   https://explorable.com/research-methodology
5. UCL – Guidelines for Report Writing
   https://www.ucl.ac.uk/teaching-learning/publications/2020/jan/report-writing

Course Outcomes (COs)	Program Outcomes (**POs**)								Program Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	3	1	1	3	2	2	2	2	3	2	2
CO2	3	3	3	2	2	2	2	3	3	3	3	3	3
CO3	2	3	3	2	1	2	2	2	3	2	2	2	3
CO4	3	3	3	1	2	1	2	3	3	3	3	2	3
3CO5	2	2	3	2	3	3	2	2	2	3	3	2	2
	Overall CO – PO Mapping index = 2.8								**Overall CO – PSO Mapping index = 2.7**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Se	Course Code	Credits	Title of the Course	AC/CC/DE/ ES / GS / NME/ PF / PW / VAC/ VE / SE / WK	Category			Sem. Exam	Max. Marks		
					Lect. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	25PCS2EC31	4	**DATA MINING AND DATA WAREHOUSING**	Core Course	4	1	-	**3 Hrs.**	**25**	**75**	**100**

Pre-Requisite: Basic understanding of databases, statistics, and programming concepts.

Course Objectives: The purpose of learning this course is:

1. Enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing
2. Develop skills of using recent data mining software for solving practical problems
3. Develop and apply critical thinking, problem-solving, and decision-making skills.
4. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.
5. Master data mining techniques in various applications like social, scientific and environmental context.

Course Outcomes:

CO1: Underset and the basic data mining techniques and algorithms

CO2: Underset and the Association rules, Clustering techniques and Data ware housing contents

CO3: Compare and evaluate different data mining techniques like classification, prediction, Clustering and association rule mining

CO4: Design data ware house with dimensional modelling and apply OLAP operations

CO5: Identify appropriate data mining algorithms to solve real world problems

Unit-I	**BASICS AND TECHNIQUES**	12 Hrs.

Basic data mining tasks – data mining versus knowledge-discovery in databases – data mining issues – data mining metrics – social implications of data-mining – data mining from a database perspective. Data mining techniques: Introduction – a statistical perspective on data mining – similarity measures – decision trees – neural networks –genetic algorithms.

Unit-II	**ALGORITHMS CLASSIFICATION**	12Hrs.

Introduction –Statistical –based algorithms -distance based algorithms-decision tree-based algorithms-neural network–based algorithms–rule-based algorithms–combining-techniques.

Unit-III	**DATA MINING CLUSTERING AND ASSOCIATION**	12 Hrs.

Clustering: Introduction– Similarity and Distance Measures–Outliers–Hierarchical Algorithms –Partitioned Algorithms. Association rules: Introduction - large item sets - basic algorithms – parallel &distributed algorithms – comparing approaches- incremental rules – advanced association rules techniques – measuring the quality of rules.

Unit-IV	**DATAWARE HOUSING AND MODELING**	12 Hrs.

Data ware housing: introduction characteristics of data warehouse–data marts–other aspects of data mart. Online analytical processing :introduction -OLTP&OLA P systems Data modeling –star schema for multidimensional view –data modeling – multifactstar schema or snow flake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet

Unit-V	**APPLICATIONS OF DATA WAREHOUSE**	12 Hrs.

Developing a data WAREHOUSE: why and how to build a data warehouse –data warehouse architectural strategies and organization issues - design consideration – data content – metadata distribution of data – tools for data warehousing – performance considerations – crucial decisions in designing a data warehouse. Applications of data warehousing and data mining in government: Introduction - national data warehouses – other areas for data warehousing and data mining.

Text Book(s):

1. MargaretH.Dunham,"DataMining:IntroductoryandAdvancedTopics",Pearson education,2003
2. C.S.R. Prabhu, "Data Warehousing Concepts, Techniques, Products and Applications", PHI, Second Edition.

Reference Book(s):

1. ArunK.Pujari,“Data Mining Techniques”, Universities Press(India)Pvt. Ltd.,2003.
2. AlexBerson, StephenJ.Smith,“DataWarehousing,DataMiningandOLAP”,TMCH, 2001.

Web Resources:

1. https://www.javatpoint.com/data-warehouse
2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/
3.https://www.btechguru.com/training--it--database-management-systems--file-structures- introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.htm

Course Outcomes (COs)	Program Outcomes (POs)								Program Specific Outcomes (PSOs)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	2	3	2	1	1	2	3	1	3	2	1	3	2
CO2	2	3	2	1	1	2	3	1	3	3	2	3	2
CO3	3	3	3	2	2	3	3	1	3	3	2	3	3
CO4	3	3	2	1	3	2	3	2	3	2	3	3	3
CO5	3	3	3	2	2	3	3	1	1	3	3	3	3
	Overall CO – PO Mapping index = 2.8								**Overall CO – PSO Mapping index = 2.76**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Sem. Exam Hrs	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	25PCS2EC32	4	**Mobile Application Development**	Core Course	4	1	-	**3 Hrs.**	**25**	**75**	**100**

Pre-Requisite: Mobile computing requires portable devices, wireless communication and reliable internet connectivity.

Course Objectives:

The purpose of learning this course is:

1. To understand the need and characteristics of mobile applications..
2. To design the right user interface for mobile applications.
3. To understand the design issues in the development of mobile applications.
4. To understand the development procedure for mobile applications.
5. To develop mobile applications using various tools and platforms.

Course Outcomes:

CO1: Understand the basics of mobile application development frameworks and tools.

CO2: Develop a UI for mobile applications.

CO3: Design mobile applications that manage memory dynamically.

CO4 Build applications based on mobile OS like Android, iOs.

CO5 Build location based services.

Unit-I	**Introduction**	10 Hrs.

Mobile Application Model – Infrastructure and Managing Resources – Mobile Device Profiles – Frameworks and Tools

Unit-II	**USER INTERFACE**	12 Hrs.

Generic UI Development - Multimodal and Multichannel UI –Gesture Based UI – Screen Elements and Layouts – Voice XML.

Unit-III	**APPLICATION DESIGN**	14 Hrs.

Memory Management – Design Patterns for Limited Memory – Workflow for Application development – Java API – Dynamic Linking – Plugins and rule of thumb for using DLLs – Multithreading in Java - Concurrency and Resource Management.

Unit-IV	**Mobile OS**	14Hrs.

Mobile OS: Android, iOS – Android Application Architecture – Understanding the anatomy of a mobile application - Android basic components –Intents and Services – Storing and Retrieving data – Packaging and Deployment – Security and Hacking.

Unit-V	**APPLICATION DEVELOPMENT**	10 Hrs.

Communication via the Web – Notification and Alarms – Graphics and Multimedia: Layer Animation, Event handling and Graphics services – Telephony – Location based services.

Text Book(s):

1. Reto Meier, Ian Lake, “Professional Android”, 4th Edition, Wrox, 2018.
2. Zigurd Mednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, “Programming Android”, O’Reilly, 2nd Edition, 2012.

Reference Book(s):

1. Alasdair Allan, “Learning iOS Programming”, O’Reilly, Third Edition, 2013.

2. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, Android Programming: The Big Nerd Ranch Guide, 4th edition, 2019.
3.Christian Keur, Aaron Hillegass, iOS Programming: The Big Nerd Ranch Guide, 6th Edition, O’Reilly, 2016.
4. Barry Burd, “Android Application Development All-In-One for Dummies”, 3rd Edition, 2021.

Web Resources:

1. http://www.scribd.com
2. http://www.geeksforgeeks.org
3. https://mrcet.com/downloads/digital_notes
4. https://www.sciencedirect.com/topics/computer-science/mobile-computing
5. https://www.tutorialspoint.com

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Course Outcomes (COs)	Program Outcomes (**POs**)								Program Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	2	1	2	3	2	3	2	3	3	3
CO2	3	2	3	2	2	2	3	2	3	2	3	3	3
CO3	3	3	3	3	3	2	3	3	3	2	3	3	3
CO4	3	3	3	3	3	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3
	Overall CO – PO Mapping index = 2.025								**Overall CO – PSO Mapping index = 2.48**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Sem. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	25PCS2CCP2	2	**Artificial Intelligence and Machine Learning Lab**	CC	-	-	3	**3 Hrs.**	**40**	**60**	**100**

Pre-Requisite: Basic Proficiency in Python Programming along with the foundational knowledge of algorithms, Data Structures and core AI/ML concepts required.

Course Objectives: The purpose of learning this course is:

1. 1. To translate theoretical knowledge into practice through coding and experimentation.
2. To enable students to apply algorithms to solve real-world problems**.**
3. To enhance problem-solving and analytical skills using Machine Learning techniques.
4. To familiarize students with open-source libraries and toolkits for developing intelligent applications.
5. To provide a platform for exploring, validating, and optimizing algorithm performance**.**

Course Outcomes:

CO1: Implement key AI and ML algorithms using appropriate toolkits.

CO2: Apply machine learning models to real-world datasets and assess their outcomes.

CO3: Evaluate model performance using appropriate metrics and improve accuracy through tuning.

CO4: Perform data cleaning, transformation, and feature engineering for ML tasks.

CO5: Develop and demonstrate mini-projects or working prototypes using intelligent systems.

List of Programs:

1	Write a program to 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.	4 Hrs.
2	Write a program 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.	5 Hrs.
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 Hrs.
4	Write a program to build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.	4 Hrs.
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.	4 Hrs.
6	Write a program to assuming 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.	5 Hrs.
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 Dataset use Java/Python ML library classes/API.	4 Hrs.

Course Outcomes (COs)	Programme Outcomes (POs)								Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	1	2	3	3	3	3	2	3	3
CO2	3	3	3	2	2	2	3	3	3	3	2	3	3
CO3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO4	3	3	2	1	1	2	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3
	Overall CO – PO Mapping index = 2.69								**Overall CO – PSO Mapping index = 2.87**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	AC/CC/DE/ ES / GS / NME/ PF / PW / VAC/ VE / SE / WK	Category			Exam	Max. Marks		
					Lect. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	23PCS2EC41	2	**DATA MINING LAB USING R**		-	-	3	**3 Hrs.**	**25**	**75**	**100**

Pre-Requisite: Basic understanding of statistics, linear algebra, and programming (preferably in Python). Let me know if you want variations focused more on tools, math, or ML concepts.

urse Objectives: The purpose of learning this course is:

1. To enable the students to learn the concepts of Data Mining algorithms namely classification, clustering, regression
2. To understand & write programs using the DM algorithms
3. To apply statistical interpretations for the solutions
4. Able to use visualizations techniques for interpretations
5. Data Visualization: R offers powerful tools for creating visual representations of data

Course Outcomes:

CO1: Able to write programs using R for Association rules, Clustering techniques

CO2: To implement data mining techniques like classification, prediction

CO3: Able to use different visualizations techniques using R

CO4: To apply different data mining algorithms to solve real world applications

CO5: The data mining process and important issues around data cleaning, pre-processing and Integration

Sno	List of programs	Hours
1	Implement Apriority algorithm to extract association rule of data mining.	4 Hrs.
2	Implement k-means clustering technique.	5 Hrs.
3	Implement any one Hierarchal Clustering.	4 Hrs.
4	Implement Classification algorithm.	4 Hrs.
5	Implement Decision Tree.	4 Hrs.
6	Linear Regression.	5 Hrs.
7	Data Visualization	4 Hrs.

Course Outcomes (COs)	Program Outcomes (**POs**)								Programme Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	2	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	2	3	3	2	3	2	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	2	3	2
CO4	3	2	3	3	3	2	3	3	3	3	3	2	3
CO5	3	3	3	2	3	3	2	3	3	2	3	3	3
	Overall CO – PO Mapping index = 2.8								**Overall CO – PSO Mapping index = 2.76**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE SE / GS / EVS VE / VAC	Category			Sem. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
I	25PCS2EP32	2	**Mobile Application Development Lab**	CC	-	-	3	**3 Hrs.**	**40**	**60**	**100**

Pre-Requisite: Basic knowledge of Java, object-oriented programming, and fundamental Android concepts is required.

Course Objectives: The purpose of learning this course is:

1. To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles
2. Learn the basic and important design concepts and issues of development of mobile applications.
3. To prepare students understanding of the fundamentals of Android operating systems
4. Install and configure Android application development tools Like Android Studio and Eclipse IDE.
5. Learn the basic and important design concepts and issues of development of Mobile applications.

Course Outcomes:

CO1 Develop user-friendly mobile applications using GUI components, colors, fonts, layout managers, and event-driven programming.

CO2: Design and implement native applications that integrate core Android features such as multithreading, GPS, and SD card storage.

CO3: Use system services like SMS, email, and alert notifications to build communication-enabled apps.

CO4: Integrate external data sources such as databases and RSS feeds into mobile applications

CO5: Apply mobile application development tools, frameworks, and principles to create real-time, interactive solutions aligned with modern trends.

List of Experiments:

Sno	List of programs	Hours
1	Develop an application that uses GUI components, Font and Colors	3 Hrs.
2	Develop an application that uses Layout Managers and event listeners.	3 Hrs.
3	Develop a native calculator application.	3 Hrs.
4	Write an application that draws basic graphical primitives on the screen.	3 Hrs.
5	Develop an application that makes use of database	3 Hrs.
6	Develop an application that makes use of RSS Feed	3 Hrs.
7	Implement an application that implements Multi-threading	3 Hrs.
8	Develop a native application that uses GPS location information.	3 Hrs.
9	Implement an application that writes data to the SD card	3 Hrs.
10	Implement an application that creates an alert upon receiving a message.	3 Hrs.

Course Outcomes (COs)	Program Outcomes (**POs**)								Program Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	1	1	2	1	2	1	2	3	2	2	2
CO2	3	3	2	1	2	2	2	3	3	3	1	3	3
CO3	3	3	2	2	2	2	2	3	3	3	2	3	3
CO4	3	3	2	1	1	2	3	3	3	3	2	3	3
CO5	3	3	3	2	2	3	3	3	3	3	3	3	3
	Overall CO – PO Mapping index = 2.15								**Overall CO – PSO Mapping index = 2.68**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Exam.	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	25PCS2EC41	4	**Open Source software**	SE	4	1	-	**3 Hrs.**	**25**	**75**	**100**

Pre-Requisite: Fundamental programming skills are required.

Course Objectives: The purpose of learning this course is:

1. To introduce the concept of open source software and explain its benefits and uses.
2. To teach the basic features and working of the Linux operating system.
3. To help students learn how to use MySQL for database creation and management.
4. To develop skills in writing web applications using PHP programming.
5. To provide knowledge on using Python and Perl for programming and scripting tasks.

Course Outcomes:

CO1: Understand what open source software is and how Linux works.

CO2: Learn how to use MySQL to create and manage databases.

CO3: Write simple web programs using PHP and connect them to databases.

CO4: Write basic Python programs using loops, functions, and files.

CO5: Use Perl to write scripts for working with text and files.

Unit-I	**INTRODUCTION**	12 Hrs.

Introduction to Open sources – Need of Open Sources – Advantages of Open Sources – Applicatio systems: LINUX: Introduction – General Overview – Kernel Mode and user mode – Process – Advanc Cloning – Signals – Development with Linux.

Unit-II	**OPEN SOURCE DATABASE**	12 Hrs.

MySQL: Introduction – Setting up account – Starting, terminating and writing your own SQL programs with strings – Date and Time – Sorting Query Results – Generating Summary – Working with metadata – Using sequences – MySQL and Web.

Unit-III	**OPEN SOURCE PROGRAMMING LANGUAGES : PHP**	12 Hrs.

Programming in web environment – variables – constants – data;types – operators – Statements – Functions – Arrays – OOP – String Manipulation and regular expression – File handling and data storage – PHP and SQL database – PHP and LDAP – PHP Connectivity – Sending and receiving E-mails – Debugging and error handling – Security – Templates.

Unit-IV	**OPEN SOURCE PROGRAMMING LANGUAGES : PYTHON**	12 Hrs.

Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment.

Unit-V	**OPEN SOURCE PROGRAMMING LANGUAGES : PERL**	12 Hrs.

Perl backgrounder – Perl overview – Perl parsing rules – Variables and Data – Statements and Control structures – Subroutines, Packages, and Modules- Working with Files – Data Manipulation.

Text Book(s):

1. Paul Kavanagh, *"Open Source Software: Implementation and Management"*, Elsevier, Reprint Edition, 2019.
2. W. Jason Gilmore, *"Beginning PHP and MySQL: From Novice to Professional"*, Apress, Fifth Edition, 2019.
3. Mark Lutz**,** *"Learning Python"*, O'Reilly Media, Fifth Edition, 2020.

Reference Book(s):

1. Robert Love**,** *"Linux Kernel Development"*, Addison-Wesley, Third Edition**,** Reprinted 2019.
2. Larry Wall, Tom Christiansen, Jon Orwant**,** *"Programming Perl"*, O'Reilly Media, Fourth Edition, Reprinted 2020.
3. Luke Welling, Laura Thomson**,** *"PHP and MySQL Web Development"*, Addison-Wesley, Fifth Edition, Reprint 2021.

Web Resources:

1. *Opensource.com*, "What is Open Source?", https://opensource.com, Accessed August 2025.
2. *MySQL Official Website*, "MySQL Documentation", https://www.mysql.com, Accessed August 2025.
3. *PHP.net*, "PHP Manual", https://www.php.net, Accessed August 2025.
4. *Python.org*, "Python 3 Documentation", https://docs.python.org/3/, Accessed August 2025.
5. *Perldoc*, "Perl Documentation", https://perldoc.perl.org, Accessed August 2025.

Course Outcomes (COs)	Program Outcomes (POs)								Program Specific Outcomes (PSOs)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	2	2	2	3	2	3	2	3	3	2
CO2	3	3	3	3	2	2	3	2	3	3	3	3	3
CO3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	2	3	2	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	3	3	3
	Overall CO – PO Mapping index = 2.8								**Overall CO – PSO Mapping index = 2.76**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by **Checked by** **HoD**

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Exam.	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	25PCS2EC42	4	**Social Networks and Law**	SE	4	-	-	**3 Hrs.**	**25**	**75**	**100**

Pre-Requisite: Basic understanding of law, digital communication, and internet technologies.

Course Objectives: The purpose of learning this course is:

1. Understand the nature and function of social networks in modern society and their role in communication, business, and governance
2. Examine the legal challenges and implications posed by social media usage, including privacy violations, hate speech, misinformation, and cyber bullying.
3. Analyze relevant national and international laws that govern social media platforms, user behavior, and platform responsibilities.
4. Evaluate ethical issues involved in the use and governance of social networks.
5. Equip students with the ability to critically assess case law, legislation, and regulatory responses related to online social interaction.

Course Outcomes:

CO1: Identify and explain key legal concepts and principles applicable to social networking platforms.

CO2: Critically analyze the legal risks and responsibilities associated with the use of social media by individuals, Corporations and governments.

CO3: Apply relevant laws to real-world case studies, demonstrating an understanding of issues like data Protection, freedom of expression, defamation, and cybercrimes.

CO4: Develop informed opinions and arguments about regulatory approaches to social networks, including self-Regulation, platform liability, and government intervention.

CO5: Demonstrate awareness of international variations in laws and policies regulating social media content and User behavior.

Unit-I **Introduction to Social Networks and Legal Frameworks** 12 Hrs.

Evolution and types of social networks – Legal definitions: Social media – intermediaries – platforms – Jurisdiction and cross – border legal issues – Digital identity and online communities – Overview of key legal systems.

Unit-II **Free Speech, Censorship, and content Regulation** 12 Hrs.

Freedom of expression: National constitutions vs. platform policies – Government regulation vs. private moderation – Hate speech – misinformation – and political content – Transparency – algorithmic bias – and shadow banning.

Unit-III **Privacy, Data Protection, and Surveillance** 12 Hrs.

Data protection laws: GDPR – CCPA – IT Rules – Informed consent – cookies – third-party access – User profiling – targeted ads – and surveillance capitalism – State surveillance via social platforms– Children's privacy and social media.

Unit-IV **Cybercrimes, Defamation, and Harassment** 12 Hrs.

Online defamation and liability of users and platforms–Cyber bullying – trolling – and revenge porn – Legal remedies and criminal liabilities – Role of intermediaries in content takedown – Case studies on social media abuse.

Unit-V **Intellectual Property and Emerging Legal Issues** 12 Hrs.

Copyright infringement and DMCA – Trademark misuse, memes, and parody – AI-generated content and legal personhood – Disinformation – deep fakes, and election interference – Future challenges: Decentralized platforms – block chain based social media.

Text Book(s):

1. Stewart, Daxton R., Social Media and the Law: A Guidebook for Communication Students and Professionals, 3rd edition, Taylor & Francis, 2022, ISBN: 9781000684384.
2. Robert, Ebi, Social Media Law, ACER Writing House, 2024, ISBN: 9789787655764.
3. Lipschultz, Jeremy Harris, Social Media Law and Ethics, Routledge, 2021, ISBN: 9781000406399.
4. Furi-Perry, Ursula, Social Media Law: A Handbook of Cases & Use, 3rd edition, American Bar Association, 2023, ISBN: 978-1627223423.
5. Garcia, Ryan & Hoffmeister, Thaddeus A., Social Media Law in a Nutshell, 2nd edition, West Academic Publishing, 2022, ISBN: 978-1647084042.

Reference Book(s):

1. Hoffmeister, Thaddeus, Social Media Law in a Nutshell, 2nd edition, West Academic Publishing, 2022, ISBN: 9781647084042.
2. Jacobowitz, Jan L., Browning, John G., Legal Ethics and Social Media: A Practitioner's Handbook, 2nd edition, American Bar Association, 2023, ISBN: 9781639051960.
3. Smith, Marcus & Urbas, Gregor, Social Media and Communications, Cambridge University Press, 2021, ISBN: 978-1108816014.
4. Cruz, Ana, Digital and Social Media Marketing: A Results-Driven Approach, 2nd edition, Taylor & Francis, 2020, ISBN: 978-0367236021.
5. Tuten, Tracy, Social Media Marketing, 4th edition, SAGE Publications Limited, 2020, ISBN: 978-1529731996.

Web Resources:

1. https://www.eff.org/
2. https://www.ftc.gov/news-events/media-resources/truth-advertising/advertising-social-media
3. https://cyber.harvard.edu/
4. https://www.ssrn.com/index.cfm/en/
5. https://www.lawfaremedia.org/

Course Outcomes (COs)	Program Outcomes (POs)								Program Specific Outcomes (PSOs)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	2	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	2	3	3	2	3	2	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	2	3	2
CO4	3	2	3	3	3	2	3	3	3	3	3	2	3
CO5	3	3	3	2	3	3	2	3	3	2	3	3	3
	Overall CO – PO Mapping index = 2.8								**Overall CO – PSO Mapping index = 2.76**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Exam Hrs	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total
II	23PCS3NME21	2	INTRODUCTION TO DATA SCIENCE	Core Course	2	-	-	3 Hrs.	25	75	100

Pre-Requisite: Basic knowledge of statistics and programming fundamentals (preferably in Python).

Course Objectives:

1. Students will develop relevant programming abilities.
2. Students will demonstrate proficiency with statistical analysis of data.
3. Students will develop the ability to build and assess data-based models
4. Students will execute statistical analyses with professional statistical software
5. Students will execute Machine Learning algorithm.

Course Outcomes:

CO1: Understand the concept and significance of data science

CO2: Perform data cleaning and preprocessing

CO3: Utilize data visualization techniques for EDA

CO4: Apply statistical concepts for data analysis

CO5: Apply supervised and unsupervised learning algorithms

Unit-I	**Introduction to Data Science**	6 Hrs.

Definition and scope of data science-Data science process and lifecycle-Ethical considerations in data science.

Unit-II	**Data Acquisition and Cleaning**	6 Hrs.

Data sources and types -Data acquisition techniques (e.g., web scraping, APIs)-Data cleaning and pre-processing techniques.

Unit-III	**Exploratory Data Analysis (EDA)**	6 Hrs.

Descriptive statistics and data visualization EDA techniques (e.g., histograms, scatter plots)-Handling missing values and outliers.

Unit-IV	**Statistical Analysis and Modeling**	6 Hrs.

Probability and statistical concepts-Hypothesis testing and significance-Regression analysis and predictive modelling.

Unit-V	**Machine Learning**	6 Hrs.

Supervised and unsupervised learning algorithms-Model training and evaluation-Feature selection and dimensionality reduction.

Text Book(s):

1. Thareja, Reema, Malik, Latesh, "Data Science and Machine Learning Using Python", 1st Edition, McGraw Hill Education (India), 2022, ISBN: 9789355322142
2. Dua, Amit, Ayub, Umair, "Beginning with Machine Learning", 1st Edition, BPB Publications, 2022, ISBN: 9789355511041
3. Thareja, Reema**,** Malik, Latesh**,** "Data Science and Machine Learning Using Python", 1st Edition, McGraw Hill Education (India), 2022, ISBN: 9789355322142

Reference Book(s):

1. Dangeti, Pratap, “Statistics for Machine Learning”, 1st Edition, Packt Publishing, 2017, ISBN: 9781788295758 amazon.in
2. Arora, Sandhya, Malik, Latesh, “Data Science and Analytics with Python”, 1st Edition, BPB Publications, 2024, ISBN: 9789393330344
3. Shastri, V. Harsha, Sreeprada, V., Udhayakumar, T., Ananth, K. R., “A Textbook on Big Data Analytics”, 1st Edition, Notion Press, 2023, ISBN: 9798889517528 flipkart.com
4. Raju, C., “Data Science: A Beginner’s Guide”, 1st Edition, Self-Published, 2023, Kindle ISBN: B0CD82TFX7

Web Resources:

1. NPTEL – Introduction to Data Science (IIT Madras) : https://nptel.ac.in/courses/106/106/106106212
2. Kaggle – Data Science Learning Paths & Datasets: https://www.kaggle.com/learn
3. Analytics Vidhya – Data Science and ML Articles: https://www.analyticsvidhya.com
4. Scikit-learn Official Documentation : https://scikit-learn.org/stable/user_guide.html

Course Outcomes (COs)	Program Outcomes (**POs**)								Program Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	1	2	3	2	2	1	3	3	2	1	1
CO2	3	3	2	3	3	1	2	2	3	3	3	2	3
CO3	3	3	2	1	2	3	2	2	3	3	2	2	1
CO4	3	3	3	2	3	2	3	2	3	3	3	2	2
CO5	3	3	3	3	3	2	2	3	3	3	3	2	2
	Overall CO – PO Mapping index = 2.42								**Overall CO – PSO Mapping index = 2.44**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Sem. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
I	25PCS1VAC	2	Introduction to Cyber Security	VAC	-	-	-	3 Hrs.	50	50	100

Pre-Requisite: Basic knowledge of computer systems, internet, and general IT awareness..

Course Objectives: The purpose of learning this course is:

1. To introduce the fundamental principles of cyber security and key concepts such as threats, vulnerabilities, and risk.
2. To explain network security technologies and protocols.
3. To explore system, application, and cryptographic security measures.
4. To understand cyber laws and data protection regulations.
5. To prepare students for identifying and responding to security incidents effectively.

Course Outcomes:

CO1: Understand the basic concepts and importance of cyber security, including types of attacks and legal frameworks.

CO2: Demonstrate understanding of network security, including firewalls, VPNs, and intrusion detection systems.

CO3: Apply system and application-level security practices to secure computing environments.

CO4: Use basic cryptographic techniques to ensure data confidentiality and integrity.

CO5: Identify cyber threats, apply risk management principles, and implement an incident response plan.

Unit-I	**Introduction**	6 Hrs.

Definition and scope of cyber security – Security goals (CIA Triad) – Types of attacks (malware, phishing, DoS, insider threats)– Role of professionals.

Unit-II	**Network Security Basics**	6 Hrs.

Network fundamentals – TCP/IP, DNS – Network vulnerabilities – Firewalls, IDS/IPS – Virtual Private Networks (VPNs) – Common network attacks

Unit-III	**Application Security**	6 Hrs.

Application security principles – Secure coding practices – Input validation – Common application attacks (e.g., SQL injection, XSS).

Unit-IV	**Cryptography**	6 Hrs.

introduction to cryptography – Symmetric and asymmetric encryption – Hashing – Digital signatures – Public Key Infrastructure (PKI)

Unit-V	**Security Management**	6 Hrs.

Security policies – Risk assessment and mitigation – Security auditing- Cyber forensics basics – Organizational roles and responsibilities in security.

Textbooks:

1. William Stallings, Network Security Essentials: Applications and Standards, Pearson.
2. Chuck Easttom, Computer Security Fundamentals, Pearson.
3. Mark Ciampa, Security+ Guide to Network Security Fundamentals, Cengage.

Reference Books:

1. Matt Bishop, *Computer Security: Art and Science*, Addison-Wesley.
2. Ross Anderson, *Security Engineering*, Wiley.
3. Nina Godbole & Sunit Belapure, *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley.

Web Resources:

1. Cybrary – Free online cyber security courses
2. Khan Academy – Internet Safety
3. OWASP – Open Web Application Security Project

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Sem. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	25PCS2VAC	2	**Natural Language Processing**	VAC	-	-	-	3 Hrs.	50	50	100

Pre-Requisite: Basic understanding of programming, probability, and data structures.

Course Objectives: The purpose of learning this course is:

1. To introduce the foundational concepts of Natural Language Processing and computational linguistics.
2. To familiarize students with syntactic, semantic, and pragmatic processing techniques.
3. To explore machine learning methods applied to NLP tasks.
4. To study applications of NLP like text classification, information retrieval, and machine translation.
5. To develop practical skills in implementing NLP models using Python and popular libraries.

Course Outcomes:

CO1: Understand the fundamental challenges and approaches in NLP.

CO2: Apply tokenization, stemming, lemmatization, and parsing techniques to text.

CO3: Analyze language models and probabilistic methods in NLP.

CO4: Implement classification, clustering, and sequence labeling algorithms for NLP tasks.

CO5: Design solutions for real-world NLP applications including sentiment analysis and machine translation.

Unit-I	**Introduction to Natural Language Processing**	6 Hrs.

Overview of NLP – History and challenges – Language structure: morphology, syntax, semantics – Tokenization, stemming, and lemmatization.

Unit-II	**Syntax and Parsing**	6 Hrs.

Context-free grammars – Part of speech tagging – Parsing algorithms: top-down, bottom-up, CYK parser – Dependency parsing – Syntax trees.

Unit-III	**Language Modeling and Probability**	6 Hrs.

N-gram models – Smoothing techniques – Evaluation metrics – Introduction to probabilistic models – Hidden Markov Models (HMM) for POS tagging.

Unit-IV	**Machine Learning for NLP**	6 Hrs.

Supervised learning: classification and sequence labeling – Conditional Random Fields (CRFs) – Unsupervised learning: clustering – Word embeddings (Word2Vec, GloVe).

Unit-V	**NLP Applications and Advanced Topics**	6 Hrs.

Sentiment analysis – Text classification – Information extraction – Named entity recognition – Machine translation basics – Introduction to neural networks and deep learning in NLP.

Textbooks:

1. Daniel Jurafsky, James H. Martin, *Speech and Language Processing*, 3rd Edition (Draft), Pearson, 2024, ISBN: 978-0131873216
2. Christopher D. Manning, Hinrich Schütze, *Foundations of Statistical Natural Language Processing*, MIT Press, 1999, ISBN: 978-0262133609
3. Steven Bird, Ewan Klein, Edward Loper, *Natural Language Processing with Python*, O'Reilly Media, 2009, ISBN: 978-0596516499

Reference Books:

1. Jacob Eisenstein, *Natural Language Processing*, MIT Press, 2019, ISBN: 978-0262042840
2. Yoav Goldberg, *Neural Network Methods for Natural Language Processing*, Morgan & Claypool, 2017, ISBN: 978-1681732877
3. Tom M. Mitchell, *Machine Learning*, McGraw Hill, 1997, ISBN: 978-0070428072

Web Resources:

1. NLTK Documentation – Python library for NLP
2. Stanford NLP Group – Research and tools in NLP
3. Hugging Face – State-of-the-art NLP models and datasets
4. Coursera – Natural Language Processing Specialization – Deep learning-based NLP courses
5. Kaggle NLP Competitions – Practical NLP challenges and datasets

Prepared by Checked by HoD