SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203,

Tamil Nadu, India

SRM
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)

ACADEMIC CURRICULA

POST GRADUATE DEGREE PROGRAMMES

MASTER OF COMPUTER APPLICATIONS

M.C.A

(Detailed Syllabus for Two Years Courses)

Learning Outcomes based Curriculum Framework (LOCF)

National Credit Framework (NCrF)

Regulations 2025

Faculty of Science and Humanities

Office of the Registrar, SRM IST

Control Copy

Approved in:

70th Executive Council Meeting 29.03.2025

58th Academic Council Meeting 22.02.2025

SURUTTAIA UDAIYAR PONNUSAMY

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REGISTRAR

FACULTY OF SCIENCE AND HUMANITIES

ACADEMIC CURRICULA

POSTGRADUATE DEGREE PROGRAMME
(REGULATIONS - 2025)

MASTER OF COMPUTER APPLICATIONS
M.C.A

Two Years (Full-Time)

National Education Policy
Learning Outcomes based Curriculum Framework
(LOCF)

National Credit Framework

Academic Year
2025 - 2026



SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India

1. Department Vision Statement	
Stmt - 1	*Creating the most conducive environment for imparting quality education in Computer Applications*
Stmt - 2	*Contributing effectively to produce globally competent quality professionals in the field of IT*
Stmt - 3	*Contributing towards preparing young minds to serve community*

2. Department Mission Statement	
Stmt - 1	*Impart student's essential knowledge and skills required for a successful career in Information Technology*
Stmt - 2	*Instill confidence in the students to take up new challenges by grooming them appropriately*
Stmt - 3	*Inculcate in the students a sense of commitment to professional ethics, moral values with emphasis on team work and leadership qualities*
Stmt - 4	*Instill the students with a clear awareness of environmental issues and their relevance to their profession*
Stmt - 5	*Impress upon the students the impact of their work on the nation's economic and social progress*

3. Program Education Objectives (PEO)	
PEO - 1	*Offer the students those skill sets and domain knowledge based on needs of IT and dynamic business environment*
PEO - 2	*Provide the students with the capabilities in the areas of analysis, design, development and testing*
PEO - 3	*Kindle the minds of students to take up research and development in Computer Applications with missionary zeal*
PEO - 4	*Train the students to become effective communicators in professional as well as general aspects of life*
PEO - 5	*Prepare the students into balanced individuals who are keen to leave a mark by excelling in their profession*

4. Consistency of PEO's with Mission of the Department

	Mission Stmt. – 1	Mission Stmt. - 2	Mission Stmt. - 3	Mission Stmt. - 4	Mission Stmt. - 5
PEO - 1	3	3	2	3	2
PEO - 2	3	2	3	3	3
PEO - 3	2	3	2	3	3
PEO - 4	3	3	3	1	2
PEO - 5	1	3	2	3	3

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

5. Consistency of PEO's with Program Learning Outcomes (PO)

	Program Learning Outcomes (PO)											
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
PEO - 1	3	3	3	3	3	1	2	1	2	2	3	3
PEO - 2	3	3	3	3	3	1	2	1	2	3	2	2
PEO - 3	3	3	3	3	3	2	3	2	2	2	3	3
PEO - 4	3	2	2	3	3	3	2	3	3	3	3	1
PEO - 5	2	2	3	3	2	3	2	3	3	3	2	2

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

6. Programme Structure (Total Credits : 80 Credits)

1. Professional Core Courses (C)
(10 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
PCA25C01J	Object Oriented Programming using Java	3	0	2	4
PCA25C02T	Data Structures and Algorithms	4	0	0	4
PCA25C03J	Database Technology	3	0	2	4
PCA25C04J	Data Analysis using Python Programming	3	0	2	4
PCA25C05T	Optimization Techniques	4	0	0	4
PCA25C06J	Advanced Operating System	3	0	2	4
PCA25C07J	Artificial Intelligence and Machine Learning	3	0	2	4
PCA25C08J	Data Communication Networks	3	0	2	4
PCA25C09T	Cloud and Quantum Computing	4	0	0	4
PCA25C10L	Capstone Project	0	0	8	4
Total Learning Credits					**40**

2. Discipline Elective Courses (D)
(3 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
PCA25D01J	Software Engineering and Testing	3	0	2	4
PCA25D02J	Advanced Web Technology				
PCA25D03J	Natural Language Processing				
PCA25D04J	Software Project Management	3	0	2	4
PCA25D05J	Mobile Applications Development				
PCA25D06J	Data Visualization Techniques				
PCA25D07J	Software Quality Assurance	3	0	2	4
PCA25D08J	Augmented Reality and Virtual Reality				
PCA25D09J	Computer Vision				
Total Learning Credits					**12**

3. Generic Elective Courses (G)
(2 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
PCA25G01T	Cyber Security	2	0	0	2
PCA25G02T	Soft Computing				
PCA25G03T	Distributed Computing				
PCA25G04T	Blockchain Technology	2	0	0	2
PCA25G05T	Cyber Forensics				
PCA25G06T	Big Data Analytics				
Total Learning Credits					**4**

4. Skill Enhancement Courses (S)
(2 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
PCA25S01J	Data Mining Techniques	2	0	3	4
PCA25S02J	Internet of Things (IoT)	2	0	3	4
Total Learning Credits					**8**

5. Project Work, Internship in Industry/Higher Technical Institutions (P)
(3 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
PCA25P01L	*Internship*	0	0	0	2
PCA25P02L	*Project Work*	0	0	20	10
Total Learning Credits					**12**

6. Ability Enhancement Courses (AE)
(2 Courses))

Course Code	Course Title	Hours/ Week L	T	P	C
PCD25AE1T	Comprehensive Skills in Quantitative and Logical Reasoning	2	0	0	2
PCD25AE2T	Soft Skills and Verbal Mastery	2	0	0	2
Total Learning Credits					**4**

7. Implementation Plan

Semester – I

Code	Course Title	Hours/ Week			C
		L	T	P	
PCA25C01J	Object Oriented Programming using Java	3	0	2	4
PCA25C02T	Data Structures and Algorithms	4	0	0	4
PCA25C03J	Database Technology	3	0	2	4
PCA25D01J	Software Engineering and Testing	3	0	2	4
PCA25D02J	Advanced Web Technology	3	0	2	
PCA25D03J	Natural Language Processing	3	0	2	
PCA25G01T	Cyber Security	2	0	0	2
PCA25G02T	Soft Computing	2	0	0	
PCA25G03T	Distributed Computing	2	0	0	
PCA25S01J	Data Mining Techniques	2	0	3	4
PCD25AE1T	Comprehensive Skills in Quantitative and Logical Reasoning	2	0	0	2
	Total	28			24

Semester - II

Code	Course Title	Hours/ Week			C
		L	T	P	
PCA25C04J	Data Analysis using Python Programming	3	0	2	4
PCA25C05T	Optimization Techniques	4	0	0	4
PCA25C06J	Advanced Operating System	3	0	2	4
PCA25C07J	Artificial Intelligence and Machine Learning	3	0	2	4
PCA25D04J	Software Project Management	3	0	2	4
PCA25D05J	Mobile Applications Development	3	0	2	
PCA25D06J	Data Visualization Techniques	3	0	2	
PCA25S02J	Internet of Things (IoT)	2	0	3	4
PCD25AE2T	Soft Skills and Verbal Mastery	2	0	0	2
	Total	31			26

Semester – III

Code	Course Title	Hours/ Week			C
		L	T	P	
PCA25C08J	Data Communication Networks	3	0	2	4
PCA25C09T	Cloud and Quantum Computing	4	0	0	4
PCA25C10L	Capstone Project	0	0	8	4
PCA25D07J	Software Quality Assurance	3	0	2	4
PCA25D08J	Augmented Reality and Virtual Reality	3	0	2	
PCA25D09J	Computer Vision	3	0	2	
PCA25G04T	Blockchain Technology	2	0	0	2
PCA25G05T	Cyber Forensics	2	0	0	
PCA25G06T	Big Data Analytics	2	0	0	
PCA25P01L	Internship	0	0	0	2
	Total	24			20

Semester – IV

Code	Course Title	Hours/ Week			C
		L	T	P	
PCA25P02L	*Project Work*	0	0	20	10
	Total	20			10

Total Number of Subjects: 21
Total Number of Credits: 80

8. Program Articulation Matrix

Course Code	Course Title	Programme Learning Outcomes (PO)											
		Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
PCA25C01J	Object Oriented Programming using Java	3	3	2	3	3	3	3	3	3	3	-	3
PCA25C02T	Data Structures and Algorithms	3	3	3	3	3	3	3	3	3	3	-	3
PCA25C03J	Database Technology	3	3	2	3	3	3	3	3	3	3	-	2
PCA25C04J	Data Analysis using Python Programming	3	3	2	3	3	3	3	3	3	3	-	3
PCA25C05T	Optimization Techniques	3	3	2	3	3	3	3	3	3	3	-	3
PCA25C06J	Advanced Operating System	3	3	2	3	2	2	3	2	-	2	-	-
PCA25C07J	Artificial Intelligence and Machine Learning	3	3	2	3	3	3	3	3	3	3	-	3
PCA25C08J	Data Communication Networks	3	-	2	3	3	-	-	-	3	-	-	3
PCA25C09T	Cloud and Quantum Computing	3	3	2	3	3	3	3	3	3	3	-	3
PCA25C10L	Capstone Project	3	-	2	3	3	3	3	3	3	3	2	3
PCA25D01J	Software Engineering and Testing	2	2	2	2	3	2	3	2	-	2	-	-
PCA25D02J	Advanced Web Technology	3	3	3	2	3	3	3	3	3	3	-	3
PCA25D03J	Natural Language Processing	3	3	3	2	3	3	3	3	3	3	-	3
PCA25D04J	Software Project Management	3	3	2	3	3	3	3	3	3	3	-	3
PCA25D05J	Mobile Applications Development	3	3	3	3	3	-	2	1	3	3	3	3
PCA25D06J	Data Visualization Techniques	3	3	3	2	3	3	3	3	3	3	-	3
PCA25D07J	Software Quality Assurance	3	3	2	3	3	3	3	3	3	3	-	3
PCA25D08J	Augmented Reality and Virtual Reality	3	3	2	3	3	3	3	3	3	3	2	3
PCA25D09J	Computer Vision	1	3	3	3	2	3	2	-	2	3	-	-
PCA25G01T	Cyber Security	3	3	3	2	3	3	3	3	3	3	-	3
PCA25G02T	Soft Computing	3	3	3	2	3	3	3	3	3	3	-	3
PCA25G03T	Distributed Computing	3	3	3	2	3	3	3	3	3	3	-	3
PCA25G04T	Blockchain Technology	3	3	2	3	3	3	3	3	3	3	-	3
PCA25G05T	Cyber Forensics	3	3	2	3	3	3	3	3	3	3	-	3
PCA25G06T	Big Data Analytics	3	3	2	3	3	3	3	3	3	3	-	3
PCA25S01J	Data Mining Techniques	3	3	3	2	3	3	3	3	3	3	2	3
PCA25S02J	Internet of Things (IoT)	3	3	2	2	3	3	3	3	3	3	2	3
PCA25P01L	Internship	3	3	2	3	3	3	3	3	3	3	-	3
PCA25P02L	Project Work	3	3	2	3	3	3	3	3	3	3	2	3
PCD25AE1T	Comprehensive Skills in Quantitative and Logical Reasoning	-	3	1	3	1	-	-	-	2	-	-	-
PCD25AE2T	Soft Skills and Verbal Mastery	1	3	3	3	3	3	-	-	3	3	2	3
	Program Average	3	3	2	3	3	3	3	3	3	3	2	3

SEMESTER- I

Code	PCA25C01J	Title	Object Oriented Programming using Java	Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	The purpose of learning this course is to:
CR-1	An overview of Java and Buzz words and OO features in Java
CR-2	Understand the concept of Classes and Constructor
CR-3	Create and understand the various kind of Inheritance and Exception Handling
CR-4	Understand the Thread and Utility Classes
CR-5	Understand Event handling and JDBC

Outcomes (CO)	At the end of this course, learners will be able to:	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Understand the basics of Java	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Develop Java program using Classes and Constructors	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Use the various kinds of Inheritance and Exception Handling		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Apply the Thread and Utility in Java program.	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Understand how to use the JDBC connections and the concept of event handling	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Introduction to Java	Classes and Constructors	Inheritance and Exception Handling	Thread and Utility Classes	Event Handling and JDBC
Duration (hour)	15	15	15	15	15
SO-1	The Genesis of Java, How java changed the internet- Java's magic: Byte Code, Java Buzzword	Introducing classes- Class fundamentals- Declaring Objects, Assigning object Reference variables- Method	Inheritance Basics, Understanding Types of Inheritance: Single, Multilevel, Hierarchical Inheritance	Introduction to Java Thread model, Creating a Thread by Extending Thread Class	Introduction to Event Handling - Understanding ActionEvent, ItemEvent, KeyEvent, MouseEvent, TextEvent, WindowEvent and ComponentEvent

SO-2	Features of Java, Evolution of Java, Difference between C++ and Java	Constructors - Characteristics of constructors - Types of Constructors, this Keyword	How does java support multiple inheritance? - using Super keyword, Method Overriding	Creating a Thread by implementing Runnable Interface, Thread Class	Introduction to Event Listener Interfaces, Working with ActionListener & AdjustmentListener
SO-3	Object Oriented Concepts of Java, Lexical Issues of Java	Introduction to Garbage Collection, Using Finalize() method	Understanding Dynamic method dispatch - Introduction to Abstract keyword, Working with Abstract class and Method & Using final with inheritance	Creating multiple threads, Assigning Thread priorities	Working with ContainerListener, ItemListener, ComponentListener, KeyListener & MouseListener
SO 4-5	**Practice 1: Learning to work with Java IDE and Writing Simple Conversion Programs**	**Practice 4: Program to implement the Queue operations using Classes and Objects**	**Practice 7: Program to Implement Inheritance, Method Overriding, Abstract classes and methods,**	**Practice 10: Implement Multithreading Program** **Program to Implement Binary Search Tree**	**Practice 13: Program to implement Event Handling concepts** **Program to implement Graph**
SO-6	Data types, Variables, dynamic initialization of variables, Scope and lifetime of variables, Operators	Overloading methods- Overloading constructors, Using objects as parameters- Argument Passing	Introduction to Package - Creating a Package, Understanding Access Protection- Importing packages	Applying Synchronization- Inter-thread communication, Introduction to Legacy Classes- Working with Vector class	Introduction AWT Controls - Working with Label controls, Buttons controls, CheckBoxes and CheckBoxGroup
SO-7	Arrays, Conditional Statements,	Returning Objects- Recursion	Introduction to Interfaces- Defining an interface, Implementing Interfaces, How Interfaces are extended?	Examples using Vector class, 0Understanding Stack class	Working with Choice controls, Lists controls and TextField controls
SO-8	Iterative Statement, Jump Statements- break, continue	Introducing Access Control, Understanding Static variables and methods	Exception, Understanding, Exception Types	Examples using Stack class , Introduction to Legacy Interfaces, Understanding Enumeration Interface- Examples using Enumeration interface	Introduction to Layout Manager- Understanding Flow Layout, Border Layout and Grid Layout
SO 9-10	**Practice 2: Program to implement the Sorting Operation using Control Statements**	**Practice 5: Implement Overloading Methods, Constructors program.** **Implement Tower of Hanoi program using Recursion**	**Practice 8: Program to implement the concept Packages, Interfaces**	**Practice 11: Program to implement the concept Legacy Classes and Binary Tree Traversal**	**Practice 14: AWT Controls, Layout Managers**
SO-11	Introduction to I/O Streams, Byte Streams classes	Understanding Final variables and methods, Working with Nested Class	Introduction to Exception handling, Working with try and catch	Introduction to Utility classes, Working with String Tokenizer	Introduction to JDBC,JDBC Drivers & Architecture
SO-12	Character Streams classes, Examples using Byte and Character Streams	Understanding Inner Class, Introduction to String Class	Using multiple catch clauses, Working with Finally, Throw and throws	Working with Date class, Calendar, Gregorian Calendar- Random Class	Establishing JDBC connections, Types of Statements in JDBC

SO-13	Command Line arguments	Working with String Handling Methods	Understanding Built-in Exceptions, Creating user defined Exceptions	Working with Scanner Class, Examples using utility classes	Working with JDBC Connections and CURD operations
SO 14-15	**Practice 3: Program to implement the Stack operations using Array**	**Practice 6: Program to implement Linked List Concept** **Program to implement String Class**	**Practice 9: Implement Exception Handling program**	**Practice 12: Using Utility Classes implement the program**	**Practice 15: Implement the program using JDBC Connection**

Assessment

Level of Thinking		**Continuous Learning Assessment (CLA)** (50 % weightage)								**Final Exam** (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies

Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources			
1.	Herbert Schildt, Java: The Complete Reference, 12th Edition, McGraw-Hill Education, 2021	2.	Cay S. Horstmann, Core Java Volume I – Fundamentals, 11th Edition, Prentice Hall, 2020
3.	Java Programming and Object-Oriented Application Development" by Daniel Liang, Comprehensive Version 9th edition, Pearson 2012		

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr.V.Nisha, SRMIST

Code	PCA25C02T	Title	Data Structures and Algorithms	Category	C	Professional Core Course	L	T	P	C
							4	0	0	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Learn the different data types; Gain Knowledge in linked list
CR-2	Learn stack and queues in processing data for real-time applications
CR-3	Gain Knowledge in tree data storage structure for real- time applications
CR-4	Learn Graph and sorting techniques
CR-5	Utilize algorithms to find shortest data search in graphs for real-time application development

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth: Conceive	Depth: Design	Depth: Implement	Depth: Operate	Attainment: Level of Thinking	Attainment: Expected Proficiency (%)	Attainment: Expected Attainment (%)	PO1: Disciplinary Knowledge	PO2: Problem Solving	PO3: Design & Development	PO4: Analysis, Design, Research	PO5: Modern Tool Usage	PO6: Society & Culture	PO7: Environment & Sustainability	PO8: Ethical Practices & Social Responsibility	PO9: Individual & Team Work	PO10: Communication	PO11: Project Management & Finance	PO12: Life Long Learning
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CO-1	Identify linear and non-linear data structures. Apply linked list in real-time applications	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Construct stack and queue data structures and evaluate its operations	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Create tree data structures and evaluate its types and operations		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Create graph data structure, evaluate its operations and apply sorting technique in real-time applications	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Understand the searching algorithm and various algorithm techniques	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Introduction	Stack, Queue and Tree	Categories of Tree	Graph and Sorting	Algorithms
Duration (hour)	**12**	**12**	**12**	**12**	**12**
SO-1	Overview and importance of algorithms Algorithm specification, Performance analysis	Introduction to stack, Representation of Stacks	Threaded Binary Tree, Application of Tree	Overview of Graph, Graph Terminology	Divide and Conquer: General method, applications

SO-2	Asymptotic Notation, The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding	Stack as ADT ,Stack Operations,	Introduction to Binary Search Tree(BST)	Representation of Graph, Types of Graph,	Implementation of Min-Max Problem
SO-3	Introduction to Data structures, Abstract Data type, Data representation	Applications of Stacks – Recursion, Towers of Hanoi,	Binary Search Tree: Construction,	Operation of Graph, Graph Traversal – BFS	Introduction to dynamic Programming, General method, applications
SO-4	Complexity of Algorithms, Operations	Arithmetic Expressions, Polish notations	Operation of Binary Search tree, Introduction to AVL Tree	DFS	Multistage Graph Basics
SO-5	Types of Data structures – Linear and Non Linear	Queue, Linked Representation of Queues	Operation of AVL, AVL Tree Rotations	Overview of Shortest Path Algorithm, Topological Sorting	Implementation of Multistage Graph problem
SO-6	Arrays, Representation of Arrays, Types of Arrays	Queue as ADT, Operations on Queue	Applications of AVL tree, Introduction to Heap	Spanning Trees , Dijkstra Algorithm	Greedy Algorithm: General method, applications
SO-7	Arrays operations	Types of Queue ; Priority Queue, Circular Queue,	Types of Heap, Application of Heap	Warshalls's algorithm	Knapsack Problem Basics
SO-8	Application of Arrays	Double ended Queue, Tree terminologies	Introduction of Search, Types of Search - Linear Search, Binary Search	Prims and Kruskals Algorithms	Implementation of Knapsack Problem
SO-9	Introduction to lists, Representation of Linked list , Operations	Implementation of Tree, Function of Tree	Sorting, Types of Sorting: Internal and External Sort	Define Hashing	Backtracking: General method, applications
SO-10	Types of Linked List, Header Linked List	Binary Tree, Representation of Binary Tree	Bubble Sort, Insertion Sort	Hash functions	Implementation of Sum of Subset Problem
SO-11	Circularly Linked List	Properties of Binary tree, Tree Traversals–In order,	Radix sort, Merge Sort	Hashing: Collision avoidance	Branch and Bound: General method, applications
SO-12	Doubly Linked List	Preorder Post order.	Quick Sort, Heap Sort	Hashing: Separate chaining, Open addressing, Advantages of Hashing, Extensible Hashing	Implementation of Travelling Salesman Problem

Assessment											
Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10 %)		CLA – 2 (10 %)		CLA – 3 (20 %)		CLA – 4 (10 %)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	40%	-	40%	-	40%	-	40%	-	40%	-
2	Understand										
3	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
4	Analyze										
5	Evaluate	20%	-	20%	-	20%	-	20%	-	20%	-
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies					
Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources			
1.	R.F.Gilberg,B.A.Forouzan,“Data Structures”,ThomsonIndi,2ndEdition, 2005	2.	A.V.Aho,J.EHopcroft,J.D.Ullman,(2003),“Data structures and Algorithms”,1stEdition,Pearson Education

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. Agusthiyar R, SRMIST, RMP
				2	Dr. S. Subbaiah, SRMIST, RMP
				3	Dr.S.Usha, SRMIST, Kattankulathur

Code	PCA25C03J	Title	Database Technology	Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*	Depth				Attainment			Program Outcomes (PO)											
CR-1	To understand the basic concepts and terminology related to DBMS and Relational Database Design	1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CR-2	To design and implement Structured Query Language																			
CR-3	To understand PL/SQL (Procedural Language/Structured Query Language)																			
CR-4	To understand the architecture and Normalization Techniques																			
CR-5	To understand Transaction management- Database Administration & Database Recovery																			

Outcomes (CO)	*At the end of this course, learners will be able to:*	Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Understand the fundamental concepts of database management systems (DBMS).	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Gain proficiency in Structured Query Language	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Acquire the skills to apply to PL/SQL (Procedural Language/Structured Query Language)		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Encouraging the learner to understand the various Normalization Techniques	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Impart working methodology of Transaction Management, Concurrency Control and Recovery Management	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Introduction to Database concepts	Structured Query Language, DDL and DML commands	Concepts of PL/SQL	Decomposition & Normalization Techniques	Database Administration & Database Recovery
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Introduction to Database systems – File systems Vs DBMS- Advantages of DBMS	The Form of A Basic SQL Query- SQL Syntax, SQL Data Types	PL/SQL Overview	Single Tier –Three Tier Application Architecture	Transaction Management
SO-2	Architecture of DBMS	Set Operations, SQL Expression	PL/SQL blocks	Client-Server Architectures	ACID Property
SO-3	Data Models, Structure of Relational Databases	Data Definition Language Commands- Data Manipulation Language Commands	PL/SQL: Variables, Constants	Advantages of the Three-Tier Architecture	Transaction States- Transaction Isolation & Isolation Levels
SO 4-5	**Practice 1-** Create a Database Schema for University Database	**Practice 4 :** Implement DDL, DML commands	**Practice 7:** PL/SQL: Case, Loop	**Practice 10:** Implement Integrity Constraints	**Practice 13:** Implement the functions/procedures to begin, commit, and rollback transactions.
SO-6	Database Schema - Schema Diagrams	Transaction Control Language Commands- Data Control Language Commands	PL/SQL Data Types	Properties of Decompositions- Preserving Decomposition	Concurrency Control: Types of locks
SO-7	Relational Query Languages- Relationships And Relationship Sets	Aggregate Functions- SQL functions	PL/SQL: Conditional Statements	Normalization-Functional Dependency	File Organization: Indexing: Primary index – Secondary indices
SO-8	Keys- Primary Key Constraint:	SQL Clauses - SQL Indexes	PL/SQL: Case, Loop	First, Second, Third Normal Forms	B tree Index, B+ tree Index
SO 9-10	**Practice 2:** SQL queries for employee database with key constraints	**Practice 5:** Implement DCL,TCL Commands	**Practice 8:** Implementing PL/SQL Conditional Statements, Looping Statements	**Practice 11**: Implement First, Second and Third normalization techniques	**Practice 14:** Analyze the structure and properties of B-tree index and its variants
SO-11	Unique Constraint- Foreign Key Constraint	SQL Queries- SQL Subqueries	PL/SQL: Procedure- PL/SQL: Function	Boyce Code Normal Form	Backup and Recovery Considerations & Recovery Control
SO-12	Database Design and ER Diagrams	SQL Joins- SQL Views	PL/SQL: Cursor	Multi-valued Dependencies and Fourth Normal Form	Components for Backup and Recovery- Performing Offline backups
SO-13	Entities, Attributes, And Entity Sets	SQL Triggers- SQL Procedures	PL/SQL: Exception	Join Dependencies and Fifth Normal Form	Types of Failures

SO 14-15	**Practice 3:** Create ER Model University Database	**Practice 6:** Implement SQL sub queries, Joins and Clauses	**Practice 9: :** Sample programs for Cursors and Exceptions	**Practice 12:** Implement Fourth and Fifth form of normalization techniques	**Practice 15**: Case Study: Analyze different types of failures such as transaction failures, system crashes, and disk failures

Assessment

Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam	
		CLA – 1		CLA– 2		CLA– 3		CLA– 4			
		(10 %)		(10%)		(20%)		(10%)		(50% Weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies

Technology		Pedagogy / Andragogy		Sustainable Development	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources

1.	R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2004	2.	A. Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2008
3.	Kevin Loney , Oracle Database 10G: The Complete Reference, McGraw Hill, New Delhi.(Fifth RePrint-2007)		

Designers

Professional Experts		Higher Institution Experts		Internal Experts	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr.S.Belina V J Sara, SRMIST, Kattankulatur

Code	PCA25D01J	Title	Software Engineering and Testing	Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	Pre-requisite Courses	NIL	Co-requisite Courses	NIL	Progressive Courses	NIL	Data Book / Codes/Standards	NIL

Rationale (CR)	*The purpose of learning this course is to:*
CLR-1:	Understand the fundamental principles of software engineering and various software development life cycle models.
CLR-2:	Apply systematic approaches to software design and architectural modeling using UML and design patterns.
CLR-3:	Manage software projects by planning, monitoring, and maintaining deliverables using contemporary project management tools.
CLR-4:	Acquire knowledge of software testing principles, types, and strategies including test planning and test case design.
CLR-5:	Use modern software testing tools and frameworks for automation, bug tracking, and quality assurance.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CLO-1:	Understand and apply software engineering principles and SDLC models.	✓				2	85	75	3	3	2	3	2	1	1	2	2	2	2	2
CLO-2:	Analyze and design software systems using UML diagrams and architectural patterns.	✓	✓	✓		4	85	75	3	3	3	3	3	1	1	1	2	2	2	3
CLO-3:	Plan, manage, and maintain software projects using tools and configuration systems.		✓	✓	✓	3	85	75	3	3	2	2	3	2	2	2	3	3	3	3
CLO-4:	Apply software testing techniques and create test plans and test cases effectively.	✓	✓	✓	✓	5	85	75	3	3	2	2	3	1	1	2	2	2	2	3
CLO-5:	Use automation testing tools and continuous integration pipelines for quality assurance.	✓	✓	✓	✓	6	85	75	3	2	3	2	3	2	2	2	3	3	2	3

ddataTitle & Session Outcomes	Software Engineering Principles and SDLC	Software Design and Architecture	Software Project Management & Maintenance	Fundamentals of Software Testing	Testing Tools and Automation
Duration (hour)	**15**	**15**	**15**	**15**	**15**

SO-1	**Introduction to Software Engineering –** Definition, Evolution, Need, IEEE Standards	**Design Principles** – Modularity, Abstraction, Encapsulation	**Project Planning Activities –** Work breakdown structure, scheduling	**Software Quality Concepts** – Definitions, attributes, goals	**Introduction to Automation Testing** – Need, ROI, framework types
SO-2	**Software Development Life Cycle (SDLC)** – Phases, Deliverables, Models Overview	**Cohesion & Coupling –** Types, examples, impact on maintainability	**Resource Allocation and Monitoring** – Gantt charts, tracking	**Verification vs Validation** – Definitions, differences	**Testing Tools Overview** – Selenium WebDriver, PyTest, JUnit
SO-3	**Process Models –** Waterfall, Spiral, V-Model, Iterative, Incremental	**Software Architecture –** Architectural styles: Layered, Client-Server, MVC	**Software Configuration Management (SCM)** – SCM process, tools like Git	**STLC (Software Testing Life Cycle)** – Phases, deliverables	**Defect Lifecycle & Bug Tracking** – Lifecycle, tools (Jira, Bugzilla)
SO-4 -5	**Practice:** **1. Case Study: Write SRS for a sample project** **Create Use Case Diagram using StarUML**	**Practice :** **7. Draw Class and Sequence Diagrams for a library system** **Develop Component and Deployment Diagrams**	**Practice :** **13. Version control using GitHub (push / pull / merge / branch)** **Prepare project schedule with Gantt chart (MS Project / Excel)**	**Practice:** **19. Write test cases for user registration module** **20. Apply BVA and ECP for sample inputs**	**Practice:** **25. Automate login form using Selenium** **26. Write and run unit tests with PyTest/JUnit**
SO-6	**Agile Development –** Agile manifesto, Scrum, XP, Kanban	**Structured vs Object-Oriented Design –** Differences, advantages	**Version Control Systems** – Git vs SVN, repositories, commit, merge	**Levels of Testing** – Unit, Integration, System, Acceptance	**Static Code Analysis** – Code review, linters, SonarQube
SO-7	**Software Project Management –** Project planning, roles, deliverables	**UML Basics –** Introduction to Unified Modeling Language	**Software Maintenance** – Types: Corrective, Adaptive, Perfective, Preventive	**Types of Testing** – Functional, Non-functional, Regression	**Continuous Integration (CI)** – Jenkins basics, test automation pipeline
SO-8	**Software Metrics –** Size, Effort, Cost estimation (COCOMO), Schedule	**Class & Sequence Diagrams –** Relationships, multiplicity, messages	**Reengineering and Reverse Engineering** – Concepts and process	**Test Case Design Techniques – I** – Equivalence Class Partitioning	**Performance & Load Testing** – Tools: JMeter, LoadRunner
SO-9-10	**Practice :** **2. Compare process models (tabular analysis)** **Develop project schedule using Gantt chart**	**Practice:** **8. Design a layered architecture using diagrams** **Implement Factory and Singleton pattern in code**	**Practice :** **14. Create documentation templates (SRS, SDS)** **Reengineer a small module (add/change feature)**	**Practice:** **21. Perform unit testing using Python or Java** **22. Integration testing on two modules (login + dashboard)**	**Practice:** **27. Perform static analysis using SonarLint/SonarQube** **28. Bug reporting using Jira**
SO-11	**Risk Management –** Risk types, risk assessment and mitigation strategies	**Component & Deployment Diagrams** – Software and hardware mapping	**Software Quality Models –** McCall's, ISO 9126, Quality goals	**Test Case Design Techniques – II** – Boundary Value Analysis	**Regression Testing** – Use-cases and automation scope
SO-12	**Requirements Engineering –** Elicitation techniques, use cases, requirement types	**Design Patterns –** Factory, Singleton, Observer	**Software Documentation –** SRS, design documents, user manuals	**White Box vs Black Box Testing** – Advantages, tools	**Code Coverage & Metrics** – Statement, branch, path coverage
SO-13	**Software Requirement Specification (SRS) –** Characteristics, structure, IEEE format	**Low-level Design –** Flowcharts, pseudocode, decision tables	**Project Closure & Audits –** Closure activities, quality audits	**Test Plan and Documentation** – Test strategy, test data, traceability matrix	**Test Automation Frameworks –** Data-driven, keyword-driven, hybrid

SO-14-15	**Practice:** **3. Risk Register Preparation** **Effort Estimation using basic COCOMO**	**Practice:** **9. Design low-level pseudocode and flowchart for login module** **UML model for a real-time system using StarUML**	**Practice :** **15. Conduct internal code review & walkthrough** **Final mini-project demo with documentation**	**Practice :** **23. Test Plan Documentation and Traceability Matrix** **24. Manual testing for a form-based application**	**Practice:** **29. Build and run CI pipeline with Jenkins** **30. Load test a sample website using JMeter**

Assessment

Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies

Technology		Pedagogy / Andragogy		Sustainable Development	
Simulations		Case Studies	✓	No Poverty	
Emulations		Group Discussion	✓	Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools	✓	Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning	✓		

Resources

1	Pressman, R. S., & Maxim, B. R. (2023). *Software engineering: A practitioner's approach* (9th ed.). McGraw-Hill Education.	2	Sommerville, I. (2021). *Software engineering* (10th ed.). Pearson Education.
3	Desikan, S., & Ramesh, G. (2019). *Software testing: Principles and practices*. Pearson Education.	4	Jorgensen, P. C. (2013). *Software testing: A craftsman's approach* (4th ed.). CRC Press.
5	Fewster, M., & Graham, D. (2020). *Software test automation*. Addison-Wesley.	6	Mall, R. (2018). *Fundamentals of software engineering* (5th ed.). PHI Learning.

Designers

Professional Experts		Higher Institution Experts		Internal Experts	
1		1		1	Dr. K. Sathya, SRMIST, KTR

	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015		Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	2	Dr. R. Kiruthiga, SRMIST, KTR

Code	PCA25D02J	Title	Advanced Web Technology	Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*	Depth				Attainment			Program Outcomes (PO)											
CR-1	Learn the basic architecture of web architecture.	1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CR-2	Understand the practical knowledge of frameworks.	Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management &	Life Long Learning
CR-3	How to build web applications and secure the applications																			
CR-4	Design custom directives and understand working process of modern web technologies																			
CR-5	Understand the identity and security threats.																			

Outcomes (CO)	*At the end of this course, learners will be able to:*																			
CO-1	Understand the foundational structure of web architecture, key web protocols, and development frameworks	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Gain practical knowledge of front-end frameworks, client-side routing, and state management for creating dynamic, scalable web applications.	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Build web applications using Node.js and Express.js, develop and secure RESTful APIs, and choose appropriate databases based on application needs.		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Understand modern web technologies such as PWAs, Web Sockets, and Web Assembly, along with their practical applications.	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Identify the web security threats.	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Understand the foundational structure of web architecture	Practical knowledge of front-end frameworks	Build Web Applications	Modern Web Technologies	Identify and mitigate key web security threats.
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Web Architecture and Design Principles, Web Architecture: Client-Server Model, HTTP Protocol and Web Servers	Front-end Technologies, Advanced HTML5 Features	Back-end Technologies and Databases	Advanced Topics in Web Development	Web Security and Testing
SO-2	Web Development Frameworks (Overview of Front-End and Back-End Frameworks)	Multimedia: HTML5 Video and Audio Elements, MSE, Subtitles and Captions, HTML5 Audio API	Node.js and Express.js-Introduction, modules, programming	Progressive Web Apps (PWAs)	Web Application Security Concepts: SQL Injection, Cross-Site Scripting (XSS), Cross-Site Request Forgery (CSRF)
SO-3	Responsive Web Design and Adaptive Design, Web Standards and Accessibility	Canvas, and Geo-location	RESTful API Development-principles, design,security	WebSockets and Real-time Web Application	Security Best Practices for Front-end and Back-end Development
SO 4-5	**Practice 1: Sample Application development**	**Practice 4: Develop a dynamic SPA (Single Page Application) using React.js.**	**Practice 7: Develop a RESTful API using Node.js and Express.js**	**Practice10: Create a Progressive Web App (PWA) that can work offline.**	**Practice 13: Implement automated testing with Jest for a React application.**
SO-6	Web Standards, WCAG Guidelines (Web Content Accessibility Guidelines)	CSS3, Animations and Transitions	Databases: SQL vs. NoSQL (MySQL, PostgreSQL, MongoDB)	Serverless Computing (AWS Lambda, Firebase Functions)	Testing Strategies for Web Applications: Unit Testing, Integration Testing, and End-to-End Testing
SO-7	Security in Web Development: SSL, HTTPS, and Security Protocols, Authentication Mechanisms	Promises, Async/Await, Modules	Authentication and Authorization (JWT, OAuth, Passport.js)	Web Assembly and its Applications	Tools for Security Audits and Penetration Testing,OWASP ZAP, Burp Suite
SO-8	Design Patterns in Web Development	Front-end Frameworks and Libraries	Web Sockets for Real-time Communication	Cloud-Based Web Hosting and CI/CD Integration	Creating a filter to transform theline breaks, Sending HTML through anAngular binding
SO 9-10	***Practice 2:*** **Create a responsive website using HTML5 and CSS3.**	***Practice 5:*** **Create a to-do list application using React.js with Redux for state management.**	***Practice 8:*** **Integrate JWT authentication in a Node.js backend application.**	***Practice 11:*** **Deploy a Node.js application using AWS Lambda or Firebase Functions.**	***Practice 14:*** **Simulate and mitigate common web vulnerabilities (XSS, SQL Injection) in a sample application**
SO-11	Authentication Mechanisms, OAuth, JWT (JSON Web Tokens)	React.js, Vue.js, and Angularjs	Introduction to Web Sockets, Implementing web sockets, Advanced web socket features	Web Components and Shadow DOM	Continuous Security and Code Quality Integration
SO-12	MVC (Model-View-Controller)	Client-Side Routing and State Management	Micro services Architecture and API Gateways	Key Features of Web Components, creating a shadow DOM, advantages	Security in CI/CD Pipelines, Static Application Security Testing (SAST), Dependency Scanning

SO-13	MVVM (Model-View-View Model)	React Router, Redux, Vuex	Micro services Architecture, Advantages, communication, service discovery	Web Performance Optimization Techniques	Code Quality in CI/CD, Security as Code, Monitoring and Continuous Assessment
SO 14-15	**Practice 3*:* Develop a simple client-server application using Node.js and Express.**	**Practice 6: Create an interactive form with validation using JavaScript and CSS3.**	**Practice 9: Build a real-time chat application using Web Sockets in Node.js.**	**Practice 12: Optimize a web application for performance (minification, lazy loading, etc.)**	**Practice 15: Set up and use automated testing tools like Cypress for end-to-end testing in a web app.**

Assessment

Level of Thinking		**Continuous Learning Assessment (CLA)** (50 % weightage)								**Final Exam**	
		CLA – 1		CLA– 2		CLA– 3		CLA– 4			
		(10 %)		(10%)		(20%)		(10%)		(50% Weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies

Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools	✓	Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources

1	Getting MEAN with Mongo, Express, Angular and Node, 2nd Edition, by Simon Holmees, Clive Herber	2	Mastering Angular JS by Brad Dayley, 2015
3	Practical Node.js: Building Real-World Scalable Web Apps, 1st Edition by Azat Mardan	4	MEAN Web Development by AMOS Q. HAVIV, 2nd Edition
5	Learning Angular JS: A Guide to Angular JS Development Reilly	6	Angular JS: https://angular.io/docs

7	Angular JS: Up and Running" by Brad Green and Shyam Seshadri	8	MongoDB: https://docs.mongodb.com/manual/tutorial/getting-started/

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr.R.Shanthi, shanthir3@srmist.edu.in

Code	**PCA25D03J**	**Title**	**Natural Language Processing**	**Category**	**D**	**Discipline Elective Course**	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	**Pre-requisite Courses**	Nil	**Co-requisite Courses**	Nil	**Progressive Courses**	Nil	**Data Book / Codes/Standards**	Nil

Rationale (CR)	*The purpose of learning this course is to:*	**Depth**				**Attainment**			**Program Outcomes (PO)**												
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CR-1	Provides the foundational techniques for preprocessing text data, essential for further NLP tasks.																			
CR-2	Covers methods to transform raw text into numerical representations, enabling its use in machine learning models.																			
CR-3	Delves into advanced techniques to extract structured information from text.																			
CR-4	Introduce deep learning methods that are crucial for state-of-the-art NLP applications.																			
CR-5	Explores practical applications of NLP, along with ethical considerations.																			

Outcomes (CO)	*At the end of this course, learners will be able to:*	Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Able to preprocess raw text data, implement tokenization, text normalization, lemmatization, stemming, and perform basic text operations like stop word removal.	✓	-	-	-	5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Implement text vectorization methods such as TF-IDF, BoW, and word embeddings, and understand feature extraction for text classification tasks.	✓	✓	✓	-	4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Able to implement advanced NLP techniques such as Named Entity Recognition, dependency parsing, and topic modeling using LDA.	-	✓		-	6	85	75	3	-	-	3	-	-	-	-	3	3	-	3

CO-4	Apply deep learning models like RNNs, LSTMs, and fine-tune transformer models for text classification, generation, and sentiment analysis.	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Able to implement real-world NLP applications such as chatbots, machine translation systems, and question-answering models, while addressing ethical concerns in NLP	✓	✓	-	-	2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	**Introduction to NLP and Text Preprocessing**	**Text Representation and Feature Extraction**	**Advanced NLP Techniques**	**Deep Learning in NLP**	**Applications of NLP**
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Introduction to NLP and Its Applications	Overview of Text Representation	Named Entity Recognition (NER)	Introduction to Deep Learning for NLP	Chatbots and Conversational AI
SO-2	Text Representation and Structure	Bag-of-Words (BoW) Model	Text Parsing and Syntax Trees	Neural Networks for NLP: RNNs, LSTMs, and GRUs	Machine Translation and Statistical Models
SO-3	Text Encoding: ASCII, Unicode, UTF-8	Term Frequency-Inverse Document Frequency (TF-IDF)	Constituency Parsing vs Dependency Parsing	Attention Mechanism and Transformer Models	Speech Recognition and NLP
SO 4-5	**Practice 1: Tokenization and Text Normalization using NLTK.**	**Practice 4: Implementing TF-IDF and Bag-of-Words using Scikit-learn.**	**Practice 7: Implementing Named Entity Recognition (NER) with SpaCy.**	**Practice 10: Building a simple RNN for text classification.**	**Practice 13: Building a basic chatbot using Rasa or ChatterBot.**
SO-6	Tokenization: Sentence and Word Tokenization	Word Embeddings: Word2Vec, GloVe	Sequence Labeling and CRF (Conditional Random Fields)	Pre-trained Models: BERT, GPT	Text Summarization: Extractive vs. Abstractive
SO-7	Text Normalization: Lowercasing, Removing Punctuation, etc.	One-Hot Encoding and Sparse Matrices	Sentiment Analysis and Opinion Mining	Sequence-to-Sequence Models and Applications	Question Answering Systems
SO-8	Lemmatization vs. Stemming	Latent Semantic Analysis (LSA)	Text Summarization: Extractive and Abstractive	Transfer Learning in NLP	Information Retrieval and Semantic Search
SO 9-10	**Practice 2: Implementing Stemming and Lemmatization using NLTK.**	**Practice 5: Generating word embeddings using Word2Vec in Gensim.**	**Practice 8: Sentence parsing and dependency trees using NLTK.**	**Practice 11: Fine-tuning a pre-trained BERT model for sentiment analysis.**	**Practice 14: Implementing a machine translation model using Seq2Seq.**
SO-11	Stop Words Removal	Word Similarity and Distance Metrics	Topic Modeling with Latent Di richlet Allocation (LDA)	Fine-Tuning Pretrained Models	Recommendation Systems using NLP
SO-12	Part-of-Speech (POS) Tagging Overview	Document Classification: Overview	Language Models (N-Gram, RNN, LSTM)	Text Generation using Deep Learning Models	Ethical Considerations in NLP
SO-13	N-Grams and their Applications	Feature Selection Techniques	Evaluation Metrics for NLP Tasks	Evaluating Deep Learning Models for NLP	Challenges and Future Trends in NLP

SO 14-15	**Practice 3: Stop word removal and N-Gram generation using Scikit-learn.**	**Practice 6: Implementing Latent Semantic Analysis (LSA) for text clustering.**	**Practice 9: Sentiment Analysis using Naive Bayes Classifier.**	**Practice 12: Text generation using GPT-2 (or similar transformer-based models).**	**Practice 15: Developing a simple question-answering system using HuggingFace Transformers.**

Assessment

Level of Thinking		**Continuous Learning Assessment (CLA)** (50 % weightage)								**Final Exam** (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

Strategies

Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion	✓	Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources

1. **Jurafsky, D., & Martin, J. H.**, Speech and Language Processing, 3rd Edition, Pearson, 2021.
2. **Goldberg, Y.**, Neural Network Methods for Natural Language Processing, 1st Edition, Morgan & Claypool Publishers, 2017.

3	**Manning, C. D., & Schütze, H.**, Foundations of Statistical Natural Language Processing, *1st Edition, MIT Press, 1999.*	4	**Chollet, F.**, Deep Learning with Python, *1st Edition, Manning Publications, 2017.*
5	**Bird, S., Klein, E., & Loper, E.**, Natural Language Processing with Python, 1st Edition, O'Reilly Media, 2009.	6	**Van der Plas, L., & Cohn, T.** Introduction to Natural Language Processing, 1st Edition, Springer, 2020.

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. ANWAR R SHAHEEN, SRMIST, KTR, anwars@srmist.edu.in

Code	**PCA25G01T**	**Title**	**Cyber Security**	**Category**	**G**	**Generic Elective Course**	L	T	P	C
							2	0	0	2

Offering Department	Computer Applications	**Pre-requisite Courses**	Nil	**Co-requisite Courses**	Nil	**Progressive Courses**	Nil	**Data Book / Codes/Standards**	Nil

Rationale (CR)	*The purpose of learning this course is to:*	***Depth***				***Attainment***			***Program Outcomes (PO)***											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CR-1	Develop knowledge of common cyber threats, vulnerabilities, and attack methods affecting information systems and networks.	Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CR-2	Learn and apply key cyber security techniques.																			
CR-3	Understand risk assessment, incident response, and strategies for securing digital assets																			
CR-4	Explore ethical hacking practices and understand legal frameworks																			
CR-5	Gain practical skills through labs and simulations that prepare students for real-world cyber security challenges.																			

Outcomes (CO)	*At the end of this course, learners will be able to:*																			
CO-1	Identify key cyber security concepts, types of cyber threats and attacks.	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Apply basic cyber security tools and techniques, to detect and mitigate common cyber-attacks and web security issues.	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*

CO-3	Analyze infrastructure security challenges, access control mechanisms, and physical security systems.		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Evaluate network security protocols, VPN configurations, and encryption techniques.	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Design security solutions for cloud and IoT networks, incorporating zero trust models, vulnerability mitigation, and incident handling techniques.	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	**Introduction to Cyber security and Threats**	**Security Mechanisms and Secure Coding Practices**	**Infrastructure Security and Access Control Systems**	**Network Security Protocols and Monitoring Tools**	**Advanced Security in Cloud, IoT, and Incident Handling**
Duration (hour)	**6**	**6**	**6**	**6**	**6**
SO-1	Understanding Cyber security: What, Why, and Scope, Cyber Threats and Attacks (Malware, Phishing, Ransomware,	Antivirus, Firewalls, IDS & IPS, Virtual Private Network (VPN) and Secure Communication	Infrastructure Security in the Real World, Security Challenges-Infrastructure Security Scenario1 & 2	Fundamentals of Network Security-Introduction to network security, Types of Network attacks-Network security Policies	Cloud and IoT Network Security, Cloud Security Concepts – Shared responsibility model, cloud firewall, securing AWS/Azure/GCP- IoT Security – IoT vulnerabilities, securing IoT communication protocols (MQTT, CoAP).
SO-2	Basic Cyber security Terminologies, Roles in Cyber security (Ethical Hacker, Analyst, Engineer, etc.)	Basics of Cryptograph, Wireshark and Packet Analysis	Understanding Access control and Monitoring systems	Network Protocols and Security – TCP/IP Security – Secure Communication protocols-Wireless Security	Zero Trust Security – Micro-segmentation, continuous verification, identity and access management (IAM).
SO-3	Basic Computer Hardware & Software Concepts, Operating Systems: Windows,	OWASP Top 10 Security Vulnerabilities, Common Attacks: SQL Injection,	Concepts of Physical barriers and biometrics, Differentiate between authentication and authorization	Types of VPNs – Site-to-site VPN, Remote-access VPN. VPN Protocols – PPTP, L2TP, OpenVPN, IPSec. Configuring a VPN –	Network Forensics – Capturing and analyzing traffic logs, Incident Handling Steps – Preparation, Detection, Containment, Eradication, Recovery, Exploiting Information Disclosure-Exploiting Error Messages- Script Error Messages- Stack Traces
SO-4	Linux (Basics of Command Line), Social Engineering- Cyber stalking	Secure Coding Practices	Identify commonly used Physical access-control system-devices	Setting up OpenVPN or WireGuard for secure remote access, Network Monitoring and Logging	Informative Debug Messages- Server and Database Messages- Using Public Information

SO-5	Cybercafe- Cybercrimes- Botnets, Attack vector- Social Engineering- Cloud Computing-	Introduction to Web Application Firewalls (WAF)	Security Policies-Physical Security controls-locks and keys-standard key-Locking deadbolts-cipher locks	Network Traffic Analysis – Using Wireshark to analyze packets. Log Management – Syslog, SIEM (Security Information and Event Management) tools like Splunk, Graylog, ELK, and Threat Intelligence – Correlating logs with real-time threat feeds.	Attacking Native Compiled Applications- Buffer Overflow Vulnerabilities-stack Overflow -Heap Overflows, Integer Vulnerabilities - Integer Overflows Signedness -Errors Detecting Integer-Vulnerabilities
SO-6	Malware Types: Viruses, Trojans, Spyware, Ransomware-Introduction to Threat Intelligence	Identity Theft (ID Theft)	Access control gates-Sliding gates-Swinging gates	Encryption Techniques – Symmetric (AES, DES) vs. Asymmetric (RSA, ECC). Digital Signatures & Certificates – PKI, SSL/TLS certificates, certificate authorities. Secure Email & Data Transmission – PGP, S/MIME, Secure File Transfer Protocols (SFTP)	Tiered Architectures-Attacking Tiered Architectures -Securing Tiered Architectures - Shared Hosting and Application Service Providers Virtual Hosting - Shared Application Services Attacking Shared Environments - Securing Shared Environments

Assessment

Level of Thinking		Continuous Learning Assessment (CLA) (100 % weightage)							
		CLA – 1 (20 %)		CLA– 2 (20%)		CLA– 3 (40%)		CLA– 4 (20%)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	40%	-	40%	-	40%	-	40%	-
2	Understand								
3	Apply	40%	-	40%	-	40%	-	40%	-
4	Analyze								
5	Evaluate	20%	-	20%	-	20%	-	20%	-
6	Create								
Total		100 %		100 %		100 %		100 %	

Strategies

Technology		Pedagogy / Andragogy		Sustainable Development	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion	✓	Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources

1.	Cyber Security for beginners by Raef Meeuwisse	2.	Cyber security essentials by Charles J. Brooks, Christopher Grow, Philip Craig and Donald Short

3	The Web Applications Hackers Handbook by Dafydd Stuhard and Marcus Pinto	4	Hacking: The Art of Exploitation by Jon Erickson
5	Security Warrior by Cyrus Piekari, Anton Chuvakin, 2nd ed., Oreilly Publishers, 2005.		

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. Angel Nancy A., SRMIST, angelnaa@srmist.edu.in

Code	**PCA25G02T**	**Title**	**Soft Computing**	**Category**	G	**Generic Elective Course**	L	T	P	C
							2	0	0	2

Offering Department	Computer Applications	**Pre-requisite Courses**	Nil	**Co-requisite Courses**	Nil	**Progressive Courses**	Nil	**Data Book / Codes/Standards**	Nil

Rationale (CR)	*The purpose of learning this course is to:*	**Depth**				**Attainment**			**Program Outcomes (PO)**												
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CR-1	Understanding the fundamental concepts of Soft Computing	Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management &	Life Long Learning
CR-2	Understand the components of soft computing																			
CR-3	Understand the fuzzy logic systems																			
CR-4	Explore the real world applications of soft computing																			
CR-5	Develop practical skills in implementing soft computing																			
Outcomes (CO)	*At the end of this course, learners will be able to:*																			
CO-1	Demonstrate the basic concepts of Soft Computing	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Acquire a comprehensive understanding of the principles and algorithms of soft computing	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Acquire the knowledge in various soft computing models		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Obtain the skills in soft computing techniques	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Evaluate the performance of soft computing	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Introduction to Soft Computing	Fuzzy logic and Fuzzy Systems	Artificial Neural Networks	Genetic Algorithms& Evolutionary Computing	Hybrid Systems and Applications
Duration (hour)	6	6	6	6	6
SO-1	Definition and characteristics of Soft Computing	Introduction about Fuzzy logic Classical Sets,	Introduction to Neural Networks Biological vs Artificial Neurons	Introduction to Evolutionary Computation ,Types of Evolutionary Algorithms - Genetic Algorithms, Evolution Strategies, Genetic Programming	Hybrid Soft Computing Techniques : Neuro-Fuzzy Systems
SO-2	Hard and Soft Computing	Fuzzy Sets and Membership functions, Fuzzyset Operations	Activation Functions	Introduction to Genetic Algorithms	Genetic Fuzzy Systems, Neuro-Genetic Systems
SO-3	Components of Soft computing: Fuzzy Logic, Neural Networks,	Fuzzy Relations – Definition - Representation of Fuzzy Relations -	Single layer and Multi-layer - Perceptron	Structure of a basic GA- Initialization – Evaluation – Selection – Crossover – Mutation - Replacement	Fuzzy –Neural-Genetic Systems
SO-4	Evolutionary Algorithms, Probabilistic Reasoning	Types of Fuzzy Relations -Operations on Fuzzy Relations	Learning Rules : Hebbian, Delta , Perceptron, competitive Learning Rule	Encoding Methods - Binary Encoding - Real-valued encoding - Permutation encoding - Tree-based encoding	GA with Particle Swarm Optimization
SO-5	Applications of Soft Computing: Pattern Recognition - Data mining - Control Systems - Decision Making systems - Robotics and Forecasting	Fuzzy Inference Systems Types of Fuzzy inference Systems - Mamdani and Sugeno models	Radial Basis Function	Fitness Function - Elitism in GA Convergence of GAs	ANFIS
SO-6	Soft computing Tools and Frameworks - Matlab Fuzzy logic toolbox - TensorFlow/Keras -Scikit	Applications of Fuzzy Logic - Washing machines, Air conditioning, Decision Support Systems	Back propagation Algorithms Applications of Neural Networks	Applications of GA & Evolutionary Computing - Optimization problems, ML model tuning, Scheduling and planning	Applications of Hybrid Soft Computing Systems - Financial modeling and forecasting, Fault detection and diagnostics, Intelligent control systems

Assessment

Level of Thinking		Continuous Learning Assessment (CLA) (100 % weightage)							
		CLA – 1		CLA– 2		CLA– 3		CLA– 4	
		(20 %)		(20%)		(40%)		(20%)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	40%	-	40%	-	40%	-	40%	-

Strategies

Technology		Pedagogy / Andragogy		Sustainable Development	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓

2	Understand								
3	Apply	40%	-	40%	-	40%	-	40%	-
4	Analyze								
5	Evaluate	20%	-	20%	-	20%	-	20%	-
6	Create								
Total		100 %		100 %		100 %		100 %	

Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources			
1	Handbook of Soft Computing edited by K. A. Lee and L. C. Jain	2	Soft Computing with Python: Foundations and Applications by Umesh Kumar Bansal
3	Soft Computing and Intelligent Data Analysis by M. Nikravesh, L. A. Zadeh, and J. Kacprzyk	4	Artificial Intelligence and Soft Computing: Behavioral and Cognitive Modeling of the Human Brain by Amit Konar
5	Computational Intelligence: Concepts to Implementations by Russell C. Eberhart and Yuhui Shi	4.	Python Machine Learning by Sebastian Raschka and Vahid Mirjalili

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr.S.Lakshmi, SRMIST

Code	PCA25G03T	Title	Distributed Computing	Category	G	Generic Elective Course	L	T	P	C
							2	0	0	2

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*	*Depth*				*Attainment*			*Program Outcomes (PO)*												
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CR-1	Understand the fundamental principles, models, and architectures of distributed computing systems.	Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CR-2	Explore communication, synchronization, and coordination mechanisms in distributed environments																			
CR-3	Analyze core distributed algorithms including mutual exclusion, election, and consensus protocols																			
CR-4	To Analyze shared memory abstractions, synchronization, and recovery strategies in distributed environments.																			
CR-5	To Analyze consensus and agreement algorithms, failure detection mechanisms, and secure authentication protocols in fault-tolerant distributed systems.																			
Outcomes (CO)	*At the end of this course, learners will be able to:*																			
CO-1	Explain the fundamental concepts, models, and architecture of distributed systems and identify their unique challenges.	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Demonstrate the use of logical clocks, vector clocks, and synchronization algorithms in achieving temporal ordering and consistency in distributed environments.	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Analyze mutual exclusion and election algorithms to solve coordination problems in distributed systems.		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*

CO-4	Analyze distributed shared memory models, wait-free mechanisms, and checkpoint-based recovery techniques	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Analyze consensus and agreement algorithms, failure detection mechanisms, and secure authentication protocols in fault-tolerant distributed systems.	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	**Fundamentals of Distributed Computing**	**Logic Time and Global State**	**Distributed Mutex and Deadlock**	**Distributed Shared Memory and Recovery**	**Consensus and Failure detectors**
Duration (hour)	**6**	**6**	**6**	**6**	**6**
SO-1	Definition-Relation to Computer System Components – Motivation,	A Framework for a System of Logical Clocks – Scalar Time – Vector Time	Introduction to distributed mutual exclusion algorithms - Preliminaries –	Distributed shared memory- abstraction and advantages	Consensus and agreement algorithms - Assumption, The Byzantine agreement and other problems,
SO-2	Message-Passing Systems versus Shared Memory Systems	Physical Clock Synchronization : NTP	Lamport's algorithm , Ricart-Agrawala's Algorithm	Shared memory mutual exclusion- Wait-freedom	Agreement in (message- passing) synchronous system with failures
SO-3	Primitives for Distributed Communication	Global State and Snapshot Recording Algorithms: System Model and Definitions, Snapshot Algorithms for FIFO Channels. Variations of the Chandy Lamport algorithm.	Quorum- based mutual exclusion algorithm, Maekawa' Algorithm	Register hierarchy and wait-free simulations, Wait-free atomic snapshots of shared objects	Agreement in asynchronous message-passing systems with Failures, Wait-free shared memory consensus in asynchronous systems
SO-4	Synchronous versus Asynchronous executions, Design Issues and Challenges	Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication	Token-Based Algorithms , Suzuki-Kasami's Broadcast Algorithm	Check pointing and Rollback Recovery- System model, Consistent and inconsistent states, different types of messages, Issues in Failure Recovery	Failure detectors – Introduction- Unreliable failure detectors - The consensus problem - Atomic broadcast
SO-5	A Distributed Program – A Model of Distributed Executions	Synchronous Program Order on Asynchronous System Group Communication – Causal Order – Total Order	Deadlock Detection in Distributed Systems - System Model	Checkpoint-based Recovery, log based roll back recovery	A solution to atomic broadcast - The weakest failure detectors to solve fundamental agreement problems, An implementation of a failure detector An adaptive failure detection protocol
SO-6	Models of Communication Networks, Global State of a Distributed System.	Termination detection- System model of a distributed computation, Termination detection using distributed snapshots, Termination detection by weight throwing, Spanning tree based algorithm	Deadlocks handling strategies, issues in deadlock detection, Models of deadlocks	Coordinated Check pointing Algorithm – Algorithm for Asynchronous Check pointing and Recovery	Protocols based on symmetric and asymmetric cryptosystems, Password-based authentication, Authentication protocol failures

Assessment									
Level of Thinking		Continuous Learning Assessment (CLA) (100 % weightage)							
		CLA – 1		CLA– 2		CLA– 3		CLA– 4	
		(20 %)		(20%)		(40%)		(20%)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	40%	-	40%	-	40%	-	40%	-
2	Understand								
3	Apply	40%	-	40%	-	40%	-	40%	-
4	Analyze								
5	Evaluate	20%	-	20%	-	20%	-	20%	-
6	Create								
Total		100 %		100 %		100 %		100 %	

Strategies					
Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

1.	Kshemkalyani Ajay D, Mukesh Singhal, “Distributed Computing: Principles, Algorithms and Systems”, Cambridge Press, 2011.	2.	Pradeep L Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007.
3	Liu M L, “Distributed Computing: Principles and Applications”, Pearson Education, 2004.		

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015		Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. S.Usha, SRMIST, ushas6@srmist.edu.in

Code	**PCA25S01J**	**Title**	**Data Mining Techniques**	**Category**	**S**	**Skill Enhancement**	L	T	P	C
							2	0	3	4

Offering Department	Computer Applications	**Pre-requisite Courses**	Nil	**Co-requisite Courses**	Nil	**Progressive Courses**	Nil	**Data Book / Codes/Standards**	Nil

Rationale (CR)	*The purpose of learning this course is to:*	**Depth**				**Attainment**			**Program Outcomes (PO)**												
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CR-1	To Develop a solid understanding of data mining principles, knowledge discovery process and Data mining tools.	Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CR-2	To Learn techniques to uncover hidden patterns and relationships in data.																			
CR-3	To Understand and implement various classification algorithms,																			
CR-4	To Understand and implement various clustering methods and outlier detection techniques.																			
CR-5	To Explore advanced applications of data mining across diverse domains to solve complex problems.																			

Outcomes (CO)	*At the end of this course, learners will be able to:*																				
CO-1	Gain knowledge about Data mining and Knowledge Discovery Process, Practice the Data mining Tools to apply Data mining algorithms,	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*

CO-2	Understand Association rule mining techniques	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Apply various Classification algorithms		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Gain knowledge on the concepts of Cluster and Outlier Analysis	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Understand the Application of Data Mining concepts in Advanced Topics.	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	2	3

Title & Session Outcomes	**Introduction to Data Mining**	**Association Rule Mining**	**Classification Techniques**	**Clustering Techniques**	**Advanced Topics and Applications**
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Introduction to Data Mining and Knowledge Discovery	Basics of Association Rule Mining	Introduction to Classification	Introduction to Clustering	Introduction to Advanced Data Mining Techniques, Web and Social Media Mining (Overview),
SO-2	Data mining tools and applications, Types of Data: Structured, Semi-Structured, and Unstructured	Market Basket Analysis, Support, Confidence, and Lift	Decision Tree Classifier (ID3, C4.5 Overview), Naive Bayes Classifier	K-Means Clustering: Concept and Implementation, Hierarchical Clustering: Overview	Text Mining and Sentiment Analysis
SO-3-5	**Practice 1: Loading and Exploring Data in WEKA**	**Practice 4: Association Rule Mining in WEKA**	**Practice 7: Implement Decision Tree Classifier using J48 (C4.5) in WEKA**	**Practice 10: Implement K-Means Clustering using WEKA**	**Practice 13: Text Mining & Sentiment Analysis using WEKA**
SO-6	Data Mining Process and Stages	Apriori Algorithm: Concept and Implementation	k-Nearest Neighbors (k-NN) Overview	DBSCAN: Density-Based Clustering (Concept Only)	Anomaly Detection Techniques
SO-7	Data Preprocessing: Handling Missing Values, Data Normalization and Standardization	FP-Growth Algorithm (Overview), Mining Multilevel Association Rules	Support Vector Machines (SVM) – Basic Concept, Neural Networks and Deep Learning (Introduction)	Evaluating Clustering Results, Handling Noisy Data in Clustering	Time-Series Data Analysis, Spatial Data Mining
SO-8-10	**Practice 2:Data Preprocessing in WEKA**	**Practice 5: Implement Apriori Algorithm in WEKA**	**Practice 8: k-Nearest Neighbors (k-NN) Classifier using WEKA**	**Practice 11: DBSCAN Clustering using WEKA**	**Practice 14:Time-Series Analysis using Moving Average in WEKA**
SO-11	Introduction to Data Visualization	Applications of Association Rules, Constraint-Based Association Rule Mining	Ensemble Methods: Bagging and Boosting	Cluster Evaluation Techniques.	Big Data Analytics and Data Mining

SO-12	Tools for Data Mining: WEKA, Python, and R, Ethical Considerations in Data Mining	Recent Trends and Challenges in Association Rule Mining	Model Evaluation: (Accuracy, Precision, Recall, F1-score and Confusion Matrix,), Handling Imbalanced Datasets	Anomaly Detection and Outlier Analysis, Applications of Clustering Techniques	Data Mining in Healthcare and Finance, Ethics and Privacy in Data Mining
SO-13-15	**Practice 3:Data Visualization in WEKA**	**Practice 6: Constraint-Based Association Rule Mining in WEKA**	**Practice 9: Support Vector Machine (SVM) Classifier using WEKA**	**Practice 12: Anomaly Detection Using LOF (Local Outlier Factor) in WEKA**	**Practice 15: Disease Prediction using WEKA (Logistic Regression)**

Assessment

Level of Thinking		**Continuous Learning Assessment (CLA)** (50 % weightage)								**Final Exam** (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	-	40%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	-	40%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	-	20%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies

Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources			
1.	Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar,, "Introduction to Data Mining" –2nd Edition**:** Pearson**,** 2018	2.	Han, J., Kamber, M., & Pei, JData Mining: Concepts and Techniques (3rd Edition). Morgan Kaufmann., .2011.
3.	"Data Mining: Practical Machine Learning Tools and Techniques" (Witten, Frank, Hall, Pal)	4	"Data Mining with Open Source Tools" by Rajjan Shinghal

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. D. Kanchana, SRMIST, RMP
				2	Dr R.D.Seeja, SRMIST, seejar@srmist.edu.in

Code	PCD25AE1T	Title	Comprehensive Skills in Quantitative and Logical Reasoning	Category	AE	Ability Enhancement Course	L	T	P	C
							2	0	0	2

Offering Department	Career Guidance	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	The purpose of learning this course is to:
CR-1	Build a strong foundation in numerical concepts and arithmetic techniques, enabling learners to solve mathematical problems accurately and efficiently.
CR-2	Equip learners with essential skills for understanding and solving financial and proportional reasoning problems relevant to real-life scenarios and career needs.
CR-3	Develop problem-solving skills in time, work, speed, distance, and ratio-based applications, enabling learners to tackle real-world mathematical challenges efficiently..
CR-4	Enhance learners' logical reasoning and data interpretation skills, enabling them to solve real-life problems involving clocks, calendars, directions, relationships, and data analysis.
CR-5	Sharpen learners' logical thinking and problem-solving abilities, helping them develop skills in tackling number puzzles, logical puzzles, reasoning-based problems, and coding challenges.

Outcomes (CO)	At the end of this course, learners will be able to:

Depth				Attainment			Program Outcomes (PO)											
1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical practices &Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning

CO-1	Apply numerical methods to solve problems involving number classification, divisibility tests, progressions, HCF & LCM, simplification techniques, and vinculum-based calculations.	✓	✓	✓	✓	1	85	75	-	3	1	3	1	-	-	-	2	-	-	-
CO-2	Calculate interest, analyze profit and loss, and solve problems related to percentages, discounts, permutations, combinations, and probability, enhancing their quantitative reasoning skills.	✓	✓	✓	✓	3	85	75	-	3	1	3	1	-	-	-	2	-	-	-
CO-3	Solve problems related to time and work, speed and distance, boats and streams, mixtures and alligations, height and distance, and age-based calculations with accuracy and efficiency.	✓	✓	✓	✓	4	85	75	-	3	1	3	1	-	-	-	2	-	-	-
CO-4	Solve problems related to clocks, calendars, directions, blood relations, and interpret data from various graphical representations, including tables, bar charts, pie charts, and line graphs, with accuracy and clarity.	✓	✓	✓	✓	4	85	75	-	3	1	3	1	-	-	-	2	-	-	-
CO-5	Solve number puzzles, logical puzzles, sequential output tracing, and reasoning problems, as well as alphanumeric series and coding/decoding problems, with precision and speed.	✓	✓	✓	✓	5	85	75	-	3	1	3	1	-	-	-	2	-	-	-

Title & Session Outcomes	**Numbers and Basic Arithmetic**	**Business Mathematics and Applications**	**Applied Arithmetic Problems**	**Logical Reasoning and Data Interpretation**	**Reasoning and Puzzle Solving**
Duration (hour)	**6**	**6**	**6**	**6**	**6**
SO-1	Classification of Numbers & Tests of Divisibility	Problems on Averages and Percentage	Time and work - Problems	Clock - Problems	Number Puzzles - Problems
SO-2	Unit Digit & Trailing Zeroes	Problems on Discount	Time, Speed and Distance Problems	Problems on Calendar	Logical Puzzles –Problems
SO-3	Arithmetic Progression Geometric Progression	Problems on Simple Interest and Compound Interest	Boats and Streams - Problems	Direction Sense – Problems	Sequential Output Tracing – Problems
SO-4	Highest Common Factor (HCF) Least Common Multiples (LCM)	Profit and Loss - Problems	Mixtures and Alligations – Problems	Blood relation-Problems	Inductive, Logical, Abstract and Diagrammatic Reasoning – Problems
SO-5	Simplification - Problems	Permutation and Combination – Problems	Height and Distance - Problems	Data Interpretation – Table and Bar chart	Alphanumeric Series - Problems
SO-6	Virnaculum - Problems	Problems on Probability	Problems based on Ages	Data Interpretation – Pie Chart and Line graph	Coding and Decoding - Problems

Assessment									
Level of Thinking		**Continuous Learning Assessment (CLA)** (100 % weightage)							
		CLA– 1		CLA– 2		CLA– 3		CLA – 4	
		(20%)		(20%)		(30%)		(30%)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember								-

Strategies					
Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies		No Poverty	
Emulations		Group Discussion	✓	Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools	✓	Inquiry Learning	✓	Quality Education	✓

2	Understand	40%	-	40%	-	40%	-	40%	
3	Apply	40%	-	40%	-	40%	-	40%	-
4	Analyze								
5	Evaluate	20%	-	20%	-	20%	-	20%	-
6	Create								
	Total	100 %		100 %		100 %		100%	

Mathematical Computing Tools	✓	Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question	✓	Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning	✓		

Resources			
1.	Dr. Agarwal.R.S, Quantitative Aptitude for Competitive Examinations, S. Chand and Company Limited, 2018 Edition	2.	Archana Ram, PlaceMentor: Tests of Aptitude for Placement Readiness, Oxford University Press, Oxford, 2018
3	Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Tata McGraw Hill, 5th Edition	4	Edgar Thrope, Test Of Reasoning for Competitive Examinations, Tata McGraw Hill, 6th Edition

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Mr. Varadha Rajan M (External Expert), Assistant Manager – Human Resources, Justdial Limited, Chennai – 600015 varadha1723@gmail.com	1	Dr. Premavathy M, Associate Professor , Department of English Center for Distance and Online Education, Bharathidasan University, Tiruchirappalli – 620024 drmpremavathy@bdu.ac.in	1	Dr. Deepalakshmi S, HoD, Department of Career Guidance Cell, FSH, SRMIST
				2	Dr. Sathish K, Assistant Professor, Department of Career Guidance Cell, FSH, SRMIST
				3	Dr. Aarthi S, Assistant Professor, Department of Career Guidance Cell, FSH, SRMIST

SEMESTER – II

Code	PCA25C04J	Title	Data Analysis using Python Programming	Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Understand why Python is a useful scripting language for developers.
CR-2	Learn Python data structures – lists, tuples, and dictionaries to represent complex data.
CR-3	Learn how to design object-oriented programs with Python classes.
CR-4	Learn Error and Exception handling in Python applications.
CR-5	Gain knowledge about Data Analysis, Database connectivity and Graphical User Interface Components

Outcomes (CO)	*At the end of this course, learners will be able to:*

Depth			
1	2	3	4
Conceive	Design	Implement	Operate

Attainment		
1	2	3
Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)

Program Outcomes (PO)											
1	2	3	4	5	6	7	8	9	10	11	12
Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modem Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning

CO-1	Appreciate the basic and advanced features of core language-built ins	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Handle and control system/OS level features	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Implementing OOP Concepts in Python Applications		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Data Analysis Using NumPy and Pandas	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Design and implement basic applications with database connectivity.	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	**Introduction**	**Object Oriented Programming**	**Modules & Threads**	**Data Analysis**	**GUI and SQL lite**
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Python Interpreter	Classes, Objects	Creating and Importing Modules	Machine Learning Basics	Introduction to Tkinter
SO-2	Python IDE-Interactive Mode	Methods, Constructors	Uses of Standard Modules in Python – OS	Array Operations	Dialogs, Message and Entry
SO-3	Python Block Structure	Inheritance & its types	Random Module	Introduction to NumPy-Array Creation in NumPy	Menus
SO 4-5	**Practice 1: Simple programs**	**Practice 4: Implementing Inheritance**	**Practice 7: Implementing Modules**	**Practice 10: Descriptive Statistics Using NumPy**	**Practice 13: Building GUI Application with Tkinter**
SO-6	Data Types & Variables	Method Overloading & Overriding	Threads	Pandas	SQLite –Introduction
SO-7	Operators & Expressions	Class Method	Threading Functions	Series Indexing	Database Creation
SO-8	Tuples, Lists	Static Method	Binary Files	Data Frames with Pandas & Data Manipulation	CRUD Operations-Insert, Select, Update, Delete
SO 9-10	**Practice 2: Programs Using Tuples, List, Dictionary and Sets**	**Practice 5: Implementing Method Overloading**	**Practice 8: Implementing Threads**	**Practice 11: Illustrate Indexing Operations in data frame**	**Practice 14: Creating Tables Using SQLite**
SO-11	Decision Making and Branching	Errors and Exceptions	Command Line Arguments	Data Visualization Using Pandas	SQLite Aggregate Functions
SO-12	Decision Making and Looping Statements	User Defined Exceptions	Parallel System Tools	Data Visualization Using Matplotlib	SQLite Keys
SO-13	Functions	File Handling	Regular Expressions	Scikit-learn	Database Connectivity
SO 14-15	**Practice 3: Illustration on Lambda and Filters**	**Practice 6: Illustration on how to raise an Exception**	**Practice 9: Illustration on Command Line Arguments and Regular Expressions**	**Practice 12: Illustrate various Plots using Pandas and Matplotlib**	**Practice 15: Illustration on Database Connectivity**

Assessment											
Level of Thinking		**Continuous Learning Assessment (CLA)** (50 % weightage)								**Final Exam** (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies					
Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources

1	Charles R. Severance, “Python for Everybody: Exploring Data Using Python 3”, 1 st Edition, Shroff Publishers, 2017. ISBN: 978-9352136278.	2	Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
3	S.Sridhar , J..Indumathi,V.M . Hariharan “Python Programming “ 2023 ISBN-978-93-560-6933-6		

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. NITHYA S, SRMIST, KTR, nithyas7@srmist.edu.in	

Code	**PCA25C05T**	**Title**	**Optimization Techniques**	**Category**	C	**Professional Core Course**	L	T	P	C
							4	0	0	4

Offering Department	*Mathematics and Statistics*	**Pre-requisite Courses**	Nil	**Co-requisite Courses**	Nil	**Progressive Courses**	Nil	**Data Book / Codes/Standards**	*Graph sheet Need, Statistical table Need*

Rationale (CR)	*The purpose of learning this course is to:*	**Depth**				**Attainment**			**Program Outcomes (PO)**												
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment &	Ethical Practices & Social	Individual & Team Work	Communication	Project Management &	Life Long Learning
CR-1	To impart the overall view of the subject of operations Research																			
CR-2	To apply mathematical models for solving real life problems																			
CR-3	To develop the student’s ability and help to solve quantitative issues in information technology																			
CR-4	This mathematical modelling, provides the knowledge in planning, controlling and scheduling to the network analysis																			
CR-5	To develop the decision-making knowledge.																			
Outcomes (CO)	*At the end of this course, learners will be able to:*																			
CO-1	To understand the mathematical models and its limitations.	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	To have skill in analysis of data by Transportation and other methods.	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	To enable the student to apply the technique in solving problem by Game theory models		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*

CO-4	To provide the students with opportunity of using various software package for solving network problems	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	To introduce the students to the use of basic methodology for the solution of Queuing theory models	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Introduction to operations research	Transportation and Assignment Problems	Game Theory	Network Analysis	Queuing Theory and Inventory Control
Duration (hour)	12	12	12	12	12
SO-1	Introduction to operations research, Meaning of Operations Research	Introduction of Transportation	Introduction of game theory, Basic definitions and Examples.	Introduction of Network Analysis	Introduction of Queuing theory, Basic Definitions
SO-2	Advantages of Operations Research	Finding initial Solution by North-West Corner Method	Characteristics of Game theory and Uses of Game theory	Objectives of Network Analysis and Main function of Network	Uses of Queuing theory, Meaning of Queuing System
SO-3	Uses and Nature of Operations Research	Finding initial Solution by Row-minima Method, Column-minima Method and matrix-minima	Pure Strategies: Maximin - Minimax Principle	Advantages and Limitations of Network Analysis	Elements of Queuing System, Kendal's Notation for representing Queuing models
SO-4	Role of Operations Research in computer science and Information technology	Finding initial Solution by VAM Method	Mixed strategy: Finding value of the games without saddle points. (2X2)	Rules for constructing a project network, Constructing project network	The average number of units in the system
SO-5	Formulating the LPP	Find the initial solution for unbalanced and Maximization transportation problem	Matrix oddment method for nxn games	Network computations by Critical path method	Finding probability of waiting time in the Queue
SO-6	Some Basic Assumptions	Calculating Optimum Solutions by MODI method without Loop	Introduction of Dominance property, Rules of Dominance	Earliest start and completion time of a project network	. Problems on (M/M/1)
SO-7	Standard form of LPP and Canonical form of LPP	Calculating Optimum Solutions by MODI method with Loop	Solving Games by Dominance property	Latest start and completion time of a project network	Introduction to Inventory, Types and Application of Inventory
SO-8	Graphical solution of a LPP,Working Procedure for Graphical method	Introduction of Assignment problem, Hungarian procedure for solving Assignment Problem	Solving Games by Dominance property	Total float, Free float and Independent float	Cost involved in inventory problem
SO-9	Solving LPP by Graphically (i)Feasible Solution	Balanced and Unbalanced Assignment Problem	solving game- Graphical method,	Network computations by PERT	Deterministic inventory models
SO-10	Solving LPP by Graphically ii)Infeasible Solution iii)Unbounded Solution	Finding the optimum solution to Restriction and Maximization assignment method	Graphical Solutions of 2xM	Time estimates-Expected duration of each activity	Economic order quantity(E.O.Q)
SO-11	Simplex Method	Solving the Travelling Salesmen Problem	Graphical Solutions of N x2	Time estimates-Expected variance of each activity and variance of project length	Purchasing model with no shortages

SO-12	Simplex Method	Difference between Transportation and Assignment Problems	.Limitations of Game Theory	Basic difference between PERT and CPM	Manufacturing model with no shortages

Assessment											
Level of Thinking		**Continuous Learning Assessment (CLA)** (50 % weightage)								**Final Exam** (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	30%	-	30%	-	30%	-	30%	-	30%	-
2	Understand										
3	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
4	Analyze										
5	Evaluate	30%	-	30%	-	30%	-	30%	-	30%	-
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies					
Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources			
1.	*C.R.Kothari, Quantitative Techniques, Third Revised Edition, S.Chand Ltd, New Delhi, 2013.*	2.	*V.Sundaresan, K.S.Ganapathy Subramanian, K. Ganesan, Resource Management Techniques, Eleventh Edition, A.R Publication, 2017.*
3.	*Kalavathy.S, Operations Research, Fourth Edition, Vikas publishing house, 2014.*	4.	*Hamdy A. Taha, Operations Research: An Introduction, Tenth Edition, Pearson, 2021.*

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015		Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	*Dr. S. Lakshmi Priya, SRMIST, lakshmis3@srmist.edu.in*
2		2		2	*Dr. Suruthi S, SRMIST, suruthis3@srmist.edu.in*

Code	**PCA25C06J**	**Title**	**Advanced Operating System**	**Category**	**C**	**Professional Core Course**	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	**Pre-requisite Courses**	Nil	**Co-requisite Courses**	Nil	**Progressive Courses**	Nil	**Data Book / Codes/Standards**	Nil

Rationale (CR)	*The purpose of learning this course is to:*	**Depth**				**Attainment**			**Program Outcomes (PO)**											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CR-1	Understand the design and implementation of advanced OS features	Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CR-2	Gain hands-on experience with process scheduling																			
CR-3	Learn about process management and Memory management in OS																			
CR-4	Implement File management in OS																			
CR-5	Analyze and evaluate real-world operating systems like Linux, Windows, and Android																			
Outcomes (CO)	*At the end of this course, learners will be able to:*																			
CO-1	Understand advanced OS concepts like scheduling, memory management, and synchronization	✓				3	80	70	*3*	*2*	*2*	*3*	*2*	*2*	*2*	*2*	-	*2*	-	-

CO-2	Implement modules for system-level operations in Unix/Linux	✓	✓	✓		3	85	75	*3*	*2*	2	2	3	2	2	2	-	2	-	-
CO-3	Analyze and compare different OS architectures	✓	✓	✓	✓	3	75	70	*2*	*2*	2	3	2	3	*3*	*2*	-	2	-	-
CO-4	Understand distributed and real-time systems	✓	✓	✓	✓	3	85	80	*2*	*3*	3	3	2	2	2	3	-	3	-	-
CO-5	Apply concepts in virtualization, containers, and OS-level security	✓	✓	✓	✓	3	85	75	*2*	*3*	2	2	3	3	*3*	*2*	-	3	-	-

Title & Session Outcomes	**Introduction**	**Memory, Storage and Files**	**Distributed Operating Systems**	**Real time Operating Systems**	**Mobile Operating Systems: Android OS**
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Operating System- Functions of OS, Structures of OS – OS design issues	**Memory Management:** Logical Vs. Physical address space, Swapping	Distributed Operating Systems: System Architectures-– Design issues, Communication models,	Real time Operating Systems : Introduction , Applications of Real Time Systems	**Mobile Operating Systems:** Introduction, Architecture of Mobile operating system
SO-2	Types, Understanding different types, Overview of Process scheduling	**Virtual Memory** – Basic concepts – age fault handling, Paged memory management,	Clock synchronization, Mutual exclusion, Election algorithms	Basic Model of Real Time System	ARM and Intel architectures, Kernel structure and native level programming
SO-3	Understand the process concepts, Process states,	Understanding the concept of various paging techniques, Page replacement algorithms	Distributed Deadlock detection, Distributed scheduling	Characteristics of Real Time operating Systems	Runtime issues- Approaches to power management
SO-4 – 5	**Practice 1: Simulation of Process Scheduling**	**Practice 4: Implementation of Page replacement algorithm**	**Practice 7: Implementation of Distributed scheduling**	**Practice 10: Write a program using POSIX Real-Time Threads**	**Practice 13: Write a program using POSIX Real-Time Threads**
SO-6	System Calls, Process Synchronization: Background, Critical section Problem, Understanding the race conditions	Segmented memory management Various segmentation techniques, Thrashing, Causes of Thrashing	Distributed shared memory	Safety and Reliability, Types of Real-time tasks	**Type of Mobile OS:** Android OS , Bada ,BlackBerry OS (Research In Mo,iPhone OS / iOS (Apple),MeeGo OS, Palm OS ,Windows Mobile (Windows Phone 7)
SO-7	**Interprocess Communication and Synchronisation:** Signals, message passing, Pipes and Named Pipes (FIFOs); Shared memory	**Storage Management:** Mass storage structure – Overview of Mass storage structure – Magnetic Disks	File placement – Caching	Timing constraints, Modeling timing constraints Some important concepts	Android Operating System, The Android Software Stack
SO-8	Threats, Mutexes and Condition Variables, Semaphores	Scheduling Algorithms- Disk Scheduling algorithms	Database Operating Systems: Requirements of Database OS –	Real Time Task Scheduling	The Linux Kernel – its functions, essential hardware drivers. Libraries - Surface Manager

SO- 9-10	**Practice 2 : Implementation of System Calls**	**Practice 5: Implementation of Scheduling algorithm**	**Practice 8: Implementation of clock synchronization**	**Practice 11: Implementation of real time simulation**	Practice 14:**Study and simulate Power Management Approaches used in Android/iOS**
SO-11	CPU Scheduling; Various scheduling algorithms	**File System Interface**: File concept, File access methods, File sharing and Protection	Transaction process model	Scheduling in RTOS: Clock driven: cyclic	Media framework, SQLite, WebKit, OpenGL. Android Runtime - Dalvik Virtual Machine, Core Java Libraries
SO-12	**Deadlocks:** Resource allocation, Deadlock prevention methods,	**File system structure** Directory Implementation - Understanding the various levels of directory structure	Synchronization primitives	Event driven: Earliest Deadline First (EDF) and rate monotonic scheduling	Application Framework - Activity Manager, Content Providers, Telephony Manager, Location Manager, Resource Manager.
SO-13	Deadlock Avoidance, Deadlock detection, Recovery mechanisms, Killing the process and resource preemption	**File System Implementation**: Free space Management, Allocation methods, Understanding the pros and Cons of various disk allocation methods	Concurrency control algorithms	Hybrid schedulers	Android Application – Activities and Activity Lifecycle, applications such as SMS client app, Dialer, Web browser, Contact manager
SO-14 -15	**Practice 3: Implementation of Deadlocks**	**Practice 6: Implementation of File access methods**	**Practice 9 : Implementation of Concurrency control algorithms**	**Practice 12: Simulate a Hybrid Scheduler using combination of RMS and EDF**	**Practice 15: Implementation of Android Applications**

Assessment

Level of Thinking		**Continuous Learning Assessment (CLA)** (50 % weightage)								**Final Exam** (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										

Strategies

Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			

Total	100 %	100 %	100 %	100 %	100 %			Problem Based Learning			

Resources			
1.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating systems, 9th ed., John Wiley & Sons, 2013	2	William Stallings, Operating Systems-Internals and Design Principles, 7th ed., Prentice Hall, 2012
3.	Andrew S.Tanenbaum, Herbert Bos, Modern Operating systems, 4thed., Pearson, 2015	4	Bryant O'Hallaxn, Computer systems- A Programmer's Perspective,Pearson, 2015

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr.G.Elavarasi, SRMIST, elavarag4@srmist.edu.in

Code	**PCA25C07J**	**Title**	**Artificial Intelligence and Machine Learning**	**Category**	**C**	**Professional Core Course**	L	T	P	C
							3	0	2	4

Offering Department	**Computer Applications**	**Pre-requisite Courses**	**Nil**	**Co-requisite Courses**	**Nil**	**Progressive Courses**	**Nil**	**Data Book / Codes/Standards**	**Nil**

Rationale (CR)	*The purpose of learning this course is to:*	**Depth**				**Attainment**			**Program Outcomes (PO)**												
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design,	Modern Tool Usage	Society & Culture	Environment &	Ethical Practices & Social Responsibility	Individual & Team	Communication	Project Management &	Life Long Learning
CR-1	Understand the basic concepts and principles of Artificial Intelligence																			
CR-2	Learn Basic code of Prolog for AI																			
CR-3	Study the concepts of Supervised Machine Learning Algorithms																			
CR-4	Gain knowledge about Boosting Algorithms																			
CR-5	Implement and apply supervised and unsupervised machine leaning Algorithms																			

Outcomes (CO)	*At the end of this course, learners will be able to:*																					
CO-1	Delineate Artificial Intelligence and Machine Learning	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Practical Understanding about Prolog	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Recognize the characteristics of machine learning strategies		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Apply various supervised learning methods to appropriate problems	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Identify and integrate more than one Machine Learning Algorithms to enhance the performance	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Definition of AI	Architecture of expert systems	*Working of search Algorithms*	PROLOG: Representation	Components of Machine Learning Models
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Definition of AI and Scope of AI	Architecture of expert systems	A* algorithm, Constraint satisfaction	PROLOG: Representation	Components of Machine Learning Models
SO-2	Evolution of AI	Role of expert systems	AO* Algorithm	Structure, Backtracking	Learning Models, Geometric Models
SO-3	The Turing Test, The Cognitive modeling approach	Types of Expert system: Rule Based, Frame Based	Constraint satisfaction	Unification	Types of Learning
SO 4-5	**Lab 1: Solving Problems using AI**	**Lab4: Experts System in Prolog**	**Lab 7:Working on Informed Search -I**	**Lab 10: Decision tree implementation**	**Lab 13: Bayesian Learning**
SO-6	Intelligent Agents and its Types	Case Based, Fuzzy Logic System, Hybrid Systems	Greedy Best-First Search	Learning with trees	Supervised, Unsupervised and Reinforcement Learning
SO-7	Problem Solving Agents	Knowledge Acquisition	Beam	Decision Tree with Entropy Calculation	Linear Models for Regression, Logistic Regression, SVM, LDA
SO-8	Knowledge based systems	Meta knowledge, Heuristics	Searching Game playing: Minimax	CART Algorithm	Bayesian Learning- Naive Bayes
SO 9-10	**Lab2: Solving Problems using AI**	**Lab 5: Working on Uninformed** Search -I	**Lab 8: Working on Informed** Search-II	**Lab** 11: **Implementation of Decision tree and K- Mean algorithm**	**Lab 14: Linear** Models **for** Clustering

SO-11	Propositional Logic: Representation, Inference	Search Algorithms: Uninformed Search: Breadth First Search	Search Alpha-Beta Cutoffs,	What is Machine Learning and Why should we care about it?	K-Means, Hierarchical Clustering
SO-12	Forward and Backward Chaining	Depth First Search, Depth Limited Search	Waiting for Quiescence	Applications of Machine Learning	Gaussian Mixture Models, Logistic Regression Decision Tree Learning
SO-13	Syntax and Semantics of First order Logic Representation.	Comparison of Uninformed search Strategies	Examples	Where ML is used in the Data Science Process	Random Forest, K-NN, Bagging: Random Forest Trees
SO 14-15	**Lab3: Propositional Logic and Reasoning**	**Lab 6: Working on Uninformed Search-II**	**Lab 9: Working with PROLOG**	Lab 12: **Supervised Learning**	**Lab 15: Reinforcement Learning**

Assessment											
Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies					
Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources			
1.	StuartRussell&PeterNorvig:"Artificial Intelligence: A Modern Approach", Pearson Education, 2ndEdition	2.	Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014
3.	Ivan Bratko,"Prolog Programming For Artificial Intelligence",2nd Edition Addison Wesley.	4	Ethem Al paydin, Introduction to Machine Learning, MIT Press, Third Edition, 2014.

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. M.Gracy, SRMIST, gracym2@srmist.edu.in

Code	PCA25D04J	Title	Software Project Management	Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To get a deep insight to software project management concepts
CR-2	To learn the cost estimation techniques during the analysis of the project
CR-3	To know how to do project planning Estimation for the software process
CR-4	To teach students how to manage software projects effectively.
CR-5	To understand about the Globalization issues in project management in detail

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1 Conceive	2 Design	3 Implement	4 Operate	1 Level of Thinking	2 Expected Proficiency (%)	3 Expected Attainment (%)	1 Disciplinary Knowledge	2 Problem Solving	3 Design & Development	4 Analysis, Design, Research	5 Modern Tool Usage	6 Society & Culture	7 Environment & Sustainability	8 Ethical Practices & Social Responsibility	9 Individual & Team Work	10 Communication	11 Project Management & Finance	12 Life Long Learning
CO-1	Understand the activities during the project scheduling of any software application	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Create reliable, replicable cost estimation that links to the requirements of project planning and managing	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Identify the different project contexts and suggest an appropriate management strategy		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Learn the risk management activities and the resource allocation for the projects	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Acquire knowledge and skills needed to overcome the Globalization issues in project management	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Software Project Management Concepts	Project Evaluation	Software Resource Estimation	Risk Management	Globalization Issues in Project Management
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Introduction to Software Project Management	Project Evaluation: Strategic Assessment	Software Effort Estimation: Problems with over and under estimations	Risk Management : Introduction	Globalization issues in project management: Evolution of globalization
SO-2	An Overview of Project Planning	Technical Assessment, cost-benefit analysis	Basis of software Estimation	Nature of Risk Man aging Identification	challenges in building global teams
SO-3	Select Project, Identifying Project scope and objectives, infrastructure, project products and Characteristics	Cash flow forecasting	Software estimation techniques	Analysis, Reducing	Models for the execution of some effective management techniques for managing global teams
SO 4-5	***Case Study - 1:*** Developing an Online Examination System for a University	***Case Study - 4:*** Implementing an E-Governance Portal for a Municipality	***Case Study - 7:*** Develop a mobile e-commerce application that supports product listings, user authentication, payment gateway integration and real-time order tracking.	***Case Study - 10:*** Develop a real-time traffic monitoring system for a metropolitan city	**Case Study** - 13: Built the Multinational software firm, to managing a global project to develop a cloud-based healthcare platform involving teams from the U.S and India
SO-6	Software Myths, Layered Technology	Cost-benefit evaluation techniques	Albrecht Function Point Analysis , Function Points, Object Points	Evaluating , Z values	Impact of the internet on project management: Introduction
SO-7	Software Project Versus Other Project	Risk Evaluation	Activity Planning , Project Schedules, Projects and activities	Resource Allocation , Nature of Resources	The effect of the internet on project management
SO-8	Identify Project Infrastructure	Selection of Appropriate Project approach	Sequencing and Scheduling Activities, Network Planning Models, Formulating a Network Planning	Requirements, Scheduling, Critical Paths	Managing projects for the internet
SO 9-10	***Case Study - 2:*** Building a Mobile App for Smart Agriculture Monitoring	***Case Study - 5:*** Building a Cloud-Based Learning Management System (LMS)	***Case Study*** - 8**:** Developing an Online Examination System for a government education board.	***Case Study - 11:*** Development of a Smart City Infrastructure Management System that integrates utilities like water supply, street lighting, and waste management through IoT and cloud technologies	Practice 14: Develop the project for a cloud-based project management tool aimed at helping remote teams collaborate efficiently.
SO-11	Estimate Effort for each Activity	Choosing technologies	Adding Time Dimension, Forward Pass, Backward Pass	Resource Schedule	Effect on project management activities
SO-12	Software Quality: defining software quality	choice of process models	Identifying the Critical Path	Creating the Frame Work	Comparison of project management software: dot Project

SO-13	ISO9126, External Standards	structured methods, Rap id Application Development	Activity Float, Shortening Project Duration, Identifying Critical Activities	Collecting the Data, Visualizing the Progress	Launch pad, openProj.
SO 14-15	***Case Study*** *- 3:* Developing a Hospital Management System (HMS)	***Case Study*** *- 6: Developing a Student Attendance and Performance Monitoring System for a university*	***Case Study*** *- 9: M*anaging the development of a Library Automation System for a university	***Case Study*** *- 12:* A project to develop an e-commerce website for a client	***Case Study*** *- 15: Developing the project* for a non-profit organization that aims to develop a new mobile application to help users track personal wellness goals.

0Assessment

Level of Thinking		**Continuous Learning Assessment (CLA)** (50 % weightage)								**Final Exam** (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies

Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	✓
Emulations	✓	Group Discussion	✓	Zero Hunger	✓
Prototypes		Hands-on Practice	✓	Good Health & Well Being	✓
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources			
1	Roger .S.Pressman: Software Engineering, Tata McGrawHill , V Edition	2	Bob Hughes and Mike Cottrell, “Software Project Management”, McGraw Hill, Second Edition.
3	Robert T. Futrell , “Quality Software Project Management”, Pearson Education India, 2008.	4	Gopalaswamy Ramesh, “Managing Global Software Projects: How to Lead Geographically Distributed Teams, Manage Processes and Use Quality Models”, McGraw Hill Education, 2017.
5	Walker Royce, “Software Project Management”, Addition Wesley.		Derrel Ince, H. Sharp and M. Woodman, “Introduction to Software Project Management and Quality Assurance”, Tata McGraw Hill, 1995.
5.	Richard H.Thayer “Software Engineering Project Management”, 2nd Edition, Wiley, 2006.		S. A. Kelkar,” Software Project Management” PHI, New Delhi, Third Edition ,2013

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. A.Thilaka, SRMIST, <thilakaa@srmist.edu. in>

Code	PCA25D05J	Title	Mobile Applications Development	Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Identify various mobile programming concepts
CR-2	Facilitate students understanding android SDK
CR-3	Help students gain a basic understanding of Android application development
CR-4	Inculcate working knowledge of Android Studio development tool
CR-5	Deploy applications in Android platform

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1 Conceive	2 Design	3 Implement	4 Operate	1 Level of Thinking	2 Expected Proficiency (%)	3 Expected Attainment (%)	1 Disciplinary Knowledge	2 Problem Solving	3 Design & Development	4 Analysis, Design, Research	5 Modern Tool Usage	6 Society & Culture	7 Environment & Sustainability	8 Ethical Practices & Social Responsibility	9 Individual & Team Work	10 Communication	11 Project Management & Finance	12 Life Long Learning
CO-1	Identify various concepts of mobile programming that make it unique from other programming platforms	✓				5	85	75	1	3	3	3	2	-	1	2	3	2	3	3
CO-2	Working with Android SDK components that are required for development	✓	✓	✓		4	85	75	2	3	3	2	2	-	2	1	3	3	3	3
CO-3	Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces		✓			6	85	75	2	3	3	3	3	-	2	1	3	2	3	3
CO-4	Program mobile applications for the Android operating system that use basic and advanced phone features	✓	✓	✓	✓	3	85	75	3	3	2	3	3	-	3	1	3	3	3	3
CO-5	Deploy applications to the Android marketplace for distribution	✓	✓			2	85	75	3	3	2	3	3	-	2	3	3	3	3	3

Title & Session Outcomes	Introduction to Android	Android User Interface Design	Android Application Design	Messaging and Networking	Using Common Android APIs
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Getting Started with Android Programming, Android Versions and its feature set	Understanding the component of a screen, Views and viewgroups	Data persistence, Saving and loading user	Messaging and networking, SMS messaging	Location based services, Displaying maps
SO-2	Java for Android - Building first Android App, Android API, Android Architecture, Android Devices in the market	Absolute layout, table layout, relative layout, frame and scrollview, adapting to display orientation	Using getSharedPreferences() and getPreferences(), Persisting data to files	Sending SMS messages programmatically, Getting feedback after sending the message	Creating the project, Obtaining the maps API key
SO-3	Setting up Android Studio, Android Tools, Eclipse, Android SDK, Android Development Tools (ADT)	Managing changes to screen orientation, Detecting orientation changes, Controlling the orientation activity, Creating the user interface programmatically	Saving to internal storage, Saving to external storage	Sending SMS messages using intent, Receiving SMS messages, Updating an activity from BroadcastReceiver	Displaying the map, Displaying the Zoom control
SO 4-5	**Practice 1: Login page creation with Toast message**	**Practice 4: Implement implicit Intent**	**Practice 7: Student Registration form using Listview**	**Practice 10: Shared preferences**	**Practice 13: Simulate paintbrush applications**
SO-6	Creating Android Virtual Devices (AVD), Example: Creating android application	Listening to UI notifications, Designing user interface using views	SQLite database, SQLite database Creating and using databases	Invoking an activity from, Example program: SMS messages	Changing views, Satellite View
SO-7	Anatomy of an Android Application, Real time applications	Basic views, Picker views	Insert, display and delete, Creating the DBAdapter helper	Sending E-mail, Example: How to send email in android application	Navigating to a specific location, Adding markers
SO-8	Linking activities using intents, Resolving intent filter collision	List views, Displaying pictures and menus with views	Using the database programmatically, Example: Add, retrieve, update, delete a contact	Networking, Binary data and Text data	Getting the location that was touched, Get coding and reverse geocoding
SO 9-10	**Practice 2: Student registration form with Toast message**	**Practice 5: Implement Time Picker**	**Practice 8: Implement Context menu**	**Practice 11: Implementation of SQLite database with Examples in Android Studio**	**Practice 14: Draw an object**
SO-11	Returning results from an intent, Passing data using an intent object	Using menus with views, Some additional views	Content providers, Sharing data in android using content provider	Accessing Web services, Performing Asynchronous Calls	Getting location data, Monitoring a location
SO-12	Implicit Intent, Example program for Implicit Intent	Context Menu, Example program for Context menu	Predefined query string constants, Projections, Filtering, sorting	Downloading text files, Example program for downloading text files	Preparing for publishing APK files, Deploying apk files
SO-13	Explicit Intent, Example program for Explicit	Option menu, Example program for Optional Menu	Creating your own content providers, Using the content providers	Downloading binary data, Example program for downloading binary data	Using adb.exe tool and web, Android market

SO 14-15	Practice 3: Implement Explicit Intent	Practice 6: Implement Date Picker	Practice 9: Implement Option Menu	Practice 12: Implementation of SQLite database with Applications in Android Studio	Practice 15: Implement Webview

Assessment

Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies

Technology		Pedagogy / Andragogy		Sustainable Development	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources

1.	*Wei-Meng Lee, "Beginning Android Application Development", John Wiley & Sons, 2011 (For 1 to 5 units).*	*2*	*Ed Burnette, "Hello Android: Introducing Google's Mobile Development Platform", Third Edition, Raleigh, N.C.: Pragmatic Bookshelf, 2010.*
3.	*Reto Meier, "Professional Android 4 Application Development", John Wiley & Sons, 2012.*	*4.*	*Zigurd Mednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, "Programming Android: Java Programming for the New Generation of Mobile Devices", O'Reilly Media, 2011.*

Designers

Professional Experts		Higher Institution Experts		Internal Experts	
1	Dr. Gangadharan G.R,Professor, National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements, GUVI Geek Networks Pvt Ltd	1	Dr.Ananthi Claral Mary.T, SRMIST, ananthit1@srmist.edu.in

Code	PCA25D06J	Title	Data Visualization Techniques	Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*	Depth				Attainment			Program Outcomes (PO)											
CR-1	Describe real time data dashboards with Tableau	1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CR-2	Discover the data visualization concepts	Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CR-3	Illustrate data elaboration																			
CR-4	Creating real time data dash boards																			
CR-5	Explore Data visualization with Seaborn, Matplotlib, Bokeh,Pygal																			
Outcomes (CO)	*At the end of this course, learners will be able to:*																			
CO-1	To gather knowledge on Data visualization principles	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	To understand and implement data visualization concepts	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	To understand and implement data visualization using graphs.		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	To understand data dashboards	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	To implement open source data visualization tool	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Introduction to Tableau	Charts and Story Telling	Dashboard	Seaborn and Colour Palettes	Matplotlib, Bokeh And Pygal
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Introduction to Tableau, Overview of Tool Interface and Installation	Calculated Fields, Table Calculations	Clutter and Clutter elimination Gestalt principle, story design best practices and tools for storytelling	Open Source Data Visualization, Introduction to Seaborn and install Seaborn	Open Source Data Visualization with Matplotlib, Bokeh And Pygal

SO-2	Adding data sources in Tableau, The sample dataset	Create groups for data, Create and Use the Sets, Create data filters	Decluttering , Declutter data visualizations	Statistical data visualization	An Introduction To Matplotlib, analysing Data Using NumPy
SO-3	The Tableau Workspace, , Joining data sources, Union on data sources	Combine data sources using data blending, Bringing in More data with Joins	Dashboard storytelling	Seaborn Univariate plots, distribution plots	Analyzing Data Using Pandas
SO 4-5	**Practice 1: Installing Tableau**	**Practice 4*:* Graphical tools for data elaboration -1**	**Practice 7: Creating a new dashboard**	**Practice 10*:* explore different types of Bivariate distributions**	**Practice 13*:* summary statistics using native**
SO-6	Creating workbook, Saving Workbook, Sharing workbook	Visualizing data using Bar Chart, Line Charts, Scatterplots, and Heat maps,	Data Dashboards using Tableau	Simple Bivariate distributions, analyse multiple variable pairs	Visualizing data, Univariate distributions, Bivariate distributions
SO-7	Working with measures and dimensions,	Histograms, Dual Axis Charts, and Pie Charts.	Organizing and Formatting Tableau Dashboard	Regression plots, Themes. styles in seaborn	Python functions, Correlation, Covariance, Z-score
SO-8	Working with marks, Data extracts, Editing model's metadata , Data types,	Bump Charts, Control charts, Pareto charts, Waterfall charts	Dashboard Actions, Dashboard Titles	Graphs in Seaborn , Types of Graphs	Summary Statistics using NumPy,
SO 9-10	**Practice 2: Working with sample dataset in a Tableau Workspace**	**Practice *5:* : Graphical tools for data elaboration-2**	**Practice 8: Working with Dashboard**	**Practice 11*:* Analyze Bivariate Distribution and multiple variable pairs**	**Practice 14: plot graphs using Matplotlib**
SO-11	Adding Hierarchies, Working with Shelves and Cards, Marks, Legends	Usage and filtration of data with charts, visualizing categorical data, time series data, and multiple variables.	Data driven decisions with Dashboard	Configuring plot aesthetics normal distribution and outliers, distributions within categories-part	Using histograms – matplotlib, matplotlib libraries for visualization
SO-12	Difference between Green and Blue pill, Blue & green pills Filters, Blue & green pills effect on dates.	Storytelling –who, what, how, Storytelling process, interpreting context	Tableau dashboards and story points	Introducing color palettes	Bar chart using ggplot, bokeh and pygal
SO-13	Data Collection, Data tables, Selecting Data Tables	Visualization for storytelling, storytelling scenarios	Charts. Tableau maps and Placing charts on dashboard	Choosing color palettes, Color guide	Select visualization libraries interactive graphs and image files, animate plots with matplotlib
SO 14-15	**Practice 3: Working with Data Tables**	**Practice *6:* Create a story with Tableau**	**Practice 9*:* building a real time dashboard**	**Practice 12*:* *program* using color palettes.**	**Practice *15:* bar chart using ggplot, bokeh and pygal**

Assessment											
Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies					
Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion	✓	Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources

1. Abha Belorkar, Sharath Chandra Guntuku, Interactive Data Visualization with Python - Second Edition, *Second Edition,*, Packt Publishing, *2020*
2. Joshua N. Milligan, Learning Tableau, *Fiorst Edision*, Packt Publishing, *2016*
3. Daniel G. Murray, Tableau Your Data!,*1st Edition* , Wiley Publisher, *2013*
4. Jake VanderPlas, Python Data Science Handbook, 1st edition, O'Reilly Media,2016

Designers

Professional Experts		Higher Institution Experts		Internal Experts	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr.V.Nisha, SRMIST

Code	PCA25S02J	Title	Internet of Things (IoT)	Category	S	Skill Enhancement Courses	L	T	P	C
							2	0	3	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Understand the fundamental concepts and architecture of the Internet of Things (IoT).
CR-2	Explore various communication protocols and enabling technologies used in IoT.
CR-3	Gain practical knowledge on integrating sensors and devices with microcontrollers like NodeMCU and Raspberry Pi.
CR-4	Analyze real-time data using cloud platforms and data visualization tools in IoT systems.
CR-5	Design and implement IoT applications across domains like smart cities, health, agriculture, and energy using real-world case studies.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)												
		1 Conceive	2 Design	3 Implement	4 Operate	1 Level of Thinking	2 Expected Proficiency (%)	3 Expected Attainment (%)	1 Disciplinary Knowledge	2 Problem Solving	3 Design & Development	4 Analysis, Design, Research	5 Modern Tool Usage	6 Society & Culture	7 Environment & Sustainability	8 Ethical Practices & Social	9 Individual & Team Work	10 Communication	11 Project Management & Finance	12 Life Long Learning
CO-1	Describe the architecture, protocols, and components of IoT systems.	✓				3	80	70	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Demonstrate the ability to interface sensors and actuators with IoT hardware platforms.	✓	✓	✓		3	85	75	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Apply cloud services for IoT data processing, storage, and visualization.		✓			3	75	70	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Develop and deploy IoT applications using microcontrollers and programming environments.	✓	✓	✓	✓	3	85	80	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Analyze and evaluate IoT-based solutions addressing real-world problems in various domains.	✓	✓			3	85	75	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	*2*	*3*

Title & Session Outcomes	Fundamentals and Architecture of IoT	IoT Network Architecture and Platform Design	Communication Protocols and Sensor Integration	Enabling Technologies and IoT System Management	IoT Applications, Case Studies, and Cloud Integration
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Introduction, Definition & Characteristics of IoT	Applications of IoT, Domain Specific IoT	Introduction about IoT protocols, Infrastructure , 6LowPAN, Architecture of 6LowPAN	Create IoT Platforms Design Methodology for: Purpose & Requirements, process model	Introduction about RESTful API Designing a RESTful Web API

				specification, domain model specification	
SO-2	Physical design of IoT, Things in IoT, IoT protocols, logical Design of IoT	Home Automation, Cities, Industry, Health & Lifestyle Energy Systems, Agriculture, Logistics, Retail	Ipv6, Architecture of Ipv6, Communications / Transport Wifi, Bluetooth	Information model specifications, service specifications, Iot level specifications, Functional view specifications, operational view specifications. Device & component Integration, Application development	Amazon Web Services, Amazon Web Services for IoT Creating a ID in Amazon, EC2, Implementation of EC2, Autoscaling, Implementation of Autoscaling
SO 3-5	**Practice 1: Arduino Installation and Blink LED using Node MCU Esp8266**	**Practice 4: Interfacing Temperature Humidity Sensor with Node MCU Esp8266**	**Practice 7: Interfacing MQ 4 GAS Sensor with Node MCU Esp8266**	**Practice 10: Create a Webserver using Node MCU Esp8266**	**Practice13: Smart Irrigation System**
SO-6	IoT Functional Blocks ,IoT Communication Model and IoT Communication APIs	M2M, Architecture of M2M	mDNS , Discovery, Physical Web, DNS-SD	IoT System for Weather Monitoring, Purpose &	S3, Implementation of S3
SO-7	Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems	SDN, Architecture of SDN, NFV for IOT, Architecture of NFV, IoT System Management, , Need for IoT Systems Management	Data Protocols, MQTT, Examples of MQTT, Difference between MQTT and HTTP	IoT System for Agriculture Purpose & Requirements,	RDS, Implementation of RDS, DynamoDB, Implementation of DynamoDB, Kinesis, Implementation of Kinesis
SO 8-10	**Practice 2: Interfacing IR (Infrared Proximity) Sensor with Node MCU Esp8266**	**Practice 5: Control an LED using Cloud BLYNK APP**	**Practice 8: Interfacing Relay and Control LIGHT with Node MCU Esp8266**	**Practice 11: Home Automation – Level 0**	**Practice 14: Weather Reporting Systems**
SO-11	IoT Levels and Deployment Templates, Levels 0, Levels 1, Levels 2	Advantages and Disadvantages of IoT system management Simple Network Management Protocol	CoAP, Types of CoAP, Pros and Cons of CoAP AMQP	Introduction to Cloud Storage Models, Arduino Rasberry pi, Explanation of raspberry pi pin diagram	Case studies – Environment IoT systems for weather Reporting Bot
SO-12	Level 3, Level 4, Level 5	Limitations of SNMP, Network Requirements for IoT	Request and Response methods, JSON- LD	Introduction to Cloud Storage Communication APIs, Python Web Application Framework, Django Architecture Design of Weather Monitoring using Django, Starting Development with Django Toolkit	Air Pollution Monitoring System, Forest Fire Detection
SO 13-15	**Practice 3: Interfacing Light Sensor with Node MCU Esp8266**	**Practice 6: Interfacing Soil Moisture Sensor with Node MCU Esp8266**	**Practice 8: Working of Raspberry Pi.**	**Practice 12: Home Automation – Level4**	**Case studies - IoT system for Energy Smart grid Renewable Energy Systems**

Assessment											
Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	-	40%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	-	40%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	-	20%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies					
Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources			
1.	ArshdeepBahga and Vijay Madisetti, “Internet of Things - A Hands-on Approach”, Universities Press, 2015.(Unit I – Unit V)	2.	Dieter Uckelmann et.al, “Architecting the Internet of Things”, Springer, 2011.
3.	CunoPfister, “Getting Started with the Internet of Things”, O’Reilly, 2011.	4.	Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, Wiley, 2014.
5.	HonboZhou , “The Internet of Things in the Cloud: A Middleware Perspective “, CRC Press , 2012.	6.	Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. Leena Nesamani S, SRMIST, leenan@srmist.edu.in

Code	PCD25AE2T	Title	Soft Skills And Verbal Mastery	Category	AE	Ability Enhancement Course	L	T	P	C
							2	0	0	2

Offering Department	Career Guidance	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*	Depth				Attainment			Program Outcomes (PO)											
CR-1	Help individuals develop key skills for personal and professional growth	1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CR-2	Prepares individuals to navigate daily challenges with confidence, professionalism, and a positive mindset																			
CR-3	Create a strong resume, participate in group discussions, and perform well in interviews																			
CR-4	Enhance vocabulary and verbal reasoning skills																			
CR-5	Develop the skills needed for effective communication and critical thinking in both written and spoken language																			

Outcomes (CO)	*At the end of this course, learners will be able to:*	Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical practices &Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Gain a deeper understanding of self, including emotional intelligence and career aspirations	✓	✓	✓	✓	3	85	75	1	-	3	-	3	3	-	-	3	3	2	3
CO-2	Apply effective presentation skills for clear, engaging communication	✓	✓	✓	✓	6	85	75	1	3	3	-	3	2	-	-	3	3	2	3
CO-3	Participate confidently and effectively in group discussions and interviews	✓	✓	✓	✓	3	85	75	1	3	1	-	3	2	-	-	3	3	2	3
CO-4	Enhance their ability to understand and use language effectively in different contexts	✓	✓	✓	✓	2	85	75	1	-	-	-	1	-	-	-	-	3	2	2
CO-5	Improve language comprehension and accuracy	✓	✓	✓	✓	5	85	75	1	-	-	-	1	-	-	-	-	3	2	2

Title & Session Outcomes	Personal Development	Mastering Workspace Dynamics	Career Essentials	Verbal Ability	Verbal Reasoning and Comprehension
Duration (hour)	6	6	6	6	6
SO-1	Self-analysis through SWOT, The Johari Window	Personal, Professional and Social Etiquette	Resume Preparation and Activity	Synonyms and Antonyms	Statement and Assumption

SO-2	Goal Setting Importance, Goal Setting based on the Principle of SMART	Professional Communication - Presentation Skills	E-mail Drafting and Practice	One Word Substitution	Paragraph Summary
SO-3	Emotional Intelligence (Identifying, Managing and Understanding Emotions)	Presentation for Internal and External Communication - online & offline Meetings	Techniques to Follow in Group Discussion	Word Analogy	Idioms and Phrases
SO- 4	Process of Career Exploration	Time Management and Planning Tools	Mock Group Discussion	Verbal Classification	Cloze Test
SO-5	STAR Technique (situation, task, approach and response) for Facing an Interview	Decision Making Skills	Interview Techniques	Spotting Errors	Theme Detection
SO-6	Professional Attitude – Entrepreneurial, Rational, Optimistic Attitude	Teamwork in Workspace - Resilience and Stress Management	Mock Personal Interview	Sentence Correction	Reading Comprehension

Assessment

Level of Thinking		Continuous Learning Assessment (CLA) (100 % weightage)							
		CLA – 1 (20 %)		CLA – 2 (20 %)		CLA – 3 (30 %)		CLA – 4 (30%)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	25%	-	20%	-	30%	-	50%	-
2	Understand								
3	Apply	50%	-	50%	-	40%	-	25%	-
4	Analyze								
5	Evaluate	25%	-	30%	-	30%	-	25%	-
6	Create								
	Total	100 %		100 %		100 %		100%	

Strategies

Technology		Pedagogy / Andragogy		Sustainable Development	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion	✓	Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools	✓	Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question	✓	Clean Water & Sanitation	
		Mind Map	✓	Affordable & Clean Energy	
		Minute Paper			
		Peer Review	✓		
		Problem Based Learning	✓		

Resources

1	"The Johari Window: A Model for Self-awareness and Personal Growth" by Joseph Luft & Harrington Ingham	2	Campus Recruitment complete Reference , Praxis Groups
3	"The 7 Habits of Highly Effective People" by Stephen R. Covey	4	A Modern Approach to Verbal and Non Verbal Reasoning – Dr A S Agarwal
5	"SMART Goals: How to Set and Achieve Your Personal and Professional Goals" by S.J. Scott	6	Verbal Ability & Reading Comprehension for CAT - Arun Sharma

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Mr. Varadha Rajan M (External Expert), Assistant Manager – Human Resources, Justdial Limited, Chennai – 600015 varadha1723@gmail.com	1	Dr. Premavathy M, Associate Professor , Department of English Center for Distance and Online Education, Bharathidasan University, Tiruchirappalli – 620024 drmpremavathy@bdu.ac.in	1	Dr. Deepalakshmi S, HoD, Department of Career Guidance Cell, FSH, SRMIST
				2	Dr. Muthu Deepa M, Assistant Professor, Department of Career Guidance Cell, FSH, SRMIST
				3	Dr. Sam Israel S, Assistant Professor, Department of Career Guidance Cell, FSH, SRMIST
				4	Dr Elamathiyan E, Assistant Professor, Department of Career Guidance Cell, FSH, SRMIST

SEMESTER – III

Code	PCA25C08J	Title	Data Communication Networks	Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Understand the fundamental concepts and components of data communication systems, including network models, switching, and signal transmission.
CR-2	Analyze the functioning of data link layer protocols, media access control, and error handling mechanisms in both wired and wireless networks.
CR-3	Apply IP addressing schemes, routing algorithms, and transport protocols to configure and troubleshoot computer networks.
CR-4	Evaluate and demonstrate various application layer services and protocols, including DNS, FTP, HTTP, email, and multimedia communication.
CR-5	Explore modern trends in network security, automation, and software-defined networking (SDN), and implement scripts using open-source tools.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CO-1	Describe data communication principles, network models, and switching mechanisms.	✓				2	85	75	3	2	2	3	2	1	1	1	1	2	2	2
CO-2	Analyze media types, encoding schemes, and error control at the data link layer.	✓	✓	✓		4	85	75	3	3	2	3	2	1	1	1	2	2	2	2
CO-3	Configure IP addressing, routing protocols, and transport layer mechanisms.		✓	✓	✓	3	85	75	3	3	3	3	3	2	1	2	2	2	3	3
CO-4	Demonstrate application layer protocols and client-server interactions.	✓	✓	✓	✓	5	85	75	3	2	2	2	3	2	2	2	2	3	2	3
CO-5	Apply security concepts, SDN, and automation tools in modern networking environments.	✓	✓	✓	✓	6	85	75	3	3	3	2	3	2	2	3	3	3	3	3

Title & Session Outcomes	Fundamentals of Data Communication	Data Link Layer and Network Technologies	Network and Transport Layer Protocols	Application Layer and Network Services	Network Security and Automation Tools

Duration (hour)	15	15	15	15	15
SO-1	**Basics of Data Communication –** Components, Direction, Delivery	**Framing Techniques** – Character and bit-oriented framing	**Logical Addressing –** IPv4, IPv6 structure and assignment	**DNS and Domain Structure** – Name resolution and hierarchy	**Network Security Goals –** Confidentiality, Integrity, Availability
SO-2	**Network Models** – OSI and TCP/IP architectures w	**Error Detection and Correction –** Parity, CRC, Hamming Code	**Subnetting and Supernetting** – Practice and problem solving	**HTTP Protocol** – GET, POST methods and stateless nature	**Cryptographic Concepts** – Symmetric vs Asymmetric encryption
SO-3	**Transmission Modes –** Simplex, Half Duplex, Full Duplex	**Flow and Access Control –** Stop-and-wait, Sliding Window	**Routing Algorithms** – Distance Vector and Link State	**Email Protocols** – SMTP, POP3, IMAP	**Authentication Methods** – Digital signatures, certificates
SO 4-5	**Practice:** Tools: Packet Tracer, Python, command-line tools • Simulate OSI and TCP/IP layered communication using Cisco Packet Tracer Design a basic LAN topology with routers and switches	**Practice:** Tools: Python, Packet Tracer, Wireshark • Implement CRC and Parity checking using Python Demonstrate Hamming code for error correction	**Practice:** Tools: Packet Tracer, Wireshark, Python (socket module) • Practice IPv4 and IPv6 addressing and subnetting Configure static and dynamic routing (RIP/OSPF) in Packet Tracer	**Practice:** Tools: Postman, Wireshark, FileZilla, PuTTY/SSH, Python, terminal • Perform DNS queries using nslookup and dig Test HTTP/HTTPS requests using Postman and browser dev tools	**Practice:** Tools: Python, Wireshark, Nmap, Netmiko, Jenkins, VirtualBox (optional) • Simulate symmetric/asymmetric encryption algorithms using Python Configure basic firewall rules using iptables or UFW
SO-6	**Analog and Digital Signals –** Characteristics and conversions	**HDLC and PPP Protocols –** Features and formats	**Types of Transmission** – Unicast, Multicast, Broadcast	**FTP and TFTP** – File transfer mechanisms	**Firewall Technologies** – Packet filtering, stateful inspection
SO-7	**Bandwidth, Throughput, Latency –** Definitions and calculations	**MAC Protocols –** CSMA/CD, CSMA/CA	**Address Resolution Protocols** – ARP, RARP, DHCP	**Telnet and SSH** – Remote terminal services	**Intrusion Detection Systems** – IDS/IPS and VPNs
SO-8	**Transmission Impairments –** Attenuation, Noise, Distortion	**Ethernet Standards –** 802.3, Fast Ethernet, Gigabit Ethernet	**ICMP and Ping Utilities** – Diagnostic and reporting features	**Client-Server Architecture** – Concepts and practical examples	**Wireless Network Security** – WPA, WPA2, MAC filtering
SO 9-10	**Practice:** • Observe transmission modes (simplex, half, full-duplex) via simulation tools Analyze signal types and bit rate calculations using Python	**Practice:** • Simulate Stop-and-Wait and Sliding Window protocols Frame creation using bit stuffing/character stuffing	**Practice:** • Analyze ICMP and ARP packets using Wireshark Configure DHCP and NAT in Packet Tracer	**Practice:** • Set up FTP and email (SMTP, POP3) servers using FileZilla and Thunderbird Demonstrate Telnet and SSH sessions to remote devices	**Practice:** • Capture WPA2 authentication traffic using Wireshark Scan and analyze networks using Nmap and Zenmap
SO-11	**Data Encoding Techniques –** NRZ, Manchester, Differential Manchester	**Wireless LANs** – IEEE 802.11, Wi-Fi architecture	**TCP and UDP Protocols –** Features, ports, reliability	**Web Services and APIs** – REST, SOAP basics	**Software-Defined Networking (SDN)** – Basics and architecture
SO-12	**Switching Techniques –** Circuit, Packet, and Message Switching	**VLANs and Switch Configuration –** Concepts and benefits	**Multiplexing and Port Addressing –** Demultiplexing at receiver	**Network Performance Tools** – Ping, traceroute, netstat	**Python for Network Scripting** – Netmiko, Paramiko intro
SO-13	**Network Topologies and Protocols –** Bus, Star, Ring, Hybrid	**Token Ring and FDDI –** Legacy protocols and architecture	**Congestion Control and Flow Control –** TCP mechanisms	**Multimedia Networking** – VoIP, Streaming, QoS basics	**Monitoring and Automation Tools –** Wireshark, Nmap, Jenkins overview
SO 14-15	**Practice:** • Measure and compare latency, bandwidth, throughput using ping/traceroute Visualize network topologies (bus, star, ring, hybrid) and packet flow	**Practice:** • Configure Ethernet LAN and VLANs in Packet Tracer Capture MAC layer packets using Wireshark	**Practice:** • Compare TCP and UDP connections using Wireshark Simulate port communication and congestion control using socket programming	**Practice:** • Create simple web service client using REST API (Python/Browser) Use ping, traceroute, netstat to analyze performance	**Practice:** • Automate router config using Netmiko (Python) Create Jenkins pipeline for automated network tests

Assessment											
Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies					
Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations		Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion	✓	Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools	✓	Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning	✓		

Resources			
1	West, J., & White, C. M. (2024). *Data communications and computer networks* (9th ed.). Cengage Learning.	2	Kurose, J. F., & Ross, K. W. (2023). *Computer networking: A top-down approach* (8th ed.). Pearson.
3	Stallings, W. (2021). *Data and computer communications* (10th ed.). Pearson Education.	4	Lowe, S., Oswalt, M., & Edelman, J. (2025). *Network programmability and automation* (2nd ed.). O'Reilly Media.
5	Forouzan, B. A. (2017). *Data communications and networking* (5th ed.). McGraw-Hill Education.	6	Tanenbaum, A. S., Feamster, N., & Wetherall, D. J. (2021). *Computer networks* (6th ed.). Prentice Hall.

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. R. Reena Rose, SRMIST, KTR
				2	Dr. R. Kiruthiga, SRMIST, KTR

Code	PCA25C09T	Title	Cloud and Quantum Computing	Category	C	Professional Core Course	L	T	P	C
							4	0	0	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Understand the foundational principles, architecture, and service models of modern cloud computing, including virtualization and deployment strategies.
CR-2	Analyze the infrastructure, orchestration, and automation tools used in scalable cloud environments across various service providers.
CR-3	Explore practical applications and emerging trends in cloud computing, including DevOps, AI/ML integration, sustainability, and ethical practices.
CR-4	Comprehend the theoretical foundations of quantum computing, including quantum states, gates, circuits, and quantum algorithms.
CR-5	Investigate quantum algorithmic frameworks and platforms, and evaluate their integration with classical and cloud-based computing paradigms.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CO-1	Explain the concepts of cloud computing architecture, virtualization, and service models.	✓				2	85	75	3	2	2	2	3	1	1	1	1	2	2	2
CO-2	Analyze cloud infrastructure, orchestration tools, and security frameworks used in enterprise cloud setups.	✓	✓	✓		4	85	75	3	3	3	3	3	1	2	2	2	2	2	3
CO-3	Apply knowledge of cloud platforms to develop use cases involving DevOps, AI/ML, and serverless models.		✓	✓	✓	3	85	75	3	2	2	3	3	2	2	2	2	3	2	3
CO-4	Demonstrate understanding of core quantum principles including qubits, superposition, and quantum gates.	✓	✓	✓	✓	5	85	75	3	3	2	3	3	1	1	1	2	2	2	3
CO-5	Evaluate quantum algorithms and platforms, and discuss their applications in cryptography and hybrid cloud systems.	✓	✓	✓	✓	6	85	75	3	2	2	3	3	2	2	3	2	3	2	3

Title & Session Outcomes	Cloud Computing Fundamentals and Architecture	Cloud Infrastructure and Services	Applied Cloud and Emerging Trends	Foundations of Quantum Computing	Quantum Algorithms and Cloud Integration
Duration (hour)	12	12	12	12	12
SO-1	**Introduction to Cloud Computing** • Evolution of computing:	**Compute, Storage, and Network Architecture** • Server farms, virtual network functions,	**Hands-on with AWS Core Services** • Launch EC2, upload to S3, configure RDS basics	**Classical vs Quantum Paradigm** • Bit vs qubit, classical logic vs quantum logic	**Quantum Fourier Transform (QFT)** • Period finding, phase estimation

	• Mainframe → Grid → Cloud • Need for elasticity and scalability	block/file/object storage			
SO-2	**Characteristics and Benefits of Cloud** • On-demand, resource pooling, rapid elasticity, measured service • Cost-efficiency, global access, resilience	**Resource Provisioning and Auto-Scaling** • Elastic Load Balancing, Auto-Scaling Groups	**Azure & GCP: Cross-Platform Feature Mapping** • Compute Engine vs EC2, Azure Functions vs Lambda	**Qubits and Superposition** • Quantum state representation, basis states	**Grover's Search Algorithm** • Oracle model, quadratic speedup
SO-3	**Cloud Service Models: IaaS, PaaS, SaaS** • Examples: EC2, Google App Engine, Salesforce • Use cases and service management	**Virtual Machine Provisioning** • Image templates, orchestration, lifecycle	**CI/CD Pipelines in Cloud** • Jenkins setup, GitHub Actions, deployment workflow	**Quantum Entanglement** • Bell states, EPR paradox	**Shor's Algorithm** • Periodicity and RSA cracking
SO-4	**Cloud Deployment Models** • Public, Private, Hybrid, Community • When to choose which model	**Cloud Storage Systems** • Amazon S3, Azure Blob, Google Cloud Storage	**Serverless Computing** • Lambda functions, Cloud Functions, event-driven models	**Quantum Gates and Circuits** • X, Y, Z, H, CNOT, Toffoli gates	**Quantum Key Distribution (QKD)** • BB84 protocol, security guarantees
SO-5	**Cloud Reference Architecture (NIST)** • Roles: Consumer, Provider, Auditor, Broker • Architectural components	**Cloud Networking Concepts** • VPC, routing, subnetting, internet gateway	**Big Data Tools in Cloud** • EMR, Dataproc, HDInsight, integration with S3/GCS	**Measurement in Quantum Systems** • Collapse, expectation values, probabilities	**Quantum Teleportation** • Entangled pair usage, measurement-based transmission
SO-6	**Virtualization Technologies** • Hypervisors (Type I & II), VM lifecycle • Containers vs Virtual Machines	**Identity and Access Management (IAM)** • Roles, policies, permission boundaries	**Cloud-native App Deployment** • DevOps lifecycle, Helm, Docker Compose	**Bloch Sphere Visualization** • Polar coordinates, pure and mixed states	**Quantum Error Correction** • 3-qubit bit-flip, Shor code, stabilizers
SO-7	**Overview of Cloud Providers** • AWS, Azure, Google Cloud core services • Service coverage comparison	**Cloud Monitoring and Logging Tools** • AWS CloudWatch, Azure Monitor, GCP Stackdriver	**Cloud AI/ML Platforms** • AWS SageMaker, Google Vertex AI, Azure ML Studio	**Quantum Interference and Parallelism** • Probabilistic output manipulation	**Quantum Machine Learning** • Variational circuits, quantum kernel methods

SO-8	**Containerization and Docker Basics** • Images, containers, volumes, orchestration intro • Docker CLI basics	**Security Mechanisms and Best Practices** • Encryption, MFA, Shared Responsibility Model	**Disaster Recovery and High Availability** • RTO, RPO, backup strategies, multi-zone architecture	**Basic Quantum Algorithms** • Deutsch Algorithm, Bernstein-Vazirani	**Quantum Supremacy Benchmarks** • Google Sycamore, IBM Eagle
SO-9	**Microservices vs Monolithic Architecture** • Advantages and limitations • Case study examples	**Kubernetes and Container Orchestration** • Pods, Services, Deployment, Scaling	**Multi-cloud & Hybrid Strategies** • Federation, failover, data transfer challenges	**Quantum Mechanics Postulates** • State space, evolution, measurement postulates	**Cloud Quantum Platforms** • IBM Q, Amazon Braket, Azure Quantum features
SO-10	**Multi-tenancy and Interoperability** • Tenant isolation, APIs, vendor lock-in issues	**Infrastructure as Code Tools** • Terraform: providers, resources, plans • Ansible for configuration management	**Green Computing Initiatives** • Data center energy efficiency, sustainability metrics	**Reversible Computing & No-Cloning Theorem** • Unitary transformations, cloning limitations	**Hybrid Quantum-Classical Systems** • QAOA, VQE, simulation frameworks
SO-11	**Legal and Regulatory Issues** • GDPR, HIPAA, data locality and compliance	**Billing and Pricing Models** • Pay-as-you-go, reserved instances, spot pricing	**Cloud Ethics and Privacy** • Ownership, transparency, consent, access control	**Quantum Noise and Decoherence** • T1, T2 times, gate fidelity, quantum error causes	**Security and Ethics in Quantum Tech** • Crypto threats, misuse risks, future-proofing
SO-12	**Case Study Discussion** • Enterprise cloud adoption roadmap • Migration challenges and best practices	**Edge and Fog Computing** • Concepts, differences, applications in IoT	**Capstone: Cloud Adoption Case Study** • Solution design, architectural decision-making	**Quantum Programming Frameworks** • Qiskit basics, Q# overview, IBM Q experience	**Future of Quantum Computing** • Quantum internet, post-quantum cryptography

Assessment											
Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	40%	-	40%	-	40%	-	40%	-	40%	-
2	Understand										
3	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
4	Analyze										
5	Evaluate	20%	-	20%	-	20%	-	20%	-	20%	-
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies					
Technology		Pedagogy / Andragogy		Sustainable Development	
Simulations		Case Studies	✓	No Poverty	
Emulations		Group Discussion	✓	Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools	✓	Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning	✓		

Resources			
1	Buyya, Rajkumar, James Broberg, and Andrzej Goscinski. *Cloud Computing: Principles and Paradigms*. Wiley, 2011.	2	Erl, Thomas, Zaigham Mahmood, and Ricardo Puttini. *Cloud Computing: Concepts, Technology & Architecture*. Prentice Hall, 2013.
3	Hwang, Kai, and Geoffrey C. Fox. *Distributed and Cloud Computing: From Parallel Processing to the Internet of Things*. Morgan Kaufmann, 2012.	4	Thomas, Gordon. *Hands-On Cloud Computing with AWS, Azure, and GCP*. Packt, 2022.
5	Nielsen, Michael A., and Isaac L. Chuang. *Quantum Computation and Quantum Information*. Cambridge UP, 2010.	6	Yanofsky, Noson S., and Mirco A. Mannucci. *Quantum Computing for Computer Scientists*. Cambridge UP, 2008.
7	Sutor, Robert. *Dancing with Qubits: How Quantum Computing Works and How It Can Change the World*. Packt, 2020.	8	Rieffel, Eleanor G., and Wolfgang H. Polak. Quantum Computing: A Gentle Introduction. MIT Press, 2011.

Designers					
Professional Experts		Higher Institution Experts		Internal Experts	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. R. Kiruthiga, SRMIST, KT R

Code	PCA25C10L	Title	Capstone Project	Category	C	Professional Core Course	L	T	P	C
							0	0	8	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Demonstrate skills learnt in the real time environment.
CR-2	Explore the different industries that are using IT
CR-3	Enhance the skills in the system aspects
CR-4	Understanding the professional connections with the knowledge learnt
CR-5	Applying the skills in problem solving

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	To get an inside view of an industry and organization/company	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	To gain valuable skills and knowledge	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	To make professional connections and enhance networking		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	To get experience in a field to allow the student to make a career transition	✓	✓	✓	✓	3	85	75	3	-	2	3	3	-	-	-	3	3	-	3
CO-5	To get an inside view of an industry and organization/company	✓	✓			2	85	75	3	-	2	3	-	3	3	3	3	3	2	3

Students can choose problems of their own interest to develop software package using the programming languages/tools available. There will be two reviews conducted during the project period for all the students .At the end of the project, every student shall submit a structured project report and will take a Viva Voce examination.

Assessment				
Project Work	Continuous Learning Assessment (CLA) (50 % weightage)		Final Evaluation (50% weightage)	
	Review – 1	Review – 2	Project Report	Viva-Voce
	20%	30 %	30 %	20 %

Code	PCA25D07J	Title	Software Quality Assurance	Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Understand the software quality challenges,factors and components of the software quality assurance system
CR-2	Design and implement Pre-project software quality components.
CR-3	Understand SQA components in the project life cycle, Software testing strategies and implementation.
CR-4	Understand the Software Maintenance and Supporting quality devices.
CR-5	Understand Management components of software Quality, Software quality metrics.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1 Conceive	2 Design	3 Implement	4 Operate	1 Level of Thinking	2 Expected Proficiency (%)	3 Expected Attainment (%)	1 Disciplinary Knowledge	2 Problem Solving	3 Design & Development	4 Analysis, Design, Research	5 Modern Tool Usage	6 Society & Culture	7 Environment & Sustainability	8 Ethical Practices & Social	9 Individual & Team Work	10 Communication	11 Project Management & Finance	12 Life Long Learning
CO-1	Understand the fundamental concepts of the software quality assurance system	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Gain proficiency in implementing Pre-project software quality components.	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Acquire the skills in SQA components in the project life cycle, Software testing strategies and implementation.		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Encouraging the learner to understand the Software maintenance & quality Aassurance Tools	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Impart the methodology in Training, Certification and Software quality metrics.	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Overview	Development and quality plans	Reviews & Software Testing Strategies	Software Maintenance & Quality Assurance Tools	Training and Certification & Documentation Control

Duration (hour)	15	15	15	15	15
SO-1	The uniqueness of software quality assurance Software errors, faults and failures, definition of software	The contract review process and its stages, Contract review objectives.	Review objectives-Formal design reviews (DRs)	The foundations of high quality-Pre-maintenance software quality components	Supporting quality devices-Templates-Checklists
SO-2	Classification of the causes of software errors, Software quality,	Implementation of a contract review	Peer reviews-A comparison of the team review methods	Maintenance software quality assurance tools	Staff training and certification-Surprises for the "3S" development team
SO-3	Software quality assurance – definition and objectives-software engineering	Contract review subjects, Contract reviews for internal projects	Definition and objectives, Software testing strategies	Types of external participants	The objectives of training and certification
SO 4-5	**Practice 1-** Design a basic test plan document for a sample project (include scope, objectives, resources, schedule).	**Practice 4 :** Implementing the Contract Review Process with a case study (e.g. Online Bookstore Management System)	**Practice 7:** Study of Any Testing Tool (Win Runner)	**Practice 10:** From your project work, identify and document the quality components applied during development, the SQA tools used in the maintenance phase, and the external participants involved in the QA processes	**Practice 13:** Device a testing protocol template and Pre deployment device inspection checklist with Maintenance.
SO-6	Need for comprehensive software quality Requirements, Classifications of software requirements - software quality factors	Development plan and quality plan objectives, Elements of the development plan	Software test classifications	Risks and benefits of introducing external Participants	Determining professional knowledge requirements-Planning training and updating programs
SO-7	Product operation, revision and transition- software quality factors	Elements of the quality plan	White box testing-Black box testing	Assuring quality of external participants' contributions: objectives	Delivery of training and certification programs
SO-8	The SQA system – an SQA architecture, Pre-project components.	Development and quality plans for small projects and for internal projects	The testing process	SQA tools for assuring the quality of external participants' contributions	documentation-Controlled documents and quality records
SO 9-10	**Practice 2:** classify software requirements and map them to quality factors.	**Practice 5:** Prepare Software Development and Quality Plans for Project(eg: Employee Leave Management System	**Practice 8**: Case study for implementing white box and black box testing	**Practice 11**: Study of Any Test Management Tool (QA Complete)	**Practice 14:** Create a test plan document for any application (e.g. Library Management System)
SO-11	Management SQA components SQA standards, system certification, and assessment components	Factors affecting intensity of quality assurance activities in the development process	Test case design	CASE tool-contribution of CASE tools to software product quality	The controlled documents list-Issues of controlled document approval- storage and retrieval
SO-12	Organizing for SQA – the human components.	Verification, validation and qualification	Automated testing	Improved project management	Process metrics-Product metrics
SO-13	Considerations guiding construction of an organization's SQA system	A model for SQA defect removal effectiveness and cost	Alpha and beta site testing	Procedures and procedures manuals-preparation, implementation and updating	Implementation of software quality metrics-Limitations of software metrics

SO 14-15	**Practice 3:** Draft an SQA Policy Document	**Practice 6:** Prepare V&V Plan with defect removal for Library Management System	**Practice 9:** Design and execute test cases for a login module (valid/invalid credentials)	**Practice 12:** Case study to Demonstrate CASE Tool Usage techniques.	**Practice 15**: Study to implementt Software Quality Metrics

Assessment

Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies

Technology		Pedagogy / Andragogy		Sustainable Development	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources

1.	Software Quality Assurance-From theory to implementation, Daniel Galin,Pearson Education Limited, 2004		

Designers

Professional Experts		Higher Institution Experts		Internal Experts	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015		Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr.S.Belina V J Sara, SRMIST, Kattankulatur

Code	PCA25D08J	Title	Augmented Reality and Virtual Reality	Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To have the scientific, technical, and engineering aspects of augmented reality
CR-2	To learn the technology of augmented reality and implement it to have practical knowledge.
CR-3	To gain the knowledge of historical and modern overviews and perspectives on virtual reality.
CR-4	To learn the fundamentals of sensation, perception, and perceptual training.
CR-5	To learn the Evaluation of virtual reality from the lens of design.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Describe how AR systems work and list the applications of AR.	✔				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Describe the concept of virtual reality and Communication Media	✔	✔	✔		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Acquire knowledge of mixed reality		✔			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Understand various modeling approaches	✔	✔	✔	✔	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Build a Virtual Reality Application.	✔	✔			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	*2*	*3*

Title & Session Outcomes	Introduction to Augmented Reality	Introduction to Virtual Reality	Interactive techniques in Virtual Reality	Visual Perception & Rendering	VR software development &Application of VR

Duration (hour)	15	15	15	15	15
SO-1	Introduction to Augmented Reality	Defining Virtual Reality	Space Curves	Visual Perception	Challenges in VR software development
SO-2	Virtual and Mixed Reality	History of VR	3D Boundary Geometrical Transformations	Perception of Depth	Master/slave architectures
SO-3	Taxonomy	Human Physiology and Perception	Frames of References	Perception of Motion	Client/server architectures
SO 4-5	**Practice 1: Study of different game engines**	**Practice 4: Installation of Unity and Visual Studio, setting up Unity for VR development, understanding documentation of the same.**	**Practice 7: Implementation on Virtual tour**	**Practice 10: Understand the Human Physiology and perception,**	**Practice 13: Create an immersive environment (living room/ battlefield/ tennis court) with only static game objects**
SO-6	Technology & Features of augmented reality	Key Elements of Virtual Reality Experience	Modeling Transformations	Perception of Color, Combining Sources of Information	Cluster rendering
SO-7	Difference between AR ,VR and MR.	Virtual Reality System	Scaling the virtual Environment	Visual Rendering -Ray Tracing and Shading Models	Game Engines and available sdk to develop VR applications for different hardware (HTC VIVE, Oculus, Google VR).
SO-8	Challenges with AR	Interface to the Virtual World	Collision Detection	Rasterization	VR Technology in Film
SO 9-10	**Practice 2: Understand the use of AR Software and Toolkit**	**Practice 5: Demonstration of the working of HTC Vive, Google Cardboard, Google Daydream and Samsung gear VR**	**Practice 8: Sweeping coverage of eye movements**	**Practice 11: Automatic stitching of panoramas in Virtual Reality**	**Practice 14: Implementation to show portal planets**
SO-11	AR systems and functionality	Input & output	VR Environments	Correcting	TV Production
SO-12	Augmented reality methods	Visual & Aural Displays	VR Technologies	Optical Distortions	VR Technology in Physical Exercises
SO-13	Visualization techniques for augmented reality	Haptic Displays	VR Systems	Improving Latency and Frame Rates	VR Technology in Games.
SO 14-15	**Practice 3: Implementation on Video/ Feature viewing**	**Practice 6: Study the use of Virtual Reality at NASA**	**Practice 9: Implementation on material animation**	**Practice 12: Develop a simple UI (User Interface) menu with images, canvas, sprites and button.**	**Practice 15: Demonstration of Digital Entertainment by VR.**

Assessment											
Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

Strategies					
Technology		**Pedagogy / Andragogy**		**Sustainable Development**	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources			
1	Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.	2	Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition.Wiley-IEEE Press, 2003/2006.
2	Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc, 2017.	4	https://www.coursera.org/learn/introduction-virtual-reality
5	Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.		

Designers

Professional Experts		Higher Institution Experts		Internal Experts	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015		Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. NITHYA S, Assistant Professor, SRMIST, KTR, nithyas7@srmist.edu.in

Code	PCA25D09J	Title	Computer Vision	Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	The purpose of learning this course is to:	Depth				Attainment			Program Outcomes (PO)											
CR-1	Understanding Image formation	1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CR-2	Implementing Image Processing Skills																			
CR-3	Understanding Image Matching																			
CR-4	Insight of Image Classification																			
CR-5	Implement Real world Applications using Pattern Recognition, Motion Analysis																			

Outcomes (CO)	At the end of this course, learners will be able to:	Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Understanding various Fundamentals of Image processing	✓				5	85	75	1	3	3	3	2	3	3	-	2	3	-	-
CO-2	Implementing Image Processing Skills	✓	✓	✓		4	85	75	1	3	3	3	2	-	2	-	-	3	-	-
CO-3	Understanding Object Detection and Recognition		✓	✓		6	85	75	1	3	3	3	2	-	2	-	-	3	-	-
CO-4	Gain an insight of Object Tracking, Image Classification and OCR	✓	✓	✓	✓	3	85	75	1	3	3	3	2	-	2	-	-	3	-	-
CO-5	Implement Real world Applications using Pattern Recognition, Facial recognition and Motion Analysis	✓	✓	✓	✓	2	85	75	2	3	3	3	2	3	2	-	2	3	-	-

Title & Session Outcomes	Fundamentals of Image processing	Image Processing Skills	Object Detection and Recognition	Image Classification and OCR	Pattern Recognition and Motion Analysis
Duration (hour)	15	15	15	15	15

SO-1	Fundamentals of Image processing	Feature Extraction	Introduction to Object Detection	Image Classification	Facial Recognition System
SO-2	Color processing	Edges- Canny, LOG, DOG,	Techniques in Object Detection	Multi class classification	Components of Facial Recognition System
SO-3	Range image processing	Line detectors – Hough Transform, Corners- Harris and Hessian Affine	Two-stage detectors for Object Detection – RCNN	Multi label classification	Implementation of Facial Recognition System
SO 4-5	Practice 1: Implement Image Transformation in OpenCV	Practice 4: Edge Detection and Feature Extraction	Practice 7: Implement Object Detection	Practice 10: Implement Image Classification	Practice 13: Implement Facial Recognition System
SO-6	Image Transformations	SIFT	Single-stage detectors for Object Detection – SSD	Object Tracking	Pattern Recognition
SO-7	2-D Projective Geometry	SURF	YOLO	Types of Object Tracking – Image Object Tracking	Applications of Pattern Recognition
SO-8	2-D homography	Image Pyramids	Object Recognition - Object Recognition Using Deep Learning	Video Object Tracking	Advantages and Disadvantages
SO 9-10	Practice 2: Implement Projection	Practice 5: Implementation of SIFT and SURF	Practice 8: Implement Object Recognition	Practice 11: Implement object Tracking	Practice 14: Implement Real world Applications
SO-11	Camera geometry and Calibration	Image segmentation	Image Matching	Optical Character Recognition (OCR) - Working of OCR	Motion Analysis
SO-12	Photometry (brightness and color)	Region Growing, Edge based approaches	Key point Matching	Advantages and Disadvantages	Motion models - 2D motion vector field and optical flow, The aperture problem
SO-13	Quantization	Graph-Cut, Mean-Shift	KNN- Matching	Applications of OCR	Motion representation
SO 14-15	Practice 3: Implementation of Quantization	Practice 6: Implement Image Segmentation	Practice 9: Implement Image Matching	Practice 12: Implement Optical Character Recognition	Practice 15: Implement Real world Applications

Assessment

Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10 %)		CLA– 2 (10%)		CLA– 3 (20%)		CLA– 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										

Strategies

Technology		Pedagogy / Andragogy		Sustainable Development	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	

5	Evaluate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
6	Create										
Total		100 %		100 %		100 %		100 %		100 %	

		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources			
1.	Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.	2.	R. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3.	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, 2ndEdition, Cambridge University Press, March 2004	4.	R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992
5.	K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press,Morgan Kaufmann, 1990		

Designers					
Professional Experts		Higher Institution Experts		Internal Experts	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr.G.Elavarasi, SRMIST, elavarag4@srmist.edu.in

Code	PCA25G04T	Title	Blockchain Technology	Category	G	Generic Elective Course	L	T	P	C
							2	0	0	2

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Introduction to Blockchain Technology
CR-2	Understand the architecture and working of Blockchain
CR-3	Understand Centralized and Decentralized system
CR-4	Understand about the Consensus mechanisms in Blockchain
CR-5	Overview of Ethereum and smart contracts

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)												
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Understand how blockchain systems (mainly Bitcoin and Ethereum) work	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Securely interact with blockchain nodes	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Broadcast the transactions		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Design, build, and deploy smart contracts and distributed applications	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Integrate ideas from blockchain technology into their own projects	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Blockchain Introduction	Database Vs. Blockchain Architecture	The Structure of Blockchain	Cryptocurrency Introduction	Ethereum
Duration (hour)	**06**	**06**	**06**	**06**	**06**

SO-1	Introduction to Blockchain Technology	Blockchain Architecture	Structural unit of the Blockchain	Introduction to Cryptocurrency	Overview of Ethereum
SO-2	History of Blockchain	Classification of Blockchain	Pool of transactions	Public key cryptography	Need for Ethereum
SO-3	Need for Blockchain	Characteristics of Blockchain	Transaction verification	Cryptographic Hash functions and its types	Purpose of Ethereum
SO-4	Basic features of Blockchain	Public and Private Blockchain	Broadcasting the transaction	Introduction to Bitcoin	Bitcoin vs Ethereum
SO-5	Working of Blockchain	Consortium and hybrid Blockchain	Consensus Mechanisms	Mining	Smart contracts in Ethereum
SO-6	Blockchain applications and challenges	Centralized Vs Decentralized system	Block confirmation and Ledger maintenance	Purpose and process of mining	Advantages and disadvantages of Ethereum

Assessment

Level of Thinking		Continuous Learning Assessment (CLA) (100 % weightage)							
		CLA – 1 (20 %)		CLA– 2 (20%)		CLA– 3 (40%)		CLA– 4 (20%)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	40%	-	40%	-	40%	-	40%	-
2	Understand								
3	Apply	40%	-	40%	-	40%	-	40%	-
4	Analyze								
5	Evaluate	20%	-	20%	-	20%	-	20%	-
6	Create								
Total		100 %		100 %		100 %		100 %	

Strategies

Technology		Pedagogy / Andragogy		Sustainable Development	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources

1.	Tiana Laurence, Blockchain for Dummies, (2017), Wiley India Pvt.Ltd.	2	Tim Mathis, Blockchain: The Technology Behind Bitcoin And Other Cryptocurriences (EBook).
3.	Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions (2018), Apress Media		

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. M.GRACY, SRMIST, gracym2@srmist.edu.in

Code	**PCA25G05T**	**Title**	**Cyber Forensics**	**Category**	G	**Generic Elective**	L	T	P	C
							2	0	0	2

Offering Department	Computer Applications	**Pre-requisite Courses**	Nil	**Co-requisite Courses**	Nil	**Progressive Courses**	Nil	**Data Book / Codes/Standards**	Nil

Rationale (CR)	*The purpose of learning this course is to:*	**Depth**				**Attainment**			**Program Outcomes (PO)**											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CR-1	Learn introduction to Cyber forensics																			
CR-2	Understanding various Computer Forensics Systems																			
CR-3	Learn Evidence Collection and Data Seizure																			
CR-4	Understanding Current Computer Forensic Tools																			
CR-5	Learn Digital Forensics and cloud Forensics																			

Outcomes (CO)	At the end of this course, learners will be able to:	Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Introduction to Cyber forensics	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Types of Computer Forensics Systems	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Evidence Collection and Data Seizure		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Current Computer Forensic Tools	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Understanding the Digital Forensics	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	**Introduction to Cyber forensics**	**Types of Computer Forensics Systems**	**Evidence Collection and Data Seizure**	**Current Computer Forensic Tools**	**Understanding the Digital Forensics**

Duration (hour)	6	6	6	6	6
SO-1	Information Security Investigations	Internet Security Systems	Why Collect Evidence	Evaluating computer forensic tool needs	An Overview of Digital Forensics
SO-2	Corporate Cyber Forensics	Intrusion Detection Systems	Collection Options Obstacles	Computer forensic software tools	Digital Forensics and Other Related Disciplines
SO-3	Scientific method in forensic analysis	Firewall Security Systems	Types of Evidence	Computer forensic hardware tools	Developing Digital Forensics Resources
SO-4	Computer Forensics Technology	Storage Area Network Security Systems	Investigating Web attacks	Validating and testing forensic software	Legal Challenges in Cloud Forensics
SO-5	Military Computer Forensic Technology	Network Disaster Recovery Systems	Identification of Data: Timekeeping	Understanding email servers	Tools for Cloud Forensics
SO-6	Law Enforcement	Public Key Infrastructure Systems	Forensic Identification and Analysis of Technical Surveillance Devices	Using specialized email forensic tools	Technical Challenges in Cloud Forensics

Assessment

Level of Thinking		Continuous Learning Assessment (CLA) (100 % weightage)							
		CLA – 1		CLA– 2		CLA– 3		CLA– 4	
		(20 %)		(20%)		(40%)		(20%)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	40%	-	40%	-	40%	-	40%	-
2	Understand								
3	Apply	40%	-	40%	-	40%	-	40%	-
4	Analyze								
5	Evaluate	20%	-	20%	-	20%	-	20%	-
6	Create								
Total		100 %		100 %		100 %		100 %	

Strategies

Technology		Pedagogy / Andragogy		Sustainable Development	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	✓
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	
		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources			
1.	Computer Forensics, Computer Crime Investigation by John R,Vacca, Firewall Media, New Delhi.	1.	Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts, Ali Jahangiri, First edition, 2009
2.	Computer Forensics and Investigations by Nelson, Phillips Enfinger, Steuart, CENGAGE	3.	Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series: Computer Forensics), 2010
4.	Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, John R. Vacca, Charles River Media, 2005	5.	Internet Complete Reference, Harley Hahn, second Edition, 1996, Osborne/McGraw Hill
6.	Understanding Cryptography: A Textbook for Students and Practitioners, ChristofPaar, Jan Pelzl, 2010, Second Edition, Springer's.	7.	Internet and Web design, Ramesh Bangia Firewall Media, (An imprint of Lakshmi Publications Pvt. Ltd. Second Edition 2006.

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr.T.M.Sheeba, SRMIST

Code	PCA25G06T	Title	Big Data Analytics	Category	G	Generic Elective	L	T	P	C
							2	0	0	2

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Introduce the foundational concepts and significance of Big Data
CR-2	Familiarize students with the Hadoop ecosystem and its core components
CR-3	Gain practical knowledge of Apache Spark for efficient data processing and in-memory analytics
CR-4	Introduce NoSQL databases and their role in managing unstructured and semi-structured data
CR-5	To develop the ability to analyze, interpret, and visualize big data

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CO-1	Understand what Big Data is, its features, and why it is important.	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Learn how to use Hadoop to store and process large amounts of data.	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Use Apache Spark to process data quickly and write basic programs with it.		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Know what NoSQL databases are and do basic tasks using MongoDB.	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3

CO-5	Analyze and show data using simple tools to get useful information.	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Introduction to Big Data	Hadoop Ecosystem Basics	Introduction to Apache Spark	NoSQL Databases and Data Storage	Data Analysis and Visualization
Duration (hour)	6	6	6	6	6
SO-1	Definition and Characteristics of Big Data (Volume, Velocity, Variety, etc.)	Introduction to Hadoop and HDFS	Overview and Features of Apache Spark	Need for NoSQL in Big Data	Basics of Data Analytics in Big Data
SO-2	Importance and Applications of Big Data	Hadoop Architecture: NameNode, DataNode, JobTracker, TaskTracker	Spark Architecture and Components	Types of NoSQL Databases: Key-Value, Columnar, Document, Graph	Introduction to Data Cleaning and Preprocessing
SO-3	Differences between Traditional and Big Data Processing	MapReduce Basics and Workflow	RDD (Resilient Distributed Dataset) Basics	Introduction to MongoDB	Overview of Data Visualization Tools (e.g., Tableau, Power BI)
SO-4	Types of Big Data: Structured, Semi-structured, Unstructured	Input and Output Formats in Hadoop	Transformations and Actions in Spark	CRUD Operations in MongoDB	Simple Data Visualization using Python (matplotlib, seaborn)
SO-5	Challenges in Big Data Management	Introduction to YARN (Yet Another Resource Negotiator)	Introduction to Spark SQL	Introduction to Cassandra	Applications of Big Data Analytics in Real Life
SO-6	Overview of Big Data Technologies (Hadoop, Spark, NoSQL)	Limitations of Hadoop and Need for Spark	Introduction to PySpark (basic syntax and usage)	Comparison of SQL vs. NoSQL	Basic Concepts of Machine Learning with Big Data

Assessment

Level of Thinking		Continuous Learning Assessment (CLA) (100 % weightage)							
		CLA – 1 (20 %)		CLA– 2 (20%)		CLA– 3 (40%)		CLA– 4 (20%)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	40%	-	40%	-	40%	-	40%	-
2	Understand								
3	Apply	40%	-	40%	-	40%	-	40%	-
4	Analyze								

Strategies

Technology		Pedagogy / Andragogy		Sustainable Development	
Simulations	✓	Case Studies	✓	No Poverty	
Emulations	✓	Group Discussion		Zero Hunger	
Prototypes		Hands-on Practice	✓	Good Health & Well Being	
Hands-on Practice Tools		Inquiry Learning	✓	Quality Education	
Mathematical Computing Tools		Interactive Lecture	✓	Gender Equality	
Field Visit		Leading Question		Clean Water & Sanitation	
		Mind Map		Affordable & Clean Energy	

5	Evaluate	20%	-	20%	-	20%	-	20%	-
6	Create								
Total		100 %		100 %		100 %		100 %	

		Minute Paper			
		Peer Review			
		Problem Based Learning			

Resources			
1.	Nathan Marz and James Warren: Big Data: Principles and Best Practices of Scalable Real-Time Data Systems, Manning Publications	2.	Tom White, “Hadoop: The Definitive Guide”, O'Reilly Media
3	Jules S. Damji, Brooke Wenig, Tathagata Das, Denny Lee , “Learning Spark: Lightning-Fast Data Analytics ”, O'Reilly Media	4	Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence”, Addison-Wesley
5	Anil Maheshwari, “Data Analytics Made Accessible”, CreateSpace Independent Publishing.		

Designers					
Professional Experts		**Higher Institution Experts**		**Internal Experts**	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. A.Thilaka, SRMIST, <thilakaa@srmist.edu. in>

Code	PCA25P01L	Title	Internship	Category	P	Project Work, Internship In Industry / Higher Technical Institutions	L	T	P	C
							0	0	0	2

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*	Depth				Attainment		
		1	2	3	4	1	2	3
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)
CR-1	Demonstrate skills learnt in the real time environment.							
CR-2	Explore the different industries that are using IT							
CR-3	Enhance the skills in the system aspects							
CR-4	Understanding the professional connections with the knowledge learnt							
CR-5	Applying the skills in problem solving							

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment		
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)
CO-1	To get an insight of an industry and organization/company	✓				*5*	*85*	*75*
CO-2	To gain valuable skills and knowledge	✓	✓	✓		*4*	*85*	*75*
CO-3	To make professional connections and enhance networking		✓			*6*	*85*	*75*
CO-4	To get experience in a field to allow the student to make a career transition	✓	✓	✓	✓	*3*	*85*	*75*
CO-5	To get an inside view of an industry and organization/company	✓	✓			*2*	*85*	*75*

	Program Outcomes (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment &	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Students can choose a company of their own interest for internship for a period of minimum four weeks to learn about the application of IT in real time environment. In the first week of July, all the students have to give a presentation about their observations made by them in internship.At the end of the internship period, every student shall submit a structured internship report within 15 days from the date of the completion of the internship period.

Learning Assessment

Project Work / Internship	Continuous Learning Assessment (50% weightage)		Final Evaluation (50% weightage)	
	Review – 1	Review – 2	Internship Report	Viva-Voce
	20%	30 %	30 %	20 %

SEMSETER IV

Code	PCA25P02L	Title	Project Work	Category	P	Project Work, Internship In Industry / Higher Technical Institutions	L	T	P	C
							0	0	20	10

Offering Department	Computer Applications	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To understand the basics of software development
CR-2	To know about life cycle of the software development
CR-3	To explore risk and people management for software development
CR-4	To learn about different software tools for software development.
CR-5	To know about different techniques related to software development.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	To conceptualize a novel idea / technique into a product	✓				3	80	70	1	3	1	3	-	2	-	2	3	3	-	3
CO-2	To think in terms of multi-disciplinary environment	✓	✓	✓		3	80	75	3	3	-	3	3	-	-	-	3	3	-	3
CO-3	To understand the management techniques of implementing a project		✓			3	85	70	3	3	1	3	-	-	-	-	3	3	2	3
CO-4	To experience on the challenges of teamwork	✓	✓	✓	✓	3	85	80	3	3	2	3	3	-	-	-	3	3	-	3
CO-5	To prepare a presentation in a professional manner	✓	✓			3	85	75	3	1	2	3	-	3	3	3	3	3	-	3

Students can choose problems of their own interest to develop software package using the programming languages/tools available. There will be two reviews conducted during the project period for all the students .At the end of the project, every student shall submit a structured project report and will take a Viva Voce examination.

Learning Assessment				
Project Work	Continuous Learning Assessment(50% weightage)		Final Evaluation(50% weightage)	
	Review – 1	Review – 2	Project Report	Viva-Voce
	20%	30 %	30 %	20 %