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

GENARATIVE ARITIFICAL INTELLIGENCE

(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
GENARATIVE ARITIFICAL INTELLIGENCE

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
PGI25D01J	Introduction to Computer Vision	3	0	2	4
PGI25D02J	Intelligent Language Processing				
PGI25D03J	Intelligent Internet of Things (IIoT)				
PGI25D04J	Augmented Reality and Virtual Reality	3	0	2	4
PGI25D05J	Generative AI and Large Language Models				
PGI25D06J	IoT Cloud Infrastructure and Protocols				
PGI25D07J	Computer Vision in Smart Robotics	3	0	2	4
PGI25D08J	Building Conversational AI for Human Resources				
PGI25D09J	IoT Devices with Computer Vision Technologies				
Total Learning Credits					**12**

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

Course Code	Course Title	Hours/ Week L	T	P	C
PGI25G01T	Deep Neural Networks	2	0	0	2
PGI25G02T	Building GPT Powered Business Applications				
PGI25G03T	Cloud Infrastructure for Generative AI				
PGI25G04T	Data Engineering and Analytics	2	0	0	2
PGI25G05T	Distributed Data Processing Systems				
PGI25G06T	Quantum Machine Learning				
Total Learning Credits					**4**

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

Course Code	Course Title	Hours/ Week L	T	P	C
PGI25S01J	Generative AI and Open AI	2	0	3	4
PGI25S02J	Prompt Engineering in Generative AI	2	0	3	4
Total Learning Credits					**8**

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

Course Code	Course Title	Hours/ Week L	T	P	C
PGI25P01L	Internship	0	0	0	2
PGI25P02L	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
PGI25D01J	Introduction to Computer Vision	3	0	2	4
PGI25D02J	Intelligent Language Processing	3	0	2	
PGI25D03J	Intelligent Internet of Things (IIoT)	3	0	2	
PGI25G01T	Deep Neural Networks	2	0	0	2
PGI25G02T	Building GPT Powered Business Applications				
PGI25G03T	Cloud Infrastructure for Generative AI				
PGI25S01J	Generative AI and Open AI	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
PGI25D04J	Augmented Reality and Virtual Reality	3	0	2	4
PGI25D05J	Generative AI and Large Language Models	3	0	2	
PGI25D06J	IoT Cloud Infrastructure and Protocols	3	0	2	
PGI25S02J	Prompt Engineering in Generative AI	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
PGI25D07J	Computer Vision in Smart Robotics	3	0	2	4
PGI25D08J	Building Conversational AI for Human Resources	3	0	2	
PGI25D09J	IoT Devices with Computer Vision Technologies	3	0	2	
PGI25G04T	Data Engineering and Analytics	2	0	0	2
PGI25G05T	Distributed Data Processing Systems				
PGI25G06T	Quantum Machine Learning				
PGI25P01L	Internship	0	0	0	2
	Total	24			20

Semester - IV					
Code	Course Title	Hours/ Week			C
		L	T	P	
PGI25P02L	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
PGI25D01J	Introduction to Computer Vision	3	3	2	3	3	3	3	3	3	3	-	3
PGI25D02J	Intelligent Language Processing	3	3	2	3	3	3	3	3	3	3	-	3
PGI25D03J	Intelligent Internet of Things (IIoT)	3	3	2	3	3	3	3	3	3	3	-	3
PGI25D04J	Augmented Reality and Virtual Reality	3	3	2	3	3	3	3	3	3	3	-	3
PGI25D05J	Generative AI and Large Language Models	3	3	2	3	3	3	3	3	3	3	-	3
PGI25D06J	IoT Cloud Infrastructure and Protocols	3	3	2	3	3	3	3	3	3	3	-	3
PGI25D07J	Computer Vision in Smart Robotics	3	3	3	3	3	2	-	2	2	2	2	3
PGI25D08J	Building Conversational AI for Human Resources	3	3	2	3	3	3	3	3	3	3	2	3
PGI25D09J	IoT Devices with Computer Vision Technologies	3	3	2	2	2	2	2	-	2	-	-	2
PGI25G01T	Deep Neural Networks	3	3	2	3	3	3	3	3	3	3	-	3
PGI25G02T	Building GPT Powered Business Applications	3	3	2	3	3	3	3	3	3	3	-	3
PGI25G03T	Cloud Infrastructure for Generative AI	3	3	2	3	3	3	3	3	3	3	-	3
PGI25G04T	Data Engineering and Analytics	3	3	2	3	3	3	3	3	3	3	-	3
PGI25G05T	Distributed Data Processing Systems	3	3	2	3	3	3	3	3	3	3	-	3
PGI25G06T	Quantum Machine Learning	3	3	2	3	3	3	3	3	3	3	-	3
PGI25S01J	Generative AI and Open AI	3	3	2	3	3	3	3	3	3	3	-	3
PGI25S02J	Prompt Engineering in Generative AI	3	3	2	3	3	3	3	3	3	3	-	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 packages and interface
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 difference between C++ and Java	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Develop Java program using JVM	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Use the various kinds of packages and interfaces		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Apply the Exception handling methods in Java program.	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Understand the Java I/O classes and collections interfaces.	✓	✓			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	Introducing classes- Class	Inheritance Basics,	Introduction to Java Thread	Introduction to Event Handling -

	java changed the internet- Java's magic: Byte Code, Java Buzzword	fundamentals- Declaring Objects, Assigning object Reference variables- Method	Understanding Types of Inheritance: Single, Multilevel, Hierarchical Inheritance	model, Creating a Thread by Extending Thread Class	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,	Introduction to Exception handling, Working with try and	Introduction to Utility classes, Working with String Tokenizer	Introduction to JDBC,JDBC Drivers & Architecture

		Working with Nested Class	catch		
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				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 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,	Stack as ADT ,Stack Operations,	Introduction to Binary Search	Representation of Graph, Types of	Implementation of Min-Max

	Omega and Theta notation, Programming Style, Refinement of Coding		Tree(BST)	Graph,	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.S.Usha,SRMIST,Kattankulathur
2		2		2	Dr.S.Sivakumar, 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:*
CR-1	To understand the basic concepts and terminology related to DBMS and Relational Database Design
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:*	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 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 (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.	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					
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Code	PGI25D01J	Title	Introduction to 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:*
CR-1	Understand the basics of Computer vision including image formation and image processing techniques
CR-2	Understand the image compression and feature detection techniques
CR-3	Conceive the Multiview geometry and 3D reconstruction techniques
CR-4	Understand the segmentation techniques including object detection
CR-5	Understand the Machine learning model for Computer Vision

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	Learn the basics of Computer vision including image formation and image processing techniques	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Apply the image compression and feature detection techniques	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Implement the Multiview geometry and 3D reconstruction techniques		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Learn the segmentation techniques including object detection	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Apply Machine learning techniques for Computer Vision	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Computer Vision Introduction	Image Compression & Restoration	3D Construction	Segmentation & Detection	Computer vision for Machine learning
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Introduction to computer vision	Image compression Techniques	Multiview geometry and 3D construction	Introduction to Segmentation	Introduction to Machine Learning for computer vision

SO-2	Image formations - 2D, 3D transformations	Gaussian, Laplacian pyramids	Epipolar geometry	Active contours	Supervised and unsupervised learning for vision
SO-3	3D transformation to 2D projections	Wavelets and its applications	Fundamental of essential matrix	Split and merge techniques for segmentations	Evaluation metrics
SO 4-5	**Practice 1: Implement 2D and 3D transformations using OpenCV**	**Practice 4: Implement image compression techniques**	**Practice 7: Implement epipolar lines**	**Practice 10: Write a code to find active contours**	**Practice 13: Implement K-Nearest neighbor classifier**
SO-6	3D to 2D projections, 3D Rotations, Lens Distortion	Geometric Transformations	Stereo Vision	Watershed	Various classification techniques
SO-7	Photometric Image formation	Types of transformations	Structure from stereo and Motion	Region splitting and merging	Computer Vision in Real world problems
SO-8	Lightning, Reflectance and shading	Image restoration techniques	Various techniques	Graph based segmentation	Image classification using KNN
SO 9-10	**Practice 2: Implement camera calibration**	**Practice 5: Implement geometric transformations**	**Practice 8: Write a code to find pixel level disparity**	**Practice 11: Implement watershed segmentation**	**Practice 14: Implement KNN for health care dataset**
SO-11	Introduction to Image Processing	Feature detection and descriptors	3D reconstruction	Introduction to Object detection	Image classification using SVM
SO-12	Point Operators, Linear Filters	Feature matching and tracking techniques	Shape from X, Active range finding.	Face detection	Image Classification using Decision Trees
SO-13	Fourier transform, Wiener filtering	Edge detection and linking	Surface representation, point based representations	Instance recognition	Comparison of classifiers, advantages and dis advantages
SO 14-15	**Practice 3: Implement filters**	**Practice 6: Implement SHIFT, HOG technique**	**Practice 9: Implement any 3D reconstruction technique**	**Practice 12: Implement object detection technique**	**Practice 15: Implement SVM classifiers for any real world 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	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.	Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.	2.	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, 2nd Edition, Cambridge University Press, March 2004
3.	R. Bishop; Pattern Recognition and Machine Learning, Springer, 2006	4	R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.
5	K. Fukunaga; Introduction to Statistical Pat- tern 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.Vanitha, SRMIST,Kattankulathur

Code	PGI25D02J	Title	Intelligent 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:*
CR-1	Understand fundamentals of Natural Language Processing
CR-2	Understand Named Entity Recognition and Parsing techniques in NLP
CR-3	Understand NLP algorithms for parsing and topic modeling
CR-4	Explore advanced text processing techniques in NLP
CR-5	Develop practical skills in implementing NLP based Applications

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	Demonstrate a comprehensive understanding of NLP Pipeline	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Demonstrate a comprehensive understanding of the principles and different approaches in NLP	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Develop practical skills in implementing NLP based pipeline		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Apply NLP concepts to solve variety of real-world problems in text processing	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Critically evaluate the performance and ethical implications of different NLP Real world applications	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Introduction to NLP	Text Analysis and Information Extraction	Semantic Approach	Semantic Representations and Information Retrieval in NLP	Intelligent Text Understanding and Generation
Duration (hour)	15	15	15	15	15
SO-1	Overview of NLP, Definition and Scope of NLP, Why ILP is	Introduction to Named Entity Recognition (NER), Types of	Probabilistic Context-Free Grammar (PCFG), Applications	Introduction to Word Vectors, Role and applications of word	Information Extraction and its

	Important.	Named Entities	of PCFG	vector	approaches
SO-2	Uses of NLP, Challenges of NLP, Natural Language Understanding (NLU), Natural Language Generation (NLG).	NER Approaches and Algorithms	Chunking and Segmentation, Chunking techniques and approaches	Word2Vec Model-CBOW and Skip Gram	Introduction to Text Summarization.
SO-3	Retrieval based and Conversation based NLU and NLG	NER Applications, Challenges in NER	Hidden Markov Models	GloVe (Global Vectors for Word Representation):, FastText:	Extractive vs. Abstractive Summarization
SO 4-5	**Practice 1: Exploration of NLP Library - NLTK, SpaCy, CoreNLP and others**	**Practice 4: Building a Named Entity Recognition System**	**Practice 7: Implement a simple rule-based chunker that identifies noun phrases (NP) in a given sentence**	**Lab 9: Implementation of Word Similarity Exploration with Word Vectors**	**Lab 11: Case Study: Analyzing Twitter Data for Sentiment Analysis**
SO-6	Linguistics for NLP-Morphology, Syntax, Semantics, Pragmatics, Corpus and Corpus Linguistics	Introduction to Stopwords, Common Stopword Lists in Various NLP Applications	Conditional Random Field and its implementation.	ELMo (Embeddings from Language Models): BERT (Bidirectional Encoder Representations from Transformers):	Summarization in Real-world Applications.
SO-7	Tokenization, Lemmatization, Stemming, stemming Algorithm	Introduction to Regular Expression, Splitting text into tokens based on regex pattern	Introduction to Topic Modeling , Generative vs. Discriminative Models in NLP,	Introduction to Information Retrieval, Information Retrieval Models-Vector space model and other models	Ethical and Social Implications of Summarization.
SO-8	Introduction to Text encoding, Various text encoding techniques	Regex libraries and functions for text processing tasks, Regular expression Applications in NLP	Latent Dirichlet Allocation (LDA)	Query Processing and Evaluation, Semantic Search and Knowledge Graphs:	Introduction to Chatbots, Types of Chatbots
SO 9-10	**Practice 2: Perform tokenization, stemming, and lemmatization on a text dataset**	**Practice 5: Perform stop word removal from text**	**Practice 8: Implement a basic Latent Dirichlet Allocation (LDA) topic model using Python's Gensim library and apply it to a small text corpus**	**Lab 9: Implement a simple information retrieval system using a vector space model to retrieve relevant documents for user queries.**	**Lab 12: Case Study: Designing a Chatbot for Customer Service Queries**
SO-11	Introduction to POS tagging, POS tagging in NLP applications	Introduction to Syntax analysis in NLP, Syntax tree	Latent Semantic Analysis (LSA), implementation	Multimodal Information Retrieval, Challenges in Information Retrieval	Machine Translation, Rule-based Machine Translation (RBMT)
SO-12	POS Tagging Algorithm and Techniques	Context Free Grammars, Syntax rules and productions in CFGs	Applications in Topic modeling, Challenges in Topic modeling	Information Fusion, Methods of Information Fusion-cross model information fusion	Statistical Machine Translation (SMT), Neural Machine Translation (NMT)
SO-13	POS Tagging Libraries and Tools, Challenges in POS	Parsing in NLP, Dependency	Sentiment Analysis, Types of	Applications of Information Fusion in NLP:, Challenges in	Challenges in Machine Translation, Question Answering

	tagging	Parsing	Sentiment Analysis	Information Fusion	Systems
SO 14-15	**Practice 3: Apply Part-of-Speech (POS) tagging on sample sentences using various NLP tools and algorithms.**	**Practice 6: Develop a Python script to validate password strength based on specific criteria using regular expressions, and extract the username from an email address using regex.**	**Practice 9:Impement of sentiment analysis**	**Lab 10: Implement a basic system to perform sentiment analysis by fusing textual and visual features from social media posts.**	**Lab 13: Case Study: Building a Question Answering System for Wikipedia Articles**

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.	"Speech and Language Processing" by Daniel Jurafsky and James H. Martin:	2.	Natural Language Processing with Python Quick Start Guide, NirantKasliwal, November 2018
3.	Practical Natural Language Processing, By Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta and Harshit Surana, June 2020	4	YoavGoldberg, Neural Network Methods for Natural Language Processing
5	. Natural Language Processing with Python and spacy, Vasiliev, April 2020.	6	C.Manning and H.Schutze, ―Foundations of Statistical Natural Language Processing‖, MIT Press. Cambridge,MA:,1999

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		Dr.S.Sivakumar, SRMIST

Code	PGI25D03J	Title	Intelligent Internet of Things (IIoT)	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	Demonstrate the design, communication model and enabling technologies for IoT.
CR-2	Gain expertise in IoT protocols, wireless tech, and data analytics for edge AI.
CR-3	Analyze microcontrollers, sensors, and interfaces in intelligent IoT systems.
CR-4	Learn how AI and IoT integrate for advanced data processing and ML.
CR-5	Develop intelligent IoT solutions using generative models, microcontrollers, and cloud integration.

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 IoT architecture, security, and real-world applications.	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Understand IoT protocols, wireless technologies, and data analytics	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Enhance IoT skills for Devices, Cloud, and Smart Systems.		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Apply IoT and AI concepts for data processing, ML, and smart automation.	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Develop IoT solutions with AI, microcontrollers, cloud, and automation.	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Fundamentals and Applications	Protocols, Analytics, and Edge Computing	IoT Systems, AI Integration, and Cloud Computing	IoT and AI: Foundations and Applications	IoT and AI: Smart Systems & Cloud
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	IoT Fundamentals: Definitions, Architectures, Challenges, and Promises, Impact	IoT Protocols and Software: MQTT, UDP, HTTP, AMQP, CoAP - XMPP and Gateway Protocols	The Smart "Things" in IoT:Definition and Architecture of Smart Things	Principles and Foundations of IoT and AI: IoT Reference Model, IoT Platforms. Big Data and IoT	Generative Models for IoT: Generating Images using VAEs
SO-2	Benefits of Adopting IoT in Healthcare - IoT Cyber Security	IoT point to point communication technologies: IoT Communication Pattern - IoT protocol Architecture	Sensors, Actuators and Electrical Motors	CRoss-Industry Standard Process for Data Mining, AI platforms and IoT platforms - TensorFlow, Keras, Datasets	GANs - Personal and Home IoT
SO-3	Architectures and Reference Models of IoT: IoTWF Reference Model of IoT - Simplified Reference Model of IoT	Selection of Wireless Technologies: 6LoWPAN, Zigbee, WIFI	Processing Unit: Microcontroller, Classifications of Microcontrollers - Three Main Types of Microcontrollers	Data Access and Distributed Processing for IoT: TXT format	IoT and Smart Homes - Smart Lighting
SO 4-5	**Practice 1: Arduino Installation and Blink LED using Node MCU Esp8266**	**Practice 4: Interfacing Temperature Humidity Sensor with Node MCU Esp8266**	**Practice 7: Create a an Access point and a Webserver using Node MCU Esp8266**	**Practice 10: Create a Voice Controlled Switch Using Arduino IoT Cloud**	**Practice 13: Integrating IR sensor with Raspberry pi and control an LED using python**
SO-6	IoT Applications in Vertical Market: Smart Agriculture, Logistics and Transportation - Smart Grid, Smart Building, Smart Factory, Smart City	Data Analytics for IoT: Data; IoT Data Analytics Overview and Challenges - Machine Learning: Supervised Learning and Unsupervised Learning, Neural Networks - Machine Learning and Getting Intelligence from Big Data	ARM Microcontrollers - Architecture	CSV format, XLSX format - Working with the JSON format, HDF5 format	Microcontrollers for IoT: Introduction to Arduino, ESP8266 Node MCU, Arduino IDE, Raspberry pico
SO-7	Standards: "Traditional" Internet Review - Physical/Link Layer	Predictive Analytics - Big Data Analytics Tools and Technology, Massively Parallel Processing Databases - NoSQL Databases, Hadoop, YARN - The Hadoop Ecosystem, Apache Kafka, Lambda Architecture	GPIOs and Interfaces: General-Purpose Input/Output (GPIO), Analog Inputs, Analog Outputs	Machine Learning for IoT: ML and IoT - Prediction using Linear Regression, Logistic Regression for Classification	Getting Started with the ESP8266 , Installing the Arduino IDE for the ESP8266 - Connecting your module to your Wi-Fi Network
SO-8	Network Layer - Transport Layer , Application Layer	Edge Streaming Analytics - Comparing Big Data and Edge Analytics, Edge Analytics Core	Parallel Interfaces vs Serial Interfaces, Universal Asynchronous,	Classification using Support Vector Machines - Naive Bayes, Decision Trees	Reading data from a GPIO pin Grabbing the content from a web page - Reading Data from a

		Functions - Distributed Analytics Systems - Network Analytics - Flexible NetFlow Architecture	Receiver/Transmitter (UART) - Serial Peripheral Interface (SPI), I2C (Inter-integrated Circuit) - Universal Synchronous Asynchronous Receiver Transmitter		Digital Sensor
SO 9-10	**Practice 2: Interfacing Light Sensor with ESP8266 NODE MCU WiFi Board**	**Practice 5: Interfacing MQ 4 GAS Sensor with Node MCU Esp8266**	**Practice 8: Interfacing Temperature Humidity Sensor and Visualize data in Cloud Server with Node MCU Esp8266**	**Practice 11: ESP8266 NodeMCU Data Logging to Firebase Realtime Database**	**Practice 14: Raspberry Pi: Send an Email using Python**
SO-11	The Internet of Things: Designing the Architecture of an IP-based Internet of Things - Physical / Link Layer	Open source IoT platforms, Cloud Dashboards	IoT Frameworks and Platforms: FIWARE, SmartThings, AWS IoT - Microsoft Azure IoT	Deep Learning for IoT - Artificial Neuron, Modelling Single Neuron in TensorFlow - Convolutional Neural Networks	Cloud Data Logging with the ESP8266 - Hardware and Software requirements -
SO-12	Network Layer and Transport Layer - Application Layer: Constrained Application Protocol (CoAP)	Fog Computing: Need for Fog Computation - Fog Applications	Azure IoT Edge, Azure Stream Analytics,	Different layers of CNN - Some popular CNN models	Configuration and Testing the sensor, Logging data to Cloud server, Displaying data using Cloud Application
SO-13	CoSIP Protocol Specification - Related work on Session Initiation	Edge computing: Need for Edge Computation - Edge Applications	Azure Machine Learning, Azure Logic Apps	LeNet to recognize handwritten digits on IoT Device - Recurrent Neural Networks	Controlling an LED from a cloud dashboard; Controlling the Lamp from anywhere in the World
SO 14-15	**Practice 3: Lab 3: Interfacing Infrared (IR) Sensor with Node MCU Esp8266**	**Practice 6: Interfacing Relay and Control LIGHT with Node MCU Esp8266**	**Practice 9: Create a Smart Switch to Control Light from Internet**	**Practice 12: Install OS and Configure Raspberry pi**	**Practice 15: Install Mosquitto MQTT Broker on Raspberry Pi**

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	Internet of Things: Architectures, Protocols and Standards, Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri, 2019 Wiley.	2.	Intelligent Internet of Things From Device to Fog and Cloud, Farshad Firouzi, Krishnendu Chakrabarty Sani Nassif, Springer.
3.	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" – By David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, and Jerome Henry, Cisco Press.	4	Kamal, R.,"Internet of Things – Architecture and Design Principles," 1st Edition, Mcgraw Hill,2017.
5	Hands-On Artificial Intelligence for IoT, Amita Kapoor, 2019, Packt Publishing Ltd.	6.	Internet of Things with ESP8266, Marco Schwartz, 2019, Packt Publishing Ltd.

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.Balamurugan, SRMIST

Code	PGI25G01T	Title	Deep Neural Networks	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	Understanding the fundamental concepts of deep learning
CR-2	Understand the principles and algorithms of deep neural networks
CR-3	Understand the optimization techniques and training procedures
CR-4	Explore advanced architectures of deep neural networks
CR-5	Develop practical skills in implementing deep neural networks

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	Demonstrate the basic concepts of deep neural networks.	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Demonstrate a comprehensive understanding of the principles and algorithms of deep neural networks.	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Develop practical skills in implementing, training, and evaluating deep learning models		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Implement advanced architectures of deep neural networks	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*

CO-5	Evaluate the performance and ethical implications of deep learning models	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	**Concepts of Deep Learning**	**Principles of Deep Neural Networks**	**Deep learning models Implementation**	**Advanced architectures of DNNs**	**Ethical implications of DNN**
Duration (hour)	**6**	**6**	**6**	**6**	**6**
SO-1	Overview of Machine Learning and Deep Learning	Artificial neural network Deep Neural Network	Convolutional Neural Network	Recurrent Neural Networks (RNNs)	Autoencoders, Architecture, Types of Autoencoder
SO-2	Evolution of Neural Network	Feed Forward Neural network, Training Deep neural network, Vanishing /Exploding Gradient Problems, Avoiding Overfitting through Regularization	Building Blocks of CNNs, Convolutional Layers, Pooling Layer, Activation Functions, Fully Connected Layer	Architecture of RNN, Types of RNN	Variational Autoencoders Basics Encoder Network, Decoder Network
SO-3	Deep learning Libraries Tensorflow Keras	Training a Neural Network with Backpropagation	CNN Architecture LeNet, AlexNet, VGGNet, ResNet,DenseNet	Long Short Term Memory (LSTM), Architecture of LSTM, Training LSTM, Hyperparameter tuning, -Gated Recurrent Units (GRUs) Basics, GRU Architecture, Training GRU, Hyperparameter tuning	Generative Adversarial network What is GAN?, Generator Discriminator, Loss Functions Training ,Optimization Evaluation, Applications of GAN
SO-4	Applications of Deep Neural Network: Computer Vision, Natural Language Processin, Healthcare & Medical AI Speech Recognition and Synthesis	Activation functions, Straight-line functions Step Functions Piecewise Linear Functions, Smooth Functions Softmax	Transfer Learning, Using Pretrained models (VGG, ResNet,), Fine-tuning on new Datasets	Bidirectional RNNs, Basic structure, Training Bidirectional RNNs, Implementing Bidirectional RNNs	Attention Mechanism : Self – Attention Multi-Head Attention
SO-5	Biological Neurons to Artificial Neurons, Logical Computations with Neurons, Perceptron	Forward and Backward Propagation Forward propagation (Forward pass) Input layer processing, Weighted sum computation, Activation function, Output layer computation- Backward propagation (Backward pass), Computing Loss Computing Gradients Updating Weights	Optimization Techniques, Stochastic Gradient Descent, Adam Adagrad RMSProp, Adadelta	Attention Mechanism: Seq2Seq models with Attention	Vision Transformers, Image Patching and Embedding, Positional Encoding Training Vision Transformers, Advantages and Challenges of ViTs

SO-6	Multi-layer perceptron, Hidden Layers, Activation Functions, Implementation of Multilayer Perceptron, Initializing Model Parameters, Activation Function, Model Loss Function Training	Loss Functions, Types of Loss functions, Regression Loss Functions: MSE, MAE, Classification Loss Functions: Binary Cross-Entropy, Categorical Cross Entropy, Sparse Categorical Cross Entropy, KL Divergence	Application: Image Classification	Application: Text Sentiment Analysis	Application: Image Generation using GAN

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.	Ian Goodfellow, Yoshua Bengio,Aaron Courviller, Deep Learning , edition, Determination Press,2015	2.	Michael A.Nielsen,Neural Networks and Deep Learning, edition, Determination Press, 2015
3.	Aurelien Geronr, Hands-on Machine Learning with Scikit-Learn,Keras & Tensorflow,concepts,tools and Techniques to build Intelligent Systems, 2019	4.	Aston Zhang,Zahary C.Lipton, Mu Li and Alexander J.Smola , Dive-intoDeep_Learning, 2021
5.	Andrew Glassner, Deep Learning A Visual Approach, edition, no starch press, 2021	4.	

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		Dr.S.Lakshmi, SRMIST, Kattankulathur

Code	PGI25G02T	Title	Building GPT Powered Business Applications	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	Learn the aspects related to ChatGPT, Capabilities, advancements and future of ChatGPT.
CR-2	Familiarize the Natural Language Processing functionalities, Part of Speech, NLP Tools and Techniques.
CR-3	Conceive the concept of Prompt Engineering, LLM and advanced techniques for text generation,
CR-4	Identify and acquire knowledge in AI Chatbot, Copilot and Role of AI in Image Generation

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
CO-1	Acquire the basics of ChatGPT, Capabilities, advancements and future of ChatGPT	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Enhance knowledge in Natural Language Processing functionalities, its tools and techniques.	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Design and implement techniques in Prompt Engineering		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	To gain knowledge in AI Chatbot, Copilot and AI in Image Generation	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Apply knowledge in developing GPT Powered Applications	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Introduction to ChatGPT	NLP Techniques	Prompt Engineering	AI Chatbot, Copilot	Building GPT Powered Applications
Duration (hour)	**6**	**6**	**6**	**6**	**6**
SO-1	Introduction to ChatGPT	Named entity recognition (NER) techniques	Introduction to Prompt Engineering – The Five Principles of Prompting	Introduction to AI Chatbot	Building GPT Powered Applications
SO-2	Advancements and future of GPT Models	Markov chains and Hidden Markov Models	Standard Practices for Text Generation with ChatGPT	Working of AI Chatbots	AI Blog Writing
SO-3	Introduction to OpenAI	Smoothing techniques for language models	Advanced Techniques for Text Generation with LangChain	Copilot by Github, Working of copilot	Topic Research, Expert Interview
SO-4	Large Language Models(LLM)	Text Classification and Sentiment Analysis	Introduction to Diffusion Models for Image Generation	Creating an application with copilot	Text Generation, Writing Style
SO-5	Introduction to Natural Language Processing (NLP) - Overview of NLP	Lexicon-based and machine learning approaches	Define GPT in academic perspective	Comparison of ChatGPT, Bard, LLAMA, Claude	Title Optimization
SO-6	Text preprocessing techniques, Word Representations	Introduction to word embeddings (Word2Vec, GloVe)	Realtime Examples of GPT	AI Tools for Image Generation	AI Blog Images, User Interface

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.	Lane, H., & Hapke, H. (2019). Natural Language Processing in Action: Understanding, Analyzing, and Generating Text with Python. Manning Publications.	2	James Phoenix & Mike Taylor, “Prompt Engineering for Generative AI”, O’REILLY Publication.
3.	Olivier Caelen & Marie-Alice Blete, “Developing APPS with GPT-4 and ChatGPT”, O’REILLY Publication.	4	. Steven Bird, Ewan Klein and Edward Loper.”Natural Language Processing with Python”, O’REILLY Publication.

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.Mothilal Nehru, SRMIST, *mothilag@srmist.edu.in*

Code	PGI25G03T	Title	Cloud Infrastructure for Generative AI	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	Introduces the foundational concepts of Generative AI and cloud computing, establishing the need for scalable infrastructure in AI workflows.
CR-2	Equips students with knowledge of cloud-based compute, storage, and networking resources essential for training and managing large AI models.
CR-3	Enables learners to containerize and orchestrate generative AI workloads using modern DevOps and MLOps practices.
CR-4	Trains students to deploy, scale, and optimize generative AI models for real-time and batch inference in cloud environments.
CR-5	Raises awareness of security, governance, and ethical challenges in deploying AI responsibly on cloud platforms.

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	Explain the fundamentals of Generative AI models and the role of cloud infrastructure in supporting them.	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Identify and evaluate cloud-based compute, storage, and networking components required for training and deploying GenAI models.	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Apply containerization and orchestration techniques to build scalable GenAI pipelines on cloud platforms.		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Design and implement inference and deployment strategies for real-time and batch GenAI applications using cloud-native tools.	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Evaluate the security, ethical, and governance challenges in deploying generative AI in a cloud environment.	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Introduction to Generative AI &Cloud Computing	Overview of Cloud Computing	Storage, Networking & Security for AI Workloads	Generative AI Architecture and Model Building	Deployment and Management of GenAI Models
Duration (hour)	**06**	**06**	**06**	**06**	**06**
SO-1	What is Generative AI? Definition of Generative AI, Difference between generative and discriminative AI models	Introduction to Cloud Computing-Definition of Cloud, Characteristics of Cloud Computing	Computer Services : VMs, Containers, Serverless	Architecture of Generative AI System – Data Pipeline,	Deployment Strategies for GenAI Models: Batch Inference vs Real-Time APIs, REST APIs with FastAPI, Flask, or Streamlit
SO-2	Overview of Gen AI types, Application of Generative AI	History and Evolution of Cloud Computing	Storage Services : Block Storage, Object Storage, File Storage	Component of Model Training, Building Generative Models – Preprocessing and Tokenization	Model Serialization: ONNX, SavedModel, TorchScript
SO-3	Basics of neural network basics, GANs - Architecture, Working process – Variants - applications	Cloud Architecture, Cloud Service Models: IaaS, PaaS, SaaS	Compute resource: GPU and TPU	Choosing a Base Model , Transfer Learning and Fine-Tuning	Model Hosting Options: cloud function, Continer services, Model Gateways
SO-4	VAEs- Concept of encoding and decoding, Latent space representation	Cloud deployment Model, Benefits of Cloud Computing and Challenges in Cloud Adoption	Data Lifecycle Management in AI Workflows	Model Training Pipelines: MLOps Tools: MLFlow, Weights & Biases	Monitoring and Logging Models in Production
SO-5	Transformer – based Generative Models – attention mechanism – How transformers generated text and other modalities	Cloud Provider: AWS, Azure,Google, Cloud	Networking Essentials: VPC, Subnets, Load Balancers, API Gateways, Bandwidth, Latency, and Data Movement Challenge	Training Monitoring and Logging	Performance Tuning and Cost Optimization
SO-6	Overview of training process – pre-training, fine-tuning	Virtualization Technology, Hypervisors	security Aspects: Identity and Access Management (IAM),Encryption (At Rest and In Transit), Network Firewalls and Secure Access (VPN, Bastion Hosts), Compliance Standards: GDPR, HIPAA, ISO	AI/ML Services: AWS Sagemaker, GCP Vertex AI, Azure ML Studio	Managing Model Drift, Feedback Loops, and Model Updating

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.	Designing Cloud Data Platforms" Danil Zburivsky & Lynda Partner Publisher: O'Reilly Media	2	"Cloud Computing: Concepts, Technology & Architecture", Thomas Erl, Ricardo Puttini, Zaigham Mahmood,Pearson
3.	Machine Learning Engineering with Python: Manage the Production Life Cycle of Machine Learning Models Using MLOps with Practical Examples", Andrew P. McMahon, Pack		

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	PGI25S01J	Title	Generative AI and Open AI	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 Generative AI
CR-2	Introduction to Generative models
CR-3	Understanding OpenAI Technology
CR-4	Generative Adversarial Networks
CR-5	OpenAI tools

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 basic concepts of Generative AI	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Design and implement VAE generative models.	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Apply and understand appropriate data modeling techniques		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Perform appropriate modeling techniques to implement text generation	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Implement Image synthesis using OpenAI	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Introduction to Generative AI	Introduction to Autoencoders	Introduction to GAN	Introduction to Text Generation	Introduction to DALL-E
Duration (hour)	15	15	15	15	15
SO-1	Introduction to AI, ML and DL, Real world applications of AI,ML,DL	Definition and intuition behind autoencoders.,Applications of autoencoders	Definition and motivation behind Generative Adversarial Networks (GANs)., Overview of Generative Adversarial Networks (GANs).	Introduction to Text Generation: Text generation tasks - language modeling, text completion, and dialogue generation.	Overview and core principle of DALL-E, DALL-E's architecture

				Applications of text generation	
SO-2	Introduction to GEN AI, ML Vs Gen AI, Generative Models Overview : Types of Generative Models	Autoencoder – Architecture, Different activation functions and layer configurations. Training Autoencoders: Overview of the backpropagation algorithm for training autoencoders., Understanding techniques for optimizing reconstruction loss - gradient descent and stochastic gradient descent.	GANs Architecture: Generator and discriminator networks' architectures. Role of activation functions and normalization techniques in GAN architecture. Training GANs: Overview of the minimax game framework used for training GANs	Evolution of GPT Models: Overview of the key advancements and improvements from GPT-1 to GPT-3, including model size, training data, and performance metrics. Impact of each GPT model, GPT Architecture Overview: Transformer architecture and its components, Self-attention mechanisms and feed-forward neural networks.	Transformer-based design and attention mechanisms. Training Process of DALL-E: data collection, preprocessing, and model optimization. Understanding DALL-E's Capabilities
SO 3 - 5	**Practice 1: Simple programs on Open API**	**Practice 4: on implementing a basic autoencoder using TensorFlow or PyTorch.**	**Practice 7: GAN model using TensorFlow or PyTorch**	**Practice 10: Fine-tuning GPT for Text Generation.**	**Practice 13: generating images using DALL-E**
SO-6	Applications of generative models in image generation and NLP	VAEs and the role of the latent space. Comparison between traditional autoencoders and VAEs	Training Dynamics: Exploration of the iterative process of generator and discriminator updates during GAN training, Analysis of the Nash equilibrium and convergence properties in GAN training dynamics.	Pretraining Objectives: autoregressive language modeling, masked language modeling	Image Representation in DALL-E: interpretation and representation of textual descriptions, latent space representation used by DALL-E
SO-7	Understanding OpenAI: History and evolution of OpenAI , OpenAI's Technologies: Overview of GPT models	Latent Space Representation-Techniques for visualizing and interpreting the latent representations, Loss Functions in VAEs: reconstruction loss and the KL divergence loss in VAEs. Trade-off between reconstruction fidelity and regularization in VAE training.	Loss Functions in GANs: Adversarial loss and the role of the generator and discriminator loss functions. Introduction to additional loss functions like feature matching and gradient penalty in GAN training.	Fine-tuning GPT Models: Hyperparameters and optimizing fine-tuning performance. Transfer Learning with GPT:Overview of transfer learning approaches such as feature extraction and fine-tuning, benefits and challenges of transfer learning with GPT	Text-to-Image Generation with DALL-E: Overview of the text-to-image synthesis process techniques and strategies for optimizing the generation process and improving image quality
SO 8 -10	**Practice 2 : Training a simple Autoencoder model on a dataset.**	**Practice 5: Implementing a Variational autoencoder using TensorFlow or PyTorch**	**Practice 8: Implementing a DCGAN for image generation**	**Practice 11:-conditioning GPT models for specific text generation tasks**	**Practice 14 conditioning DALL-E to generate images**
SO-11	Ethical Considerations in AI, Challenges related to interpretability and control in generative AI models.	Real-world examples of using autoencoders for image denoising and anomaly detection. Applications of VAEs in generating novel images and	Progressive Growing GANs (PGGANs): Overview of the progressive growing and benefits of progressive growing in generating realistic and diverse images.	Text Generation Techniques: Greedy decoding, beam search, and nucleus sampling used for text generation with GPT models. Evaluation Metrics for Text Generation	Conditioning DALL-E for Image Synthesis: DALL-E's image generation process, DALL-E's image synthesis using conditioning Ethical

		performing image-to-image translation tasks.			Considerations in Image Synthesis- Limitations and Challenges of DALL-E
SO-12	Limitations of current generative models in capturing complex data distributions, Future Trends Exploration of reinforcement learning-based generative models	Comparison with Other Models Comparison of the training stability and sample quality between autoencoders, VAEs, and GANs., interpretability and controllability of generated samples in autoencoders versus GANs	Self-Attention GANs (SAGANs): Mechanisms and their integration into GAN architectures. Wasserstein GAN (WGAN) and WGAN-GP, Conditional GANs: class-conditional and image-to-image translation GANs. Applications of conditional GANs	Ethical Considerations in Text Generation: Real-world Applications of GPT: Case studies and examples demonstrating the use of GPT models. Advanced GPT Architectures :Overview of advanced transformer-based architectures - XLNet, T5, and BERT	Applications of DALL-E: design automation, content creation, and visual storytelling. Comparison with Other Image Synthesis Models: Comparative analysis of DALL-E GANs (Generative Adversarial Networks) and VAEs (Variational Autoencoders).
SO 13 -15	**Practice 3: Implementing a basic GAN architecture for generating synthetic images using a pre-trained model.** **Top of Form**	**Practice 6: VAEs for anomaly detection in datasets**	**Practice 9: implementing a Progressive Growing GAN**	**Practice 12: interpreting and analyzing the output of GPT models for text generation tasks.**	**Practice 15: Preprocessing and formatting datasets for training and fine-tuning DALL-E models.**

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%	-	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	Goodfellow, I., Bengio, Y., & Courville, A. Deep Learning (Chapter 20: Generative Models). 2016	2	Stefano Van Der Walt, Benjamin Kallus, and Alex Lavin. "Hands-On Generative Adversarial Networks with PyTorch 1.x: Implement next-generation neural networks to build powerful GAN models using Python
3	Jakub Langr and Vladimir Bok, "GANs in Action: Deep learning with Generative Adversarial Networks"		

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.J.Anita Smiles , SRMIST,KTR

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)											
		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	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	6	6	6	6	6

(hour)					
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 (20%)		CLA– 2 (20%)		CLA– 3 (30%)		CLA – 4 (30%)	
		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.	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	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				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	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	1	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	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:*
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:*	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	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	1	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)											
CR-1	Understand the design and implementation of advanced OS features	1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
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:*	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 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	**Memory Management:** Logical	Distributed Operating Systems:	Real time Operating Systems :	**Mobile Operating Systems:**

	of OS, Structures of OS – OS design issues	Vs. Physical address space, Swapping	System Architectures-– Design issues, Communication models,	Introduction , Applications of Real Time 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										
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.	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)											
CR-1	Understand the basic concepts and principles of Artificial Intelligence	1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
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:*	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	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	PGI25D04J	Title	Augmented Reality and Virtual Reality	Category	D	Discipline Elective Core	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	Gain introductory experience in Unity Programming with C#
CR-2	To provide a strong theoretical grip on AR technology
CR-3	Implement augmented reality apps from the developer's perception.
CR-4	Use Unity to efficiently create AR apps for Android, iOS, and Windows platforms
CR-5	Navigate the Unreal Engine interface and understand its key features.

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	Discover the potential of immersive VR & AR	✓				3	80	70	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	Understand the techniques, processes , applications in immersive AR	✓	✓	✓		3	85	75	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Gain the Practical Understanding of Unity software		✓			3	75	70	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Handle scripting and events using Unity	✓	✓	✓	✓	3	85	80	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Gain a high-level understanding of game engine principles along with an overview of the Unreal's basic operation logic.	✓	✓			3	85	75	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Overview	Augmented Reality	2D Game	Script	Unreal Engine
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Virtual Reality: An Overview Introduction	What is AR? Terminologies	Unity for AR & VR Unity Interface	Scripting in Unity Setting up the Scripting Environment	Overview of Unreal Engine, Installing and Setting up Unreal Engine
SO-2	History and Tech Developments	Types of AR Current AR	Create Gameplay, Scenes, Game	Creating and Using Scripts	Working with Unreal projects

	Types of VR	Technologies	Objects	Instantiating Prefabs at runtime	and templates
SO-3		Types of VR systems and hardware Tracking System for AR	Prefabs, Layers, Constraints Lights , Cameras, Publishing Builds	Order of Execution for event functions Event Functions	Unreal Editor Interface, Content Browser
SO-4-5	**Lab 1: Set up a VR development environment using Unity : Install VR development tools, import VR SDKs, Set up a new VR project**	**Lab 4: Set up AR Foundation & ARKit Package**	**Lab 7: Create a simple scene with a controllable character (e.g., a cube) that can move forward, backward, left, and right using keyboard input.**	**Lab 10: Develop a script that rotates an object (e.g., a sphere) around its axis when the player presses certain keys (e.g., Q and E).**	**Lab 13: Create your first unreal engine project**
SO-6	Components of VR systems VR Software and Tools	AR Displays Software	Assets Workflow-Importing Assets, Assets Database	Coroutines, Namespaces	Assets and Packages, Working with Assets, Migrating Assets
SO-7	VR Tracking Systems Comparing Immersive and Non-immersive VR UI	AR Development tools Benefits	Asset Bundles Scripting with Assets	Attributes, UnityEvents	Actors and Geometry, Select, Place, Transform, Group, Snap and Merge Actors
SO-8	Visual Perception of VR, Acoustic Perception of VR	Disadvantages Examples of AR applications	Introduction to 2D game development, 2D Sorting	Few important Classes in Unity Unity Architecture	Components of Unreal: AI, Audio, Camera, Light Components, Components of Unreal: Rendering, Shape, Mesh and Widget components
SO 9-10	**Lab 2: Create a simple VR scene.**	**Lab 5: Creating and Scripting a Placement Indicator in Unity**	**Lab 8: Implement a script that allows the player to interact with objects in the scene (e.g., picking up and dropping objects, triggering events).**	**Lab 11: Implement a timer script that counts down from a specified time (e.g., 60 seconds) and displays the remaining time on the screen.**	**Lab 14: Create a simple environment, author basic materials, explore the lighting system, and add basic Landscape and Foliage to bring the scene to life.**
SO-11	How AR & VR works together?	Gamification for Education5.0 AR games for Education	Working with Sprites, Tilemaps	Multiplayer, Audio Files, Mixers. Profilers	Levels-Work with Level Assets Managing Multiple Levels
SO-12	Impact of VR on Human Lives, Gesture Interaction in VR	General Software Tools for Gamification AR Apps for Education	Tilemaps Workflow, World Building	Video Overview, Animation Clips	World Settings, Playing & Simulating
SO-13	Enabling Technologies in VR, Applications of VR	Multidisciplinary use of AR, Future of AR in Education	Terrain & Tools, Tree Editor	Animation Controllers, Playables API	Building Virtual Worlds-Water, foliage , Fog Effects
SO 14-15	**Lab3: Experiment with different audio and visual effects for immersive experience**	**Lab 6: Create an AR game by importing 3D objects**	**Lab 9: Design a simple user interface (UI) with buttons, sliders, and text elements to display information or control aspects of the game (e.g.,**	**Lab 12: Create a script that controls the playback of animations on a character or object (e.g., idle, walk, jump).**	**Lab 15: Create classes with Blueprints in Unreal Engine**

			health bar, score display).		

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	Alvin Albuero De Luna, " Introduction to Virtual Reality", Arcler Press, 2022	2.	Zeynep Tacgin,"Virtual and Augmented Reality", An Educational Handbook, Cambridge Scholars Publishing, 2020
3.	P.Kaliraj, T.Devi, " Innovating with Augmented Reality, CRC Press, 2022	4	Daniel Buckley, Morgan McKie, "AR Game Development for Beginners", Zenva Pvt Ltd 2020
5	https://docs.unrealengine.com/		

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	PGI25D05J	Title	Generative AI and Large Language Models	Category	D	Discipline Elective Courses	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 Gen AI and LLMs
CR-2	To acquire the basic concept of LLM
CR-3	Gain foundational knowledge, practical skills and functional understanding of how generative AI works
CR-4	To build applications using LLMs
CR-5	To impart knowledge of LLM

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,	5 Modern Tool Usage	6 Society & Culture	7 Environment &	8 Ethical Practices & Social	9 Individual & Team Work	10 Communication	11 Project Management &	12 Life Long Learning
CO-1	Understand the basic concept of LLMs	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	To gain knowledge for developing LLM applications	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	Implement and train a neural language model		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	Explore techniques for fine tuning pre-trained language models	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	Understand how to apply LLMs to a variety of applications	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Define language models	Introduction to Transformer	Fine-tuning Methods	Applications of LLMs,	Ethics, Deployment, Security
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Introducing generative AI	Building a Chatbot like ChatGPT	Developing Software with Generative AI	Generative AI in Production	The Future of Generative Models
SO-2	Why now?	Introduction of Chatbot	Software development and AI	LLM apps ready for production	The current state of generative AI
SO-3	Understanding LLMs	Understanding retrieval and vectors	ode LLMs, Writing code with LLMs	Terminology, How to evaluate LLM apps	Challenges, Trends in model development
SO 4-5	**Practice 1**- Python Programs for AI-Powered Content Creation	**Practice 4**: Python program to help you understand retrieval and vector-based search using LangChain	**Practice 7:** Python Program to write code and execute Using LLM	**Practice 10:** Implement LLM Terminology using Python Program	**Practice 13:** Python Program: Exploring the Current State of Generative AI

SO-6	What is a GPT? Other LLMs	Embeddings, Vector storage, Table of Contents, Vector indexing, Vector libraries, Vector databases	CStarCoder, StarChat, Llama 2 Small local model	Comparing two outputs, Comparing against criteria	Big Tech vs. small enterprises, Artificial General Intelligence
SO-7	How do GPT models work?	Document loaders, Retrievers in LangChain,	LLMs for Data Science	String and semantic comparisons, Running evaluations against datasets	Economic consequences, Creative industries and advertising
SO-8	Pre-training, Tokenization, Scaling, Conditioning	kNN retriever, PubMed retriever, Custom retrievers	The impact of generative models on data science, Automated data science,	How to deploy LLM apps, FastAPI web server	Education, Law
SO 9-10	**Practice 2:** Python program that demonstrates how to build a simple customer support system using Generative AI (OpenAI GPT model),	**Practice 5:** Demonstrates three types of retrievers using LangChain.	**Practice 8:** Python Program: Automated EDA with Generative AI	**Practice 11:** Python Program: Deploying LLM as an API with FastAPI	**Practice 14:** Python Program: Economic Consequences and Impact on Creative Industries & Advertising
SO-11	LangChain for LLM Apps, limitations of LLMs, mitigate LLM limitations	Document loader, Vector storage, Memory, Conversation buffers	Data collection, Visualization and EDA	Ray, How to observe LLM apps	Manufacturing, Medicine
SO-12	Exploring key components of LangChain	Remembering conversation summaries, Storing knowledge graphs	Preprocessing and feature extraction,	Tracking responses, Observability tools	Military, Societal implications, Misinformation and cybersecurity
SO-13	What are chains? What are agents? What is memory? What are tools?	Combining several memory mechanisms, Long-term persistence	AutoML	LangSmith, PromptWatch	Regulations and implementation challenges
SO 14-15	**Practice 3.** Python program that explores the key components of LangChain, a powerful framework for building applications with Large Language Models (LLMs).	**Practice 6:** Python Program: Combined Memory System	**Practice 9:** Python program that covers the core stages of a data science pipeline using a dataset:	**Practice 12:** Python program using LangSmith and PromptWatch	**Practice 15:** Python Program: Misinformation Detection and Cybersecurity

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	Ben Auffarth- Generative AI with LangChain, Build large language model (LLM) apps with Python, ChatGPT, and other LLMs,Packt Publishing, st Edition, 2023.	2	Utpal Chakraborty, Soumyadeep Roy, Sumit Kumar; Soumyadeep Roy; Sumit Kumar-Rise of Generative AI and ChatGPT: Understand how Generative AI and ChatGPT are transforming and reshaping the business world, BPB Online LLP, 2023.
3	*Valentina Alto- Modern Generative AI with ChatGPT and OpenAI Models: Leverage the capabilities of OpenAI's LLM for productivity and innovation with GPT3 and GPT4 [1 ed.], Packt Publishing, 2023.*	4	Patrick Parra Pennefather-Creative Prototyping with Generative AI: Augmenting Creative Workflows with Generative AI (Design Thinking) [1 ed.], Apress, 2023.

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.Sivakumar, SRMIST*

Code	PGI25D06J	Title	IoT Cloud Infrastructure and Protocols	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	Understanding the fundamentals of cloud computing is essential for effective IoT implementation.
CR-2	Knowledge of IoT protocols ensures efficient and reliable communication between devices.
CR-3	Security is a critical component in cloud-based IoT systems to protect data and maintain trust.
CR-4	Familiarity with cloud-based IoT platforms simplifies device integration and accelerates development.
CR-5	Staying informed about emerging IoT trends is crucial for future readiness and innovation.

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	Explain the concept of cloud computing and its significance in the Internet of Things (IoT).	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Compare various IoT communication protocols and select appropriate ones based on specific IoT application requirements.	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Implement security measures to safeguard IoT data stored and transmitted through cloud platforms.		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Manage and integrate IoT devices effectively using leading cloud service platforms.	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Analyze emerging trends and current research areas in IoT cloud infrastructure and communication protocols.	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Introduction to IoT Cloud Infrastructure	Cloud Platforms for IoT	IoT Protocols	Security and Data Management in IoT Cloud	Innovations in IoT and Cloud Convergence
Duration	15	15	15	15	15

(hour)					
SO-1	Cloud Computing: Definition, Significance, and Key Characteristics of Cloud Services	Overview of AWS IoT Core and Key Features and Services Offered by AWS IoT	Introduction to IoT Communication Protocols, including MQTT (Message Queuing Telemetry Transport): Overview and Applications.	Security Challenges in Cloud-Based IoT Deployments and Data Encryption Techniques for IoT Communication.	Blockchain Technology for Secure IoT Transactions and IoT Standards for Interoperability.
SO-2	Overview of Cloud Service Models (IaaS, PaaS, SaaS) and Leading Cloud Service Providers	Microsoft Azure IoT Suite: Introduction, Features, and Google Cloud IoT Core: Overview and Capabilities	CoAP (Constrained Application Protocol): Features, Benefits, and the Role of HTTP/HTTPS Protocols in IoT Applications.	Ensuring Data Integrity in Cloud-Based IoT Solutions and Role-Based Access Control (RBAC) in IoT Cloud Environments.	DevOps Practices and CI/CD in IoT Cloud Deployments.
SO-3	Integration of IoT Applications with Cloud Computing and Their Architectural Framework	Comparison of Major Cloud IoT Platforms and Device Provisioning and Management on Cloud Platforms	AMQP (Advanced Message Queuing Protocol) in IoT and a Comparison of IoT Protocols: Performance, Scalability, and Security.	IoT Security Best Practices and Data Management Strategies for IoT Applications.	Case Studies of Innovative IoT Deployments and Ethical Considerations in IoT Cloud Deployment.
SO 4-5	**Practice 1: MQTT Publisher: Develop a program to publish sensor data (e.g., temperature, humidity) from Node MCU to an MQTT broker hosted on a cloud platform**	**Practice 4: OTA Updates: Set up Over-The-Air (OTA) firmware updates for Node MCU to enable remote updating of firmware from a cloud server without physical access.**	**Practice 7: Real-time Data Streaming: Develop a program to stream real-time sensor data from Node MCU to a cloud-based database (e.g., Firebase Real time Database, AWS Dynamo DB).**	**Practice 10 : Integration with IoT Platforms: Integrate Node MCU with popular cloud-based IoT platforms (e.g., AWS IoT, Google Cloud IoT Core) to leverage their services for IoT applications.**	**Practice 13: HTTP Server: Implement an HTTP server on Raspberry Pi to receive sensor data from Node MCU or other IoT devices and store it in a cloud-based database.**
SO-6	Challenges in Implementing IoT on Cloud Infrastructure: Edge Computing vs. Cloud Computing in IoT	Message Brokering and Routing in Cloud-Based IoT Solutions and IoT Analytics and Insights Using Cloud Services	Interoperability Challenges, and a Comparison of MQTT vs. CoAP for IoT Applications.	Data Storage Options (Databases, Data Lakes, Data Warehouses) and Real-Time Data Processing in IoT Cloud Environments.	Privacy Concerns in IoT Cloud Deployments and Future Directions in IoT Cloud Infrastructure and Protocols.
SO-7	Fog Computing and Its Role in IoT: Scalability and Elasticity in Cloud-Based IoT Solutions	Integration of IoT Devices with Cloud Platforms and Security Measures in Cloud-Based IoT Deployments	Securing IoT Communication with TLS/SSL and Implementing Authentication and Authorization Mechanisms in IoT.	Data Visualization, Dashboards for IoT Applications, and the Role of Edge Computing in IoT.	IoT Ecosystem, Industry Trends, and Challenges & Opportunities in IoT Cloud Deployments.
SO-8	Cost considerations for deploying IoT on cloud platforms	IoT Security Best Practices and Role-Based Access Control (RBAC) in IoT Cloud Environments	Ensuring Data Integrity and Exploring Data Storage Options in Cloud-Based IoT Solutions.	Serverless Computing for IoT Applications and Hybrid Cloud Architectures for IoT Deployments.	IoT Security Regulations, Compliance, and Sustainable IoT Cloud Solutions.
SO 9-10	**Practice 2: MQTT Subscriber: Create a program to subscribe to MQTT topics on Node MCU**	**Practice 5: Security Measures: Secure communication between Node MCU and cloud services using TLS/SSL encryption and implement**	**Practice 8: Data Visualization: Interface Node MCU with a cloud-based data visualization platform (e.g., Thing Speak, Grafana) to visualize sensor**	**Practice 11: MQTT Publisher: Develop a Python script on Raspberry Pi to publish data from sensors connected to GPIO pins to an MQTT**	**Practice 14: Data Logging to Cloud Storage: Write a Python script to log sensor data (e.g., temperature, humidity) from Raspberry Pi to a cloud-based**

		authentication mechanisms	**data in real-time.**	**broker hosted on a cloud platform**	**storage service (e.g., Google Cloud Storage, AWS S3).**
SO-11	Case Studies of Successful IoT Deployments on Cloud Infrastructure and Future Trends in Cloud-Based IoT	Real-time data processing, analytics, and encryption techniques for IoT communication in cloud environments.	Data Streaming, Event Processing, and Implementing Over-the-Air (OTA) Firmware Updates in IoT Applications.	Containerization, Microservices in IoT Cloud Solutions, and IoT Platforms for Rapid Development.	Emerging Technologies in IoT Cloud Infrastructure and Industry Partnerships in IoT Cloud Deployments.
SO-12	Ethical Considerations and Regulatory Compliance in IoT Cloud Deployments	Data Visualization and Dashboards for IoT Applications with AWS IoT Greengrass	Implementing RESTful APIs for IoT Data Exchange and Message Queueing Protocol (MQP) in IoT Applications.	Machine Learning and AI in Cloud-Based IoT Solutions, and Compliance, Governance, and Risk Management.	Research Directions in IoT Cloud Infrastructure, Protocols, and Smart Cities & Urban IoT Deployments.
SO-13	Cloud Service Deployment Models and IoT Edge Device Management	Azure IoT Edge and Google Cloud IoT Edge	Message Queueing Telemetry Transport (MQTT) and Extensible Messaging and Presence Protocol (XMPP) in IoT Applications.	Physical Security, Environmental Controls, and IoT Endpoint Security.	IoT for Environmental Monitoring, Sustainability, and Wearable Technology in Healthcare IoT Applications.
SO 14-15	**Practice 3: HTTP Client: Implement an HTTP client on NodeMCU to send sensor data to a cloud-based server**	**Practice 6: Cloud-triggered Actions: Create a program on NodeMCU to perform specific actions (e.g., turn on/off an LED) based on commands received from a cloud-based IoT platform.**	**Practice 9: Device Shadowing: Implement device shadowing functionality on NodeMCU to synchronize device states and configurations with a cloud-based IoT platform.**	**Practice 12: MQTT Subscriber: Create a Python script to subscribe to MQTT topics on Raspberry Pi and take actions based on messages received from a cloud-based MQTT broker.**	**Practice 15: Real-time Data Analytics: Develop a Python script to perform real-time analytics on sensor data received from NodeMCU or other devices and send alerts or notifications based on predefined thresholds.**

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.	Arshdeep Bahga, Vijay Madisetti, *Internet of Things: A Hands-On Approach*, 1st Edition, VPT (Universities Press), 2014.	2.	Michael J. Kavis, *Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)*, 1st Edition, Wiley, 2014.
3.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, *IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things*, 1st Edition, Cisco Press, 2017.	4.	Thomas Erl, Zaigham Mahmood, Ricardo Puttini, *Cloud Computing: Concepts, Technology & Architecture*, 1st Edition, Prentice Hall, 2013.
5.	Houbing Song, Di Wu, Sabina Jeschke, Subhas Chandra Mukhopadhyay, *Security and Privacy in the Internet of Things (IoT)*, 1st Edition, Wiley, 2017.	6.	Olivier Hersent, David Boswarthick, Omar Elloumi, *Internet of Things: From Research and Innovation to Market Deployment*, 1st Edition, Wiley, 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. M. Pandiyan, SRMIST,pandiyam@srmist.edu.in*

Code	PGI25S02J	Title	Prompt Engineering in Generative AI	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	To generate new content based on variety of inputs
CR-2	To enhance the ability to use generative AI effectively
CR-3	To apply various models in AI
CR-4	To know the various Prompts
CR-5	To build variety of AI powered Applications

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 acquire the knowledge to get best output from the right question.	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	To work efficiently with ChatGPT, UM-GPT and DALL-E.	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	To able to craft the prompt for the various conditions.		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	To implement the encoding and Decoding of Text	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	To construct variations of AI Applications using Web Interface	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Foundations of Generative AI and Prompt Engineering	Designing Effective prompts and Text Generation Techniques	Advanced Prompting and Text Generation	Autonomous Agent with Memory and Tools:	Prompt Engineering for Image Generation using Diffusion Models
Duration (hour)	**15**	**15**	**15**	**15**	**15**

SO-1	Introduction to Prompt Engineering: Understand the role and importance of prompt.	Standard Practices for Text Generation with Chat GPT: Generating List and Hierarchical List Generation, Generating JSON	Introduction to LangChain and Chat Models	Chain of Thought Reasoning : Introduction to step-by step reasoning in LLMs, Applications	Introduction to diffusion models, Applications in generative image creation
SO-2	Definition of Generative AI and difference between traditional AI and generative AI, Principles of Prompting	Generating diverse outputs formats, Chunking Strategies	Advanced Text generation Techniques LangChain Prompt Template	Understand Agents in LangChain: What are agents?, Role of agents, Integration of OpenAI functions into workflow, API-based prompt execution	OpenAI's DALL-E, Introduction to stable diffusion models
SO-3 -5	**Practice 1- Apply 5 Principles of prompting and Generate an Image Prompt**	**Practice 4- Build a simple chunking algorithm in Python to segment large text inputs**	**Practice 7- Create a custom text generator using LangChain**	**Practice 10-** Implement a simple **ReAct-based agent** using LangChain	**Practice 14-** Generate AI images using **format and art style modifiers**
SO-6	Evolution of AI: From Rule based to Generative Models	Encoding and Sentiment Analysis	LangChain Expression Language (LCEL)	Comparing Open AI functions vs ReAct framework,	Overview of text-to-image architecture
SO-7	Text Generation Models: Overview of key models and comparison between Popular Generative A	Prompting Strategies: Least to most prompting, Role Prompting and instruction design	Vector Databases and Embeddings, Working principle and benefits of Retrieval Augmented Generation	Agent Toolkits and Customization, Memory in Agents: Introduction to agent memory	Prompt engineering for visual output: format modifier, art style modifier and refine output using negative prompts
SO-8 - 10	**Practice 2- Working with Chat GPT Prompt-I**	**Practice 5- Implement Encoding and Decoding of Text**	Practice 8- **Work with LangChain Prompt Templates and integrate with a vector database**	**Practice 11- Customize and build an agent with memory and integrated tools**	**Practice 14- Experiment with diverse prompt styles, including negative and reference-image prompts**
SO-11	Common use cases of Generative AI, Designing Effective Prompts	GPT Best Practices for prompting engineering	Loading document for context aware prompting	Understanding memory types in LangChain	Advanced Prompting Techniques: Reverse engineering image prompts Inpainting and outpainting concepts
SO-12	Prompt for domain specific applications	Classification tasks, Mets Prompting : Introduction	Memory Retrieval with FAISS, Self-Querying	Advanced Agent Framework, Callbacks	Running Stable Diffusion, Automatic1111 Web User Interface
SO-13 SO 14-15	**Practice 3- Working with Chat GPT Prompt-II**	**Practice 6- Build a Classification Model**	**Practice 9-** Implement **FAISS-based memory retrieval**, document loading, and self-querying retriever setup	**Practice 12-** Implement and test **callbacks using constructors** in an advanced agent setup	**Practice 15-** Build a simple **AI-powered image generation application** using Stable Diffusion and the Automatic1111 interface

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.	Prompt Engineering for generative AI by James Phoenix and Mike Taylor, O'Reilly Media, Inc Publication, July 2024.	2.	Prompt Engineering for generative AI by Johnny M Hill

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. B. Nagarajan, SRMIST

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)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
CR-1	Help individuals develop key skills for personal and professional growth	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	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:*																			
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		CLA – 2		CLA – 3		CLA – 4	
		(20 %)		(20 %)		(30 %)		(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

SEMSTER 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:*	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 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:*	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	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	**Practice:** • Configure Ethernet LAN and VLANs in Packet Tracer Capture MAC layer packets using	**Practice:** • Compare TCP and UDP connections using Wireshark Simulate port communication and	**Practice:** • Create simple web service client using REST API (Python/Browser)	**Practice:** • Automate router config using Netmiko (Python) Create Jenkins pipeline for automated

	Visualize network topologies (bus, star, ring, hybrid) and packet flow	Wireshark	congestion control using socket programming	Use ping, traceroute, netstat to analyze performance	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	Cloud Computing Fundamentals and	Cloud Infrastructure and Services	Applied Cloud and Emerging Trends	Foundations of Quantum Computing	Quantum Algorithms and Cloud Integration

Outcomes	Architecture				
Duration (hour)	**12**	**12**	**12**	**12**	**12**
SO-1	**Introduction to Cloud Computing** • Evolution of computing: Mainframe → Grid → Cloud • Need for elasticity and scalability	**Compute, Storage, and Network Architecture** • Server farms, virtual network functions, block/file/object storage	**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
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	**Identity and Access Management (IAM)**	**Cloud-native App Deployment** • DevOps lifecycle, Helm,	**Bloch Sphere Visualization** • Polar coordinates, pure and	**Quantum Error Correction** • 3-qubit bit-flip, Shor code,

	& II), VM lifecycle • Containers vs Virtual Machines	• Roles, policies, permission boundaries	Docker Compose	mixed states	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	PGI25D07J	Title	Computer Vision in Smart Robotics	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 understand the basic principles of computer vision and its applications in robotics.
CR-2	To learn about different techniques for image processing and feature extraction.
CR-3	To study methods for object recognition and visual tracking in robotics.
CR-4	Explain the basic principles of computer vision and its role in robotics.
CR-5	Apply image processing techniques to enhance images for robotic perception.

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	Demonstrate an understanding of the principles of computer vision and its role in robotics.	✓				3	80	70	3	*3*	*3*	*3*	*3*	*2*	-	3	2	*2*	-	*3*
CO-2	Apply image processing techniques such as filtering, segmentation, and feature extraction to process images for robotic perception.	✓	✓	✓		3	85	75	2	2	3	3	3	-	-	2	2	2	-	*3*
CO-3	Implement machine learning algorithms for tasks such as object detection and recognition in robotics.		✓			3	75	70	2	2	3	3	3	-	-	2	*2*	1	-	*3*
CO-4	Design and develop computer vision algorithms using libraries such as OpenCV for robotic applications.	✓	✓	✓	✓	3	85	80	3	3	3	3	3	2	-	2	1	3	*2*	*3*
CO-5	Integrate computer vision systems with robotic platforms and demonstrate their functionality in real-world scenarios.	✓	✓			3	75	70	3	3	3	3	3	1	-	2	3	1	1	*3*

Title & Session Outcomes	Overview of Robotics and Computer Vision	Image Acquisition& Pre Processing Techniques	Advanced Computer Vision Techniques	Understanding and Tracking for Intelligent Robotic Systems	Vision-Based Robotics
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Overview of robotics and computer vision, Importance of Computer Vision in robotics systems	Introduction on Image Acquisition	Techniques for object detection in images and videos,	Introduction to Scene Understanding and Tracking in Robotics, Sensor Fusion for Scene Understanding and Tracking	Vision-based Human-Robot Interaction (HRI): Gesture recognition, Face detection and tracking, Emotion recognition from visual input,Gaze estimation and social cues analysis
SO-2	Computer Vision Work flow steps	Image Acquisition Techniques in robotics	Object recognition and classification techniques	Object Tracking, Multi-Object Tracking, Visual SLAM	Visual Servoing: Using visual feedback to control the robot's motion or manipulation tasks.
SO-3	Computer Vision Frame Work (OpenCV, TensorFlow,PyTorch)	Object Detection Methods	Data Augmentation Techniques for Object Detection	Deep Learning Approaches for Scene understanding 3D Scene, understanding for Robotics	Robust Vision Systems for Dynamic Environments: Visual feedback for robotic arm control Positioning and alignment using cameras, Image-based control systems for robot motion
SO 4-5	**Practice 1: Reading and Writing Images using OpenCV**	**Practice 4: Write a program to capture images from a camera and display them on a screen using OpenCV or a similar library.**	**Practice 7: Write a program, to implement data augmentation techniques to training images and labels to improve model generalization.**	**Practice 10: Implement 3D Scene Reconstruction**	**Practice 13: Detect and track a face in a live video stream**
SO-6	Image Processing Fundamentals: Image formation, filtering techniques	Image Preprocessing Techniques Noise types: Gaussian, salt-and-pepper	Deep Learning Models: Convolutional Neural Networks (CNNs) for Object Detection	Machine Learning for Adaptive scene understanding Probabilistic Models for scene understanding and tracking	Multi-Modal Sensor Fusion Techniques
SO-7	Edge detection	Smoothing techniques: Gaussian blur, median filter	YOLOv5/v8: Real-time detection SSD (Single Shot Detector), Faster R-CNN	Contextual Understanding in Scene Analysis	Learning-based Visual Navigation Techniques
SO-8	Color models and segmentation	Morphological operations: erosion, dilation, opening, closing	Instance Segmentation: Mask R-CNN, SegFormer, SAM (Segment Anything Model)	Cognitive Approaches to scene understanding in Robotics	Moving Object Detection and Tracking
SO	**Practice 2: Given an image**	**Practice 5: Implement**	**Practice 8:. Object**	**Practice 11: Build a classifier to**	**Practice 14: Develop a vision-**

9-10	**with noise, apply a suitable filtering technique to reduce the noise. Compare the effects of these filters on the image quality**	**preprocessing IoT Devices with Computer Vision Technologies Techniques**	**Detection -Use a pre-trained object detection model (e.g., YOLO, SSD) to detect objects in a video stream and draw bounding boxes around them**	**classify the scenes into their respective categories.**	**based system to detect and track moving objects in a dynamic environment.**
SO-11	Integration of Computer Vision and Robotics: Applications of computer vision in robotic systems, such as navigation, manipulation, and perception.	Image filtering and enhancement techniques	Transformers in Vision: DETR (DEtection TRansformer) DINOv2, OWL-ViT for open-world object detection	Real-Time Scene Understanding, Adaptive Learning, Cognitive Approaches	Visual SLAM in Dynamic Environments: Handling moving objects and changing scenes in SLAM
SO-12	Calibration of cameras and sensors for robotic applications	Feature extraction method	Transfer Learning for Object Detection in Robotics	Benchmark Datasets and Evaluation Metrics for Scene Understanding	Vision-based Localization in GPS-denied Environments: Localizing robots using vision when GPS is unavailable.
SO-13	Calibration of cameras and sensors for robotic applications	Image Segmentation	Tracking Techniques - KLT tracker (Lucas-Kanade) , DeepSORT, ByteTrack, StrongSORT for multi-object tracking	Ethical Considerations in Scene Understanding and Tracking	Deep Reinforcement Learning for Vision-based Robotics: Using deep RL to train robots for various vision tasks.
SO 14-15	**Practice 3: Implement a Python function using OpenCV to calibrate a camera using multiple images of a checkerboard pattern**	**Practice 6:Write a program to implement image filtering and feature extraction techniques**	**Practice 9: Object Tracking-Implement a basic object tracking algorithm (e.g., KLT tracker) to track a moving object in a video stream**	**Practice 12: Implement a semantic segmentation algorithm to label each pixel in an image with the corresponding object class, providing a detailed understanding of the scene's content.**	**Practice 15: Develop a Visual SLAM system that can handle dynamic objects and changing scenes, making the SLAM algorithm robust to moving objects.**

Assessment											
Level of Thinking		Continuous Learning Assessment (CA) (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	Robot Vision, Berthold Klaus Paul Horn. McGraw-Hill Higher Education	2	Simon J.D. Prince, Computer Vision: Models, Learning, and Inference, University College London,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.Pandian, SRMIST*

Code	PGI25D08J	Title	Building Conversational AI for Human Resources	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	Discover Conversational Artificial Intelligence technologies.
CR-2	Study the basics of designing intelligent agents that can solve HR problems
CR-3	Discover appropriate HR dialogue system using natural language processing
CR-4	Perform conversational design process with different use cases of HR context
CR-5	Formalize conversational AI linear and nonlinear dialogue

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	Demonstrate fundamental understanding of the Conversational Artificial Intelligence and its foundations	✓				2	85	80	1	-	-	3	-	2	-	2	3	3	2	3
CO-2	Apply basic principles conversational artificial intelligence in HR domain knowledge	✓	✓	✓		3	85	80	3	-	-	3	3	-	-	-	3	3	2	3
CO-3	Develop conversational AI models with understanding of HR policies and procedures.		✓			3	85	80	3	-	-	3	-	-	-	-	3	3	2	3
CO-4	Ability to understand Natural Language Processing fundamentals	✓	✓	✓	✓	3	85	80	3	1	2	3	3	-	-	-	3	3	2	3
CO-5	Ability to learn conversational agents and develop dialogue systems.	✓	✓			3	85	80	3	3	2	3	-	3	3	3	3	3	2	3

Title & Session Outcomes	Introduction to Conversational AI for HR	HR Domain Knowledge	Building Conversational AI Models	Ethical and Legal Considerations	Project Development and Presentation
Duration (hour)	**15**	**15**	**15**	**15**	**15**

SO-1	Overview of Conversational AI technologies.	Understanding HR policies, procedures, and regulations.	Overview of machine learning models for NLP tasks.	Privacy concerns.	Provide students with an opportunity to work on a project integrating concepts learned throughout the course.
SO-2	Applications and benefits of conversational AI in HR. Challenges and limitations of conversational AI in HR contexts	Employee lifecycle management - Recruitment, on-boarding, performance management, off-boarding.	Pre-trained language models for conversational AI - Fine-tuning models on HR-specific datasets.	Data protection regulations - Bias and fairness in conversational AI systems.	Project Proposal - Develop a project proposal outlining the problem statement.
SO-3	Conversational Design Process - Use cases of HR context.	HR compliance and legal considerations - Employee benefits, compensation, and payroll administration.	Model evaluation - Performance metrics.	Transparency and accountability in AI decision-making - Ethical use of Conversational AI in HR interactions.	Objectives, methodology - Expected outcomes.
SO 4-5	***Practice 1:*** Implement a tokenization function to split input text into tokens.	***Practice 4:*** Construct dialogue trees representing various conversation paths based on user inputs and system responses	***Practice 7:*** Access HR-related data sources (e.g., employee database, leave management system) using APIs or database queries.	**Practice 10:** Implement strategies to mitigate biases and ensure fairness and inclusivity in conversational AI systems.	**Practice 13:** Project integrating concepts learned throughout the course.
SO-6	**Natural Language Processing (NLP) Fundamentals** - Basics of text processing and tokenization.	User-centered design principles for conversational interfaces - Personal development and conversational tone.	Linear and Non-linear dialogue - Actions & Parameters.	Fulfilment using webhook - Basic setup of webhook code.	Project Implementation - Implement the proposed conversational AI system.
SO-7	Part-of-speech tagging- Syntactic parsing.	Prompt design -Error handling.	Understanding slot filling context - Extended Lead Generation.	Extracting parameter values and structuring responses - Fulfillment using cloud function.	Incorporating NLP - Dialogue management.
SO-8	Named entity recognition and entity linking -Sentiment analysis and emotion detection.	Multimodal interactions - Accessibility considerations.	Linear dialogue - Nonlinear Dialogue.	SAP Conversational AI Connect Chatbot to HR systems.	Integration with HR systems. Ethical considerations.
SO 9-10	**Practice 2:** Use an NLP library to perform part-of-speech tagging on sample sentences.	**Practice 5:** Implement error handling strategies to handle user misunderstandings or unexpected inputs.	**Practice 8:** Preprocess retrieved data to extract relevant information and prepare it for use in conversational interactions.	**Practice 11:** Build a Web hook for a Chatbot and connect with HR Systems.	**Practice 14:** Demonstrating the functionality and effectiveness of the conversational AI system.
SO-11	Introduction to dialogue systems architecture - Dialogue Systems and Conversational Agents.	Building blocks of Interaction models -Agents, types of Intents.	Accessing HR databases - APIs, and third-party services.	Assess the performance of conversational AI systems using appropriate metrics. - User Testing.	Deployment: Introduction to Heroku, Deploying to Heroku.
SO-12	Intent recognition and dialogue state tracking - Dialogue management strategies (rule-based, statistical, reinforcement learning)	Creating Intents, training phrases - Entities, configuring rich responses.	Integrating conversational AI with HR management software - Applicant tracking systems.	Conduct user testing sessions with human participants - Evaluate the usability and effectiveness of the conversational AI system	Deploying on Alexa, Re-training, Validation& Testing.

SO-13	Handling multi-turn conversations. Context preservation.	Small talk and salutations- Configuring and testing Intents on Google Assistant.	Data privacy - Security, and compliance considerations.	Analyze common errors and misunderstandings encountered during user interactions - Identify areas for improvement.	Building a AI application on Heruku Demonstrating with HR systems.
SO 14-15	**Practice 3:** Designing Conversational Flows: Define common HR scenarios (e.g., employee onboarding, leave request) and outline the conversation flow for each scenario.	**Practice 6:** Design and train a simple intent recognition model using a rule-based or machine learning approach.	**Practice 9:** Test the integration between the conversational AI system and HR systems to ensure data accuracy and consistency	**Practice 12:** Conduct user testing sessions with human participants to evaluate the usability and effectiveness of the conversational AI system	***Practice 15:*** Deploying a chatbot on Heruku.

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.	**urafsky, Daniel; Martin, James H.**, *Speech and Language Processing*, 3rd Edition (draft), Pearson, 2023. *(Covers NLP fundamentals, tokenization, POS tagging, syntactic parsing, dialogue systems, sentiment analysis.)*	2.	**Tegmark, Max**, *Life 3.0: Being Human in the Age of Artificial Intelligence*, 1st Edition, Penguin Books, 2017. *(Explores long-term impacts, bias, accountability, and ethical use of AI.)*
3.	**Chowdhary, R.A.**, *Natural Language Processing: Fundamentals for the Real World*, 1st Edition, BPB Publications, 2020. *(Practical introduction to NLP techniques and applications relevant to HR chatbots.)*	4	**Weblink:** https://www.oreilly.com/library/view/designing-bots/9781491974810/ **Description:** Focuses on conversational design principles, dialogue flows, and user-centric interaction strategies.
5	**Rashid, Md. Rezaul Karim**, *Building Chatbots with Python*, 2nd Edition, Apress, 2022. *(Hands-on development of chatbot applications using NLP and Python libraries.)*	5	**Weblink:** https://www2.deloitte.com/us/en/insights/focus/cognitive-technologies/ethical-use-of-ai-in-human-resources.html **Description:** Industry report focusing on ethical, fair, and compliant use of AI tools in HR functions.
6	**Wooldridge, Michael**, *Artificial Intelligence: A Guide for Thinking Humans*, 1st Edition, Penguin Books, 2021. *(Introduces ethical, legal, and fairness aspects of AI systems in human contexts.)*	7	**Weblink:** https://link.springer.com/book/10.1007/978-3-030-68252-3 **Description:** Covers advanced NLP and deep learning techniques applicable to building scalable, smart conversational AI systems.

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.Arunarani, SRMIST,arunaras@srmist.edu.in*

Code	PGI25D09J	Title	IoT Devices with Computer Vision Technologies	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	To introduce Internet of Things (IoT) environment and its technologies for designing smart systems																			
CR-2	Explore the system management and domain for various applications of IoT Categorize the various protocols that are used for developing IoT applications.																			
CR-3	Inculcate the fundamentals of computer vision																			
CR-4	To teach the functions of a Computer vision techniques involved in training the Computer vision models on different problems																			
CR-5	Build intelligent and automated real-world Computer vision applications																			

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	Investigate various challenges and explore open-source hardware prototyping platforms for designing IoT devices	✓				*5*	*85*	*75*	*3*	*2*	*2*	-	*2*	*2*	-	-	-	-	-	-
CO-2	Understand basic circuits, sensors and interfacing, data conversion process and shield libraries to interface with the real world	✓	✓	✓		*4*	*85*	*75*	*3*	*3*	-	*2*	-	*2*	*2*	-	-	-	-	*1*
CO-3	Understanding the fundamental concepts of Computer vision	✓	✓	✓		*6*	*85*	*75*	*3*	*3*	-	*2*	-	*2*	*2*	-	*2*	-	-	*1*
CO-4	Gain hands-on solid skills, knowledge and expertise of real-world situations	✓	✓	✓		*3*	*85*	*75*	*3*	*3*	*2*	*2*	-	*2*	*2*	-	*2*	-	-	*2*
CO-5	Expertise in Data gathering, Data collection, Model training, and model evaluation with domain-specific components. Applying all the computer vision techniques to real -world industry problems	✓	✓	✓	✓	*2*	*85*	*75*	*3*	*3*	*2*	*2*	*1*	*2*	*3*	-	*2*	-	-	*2*

Title & Session Outcomes	Introduction to IoT & Communication Models	IoT System Design & Security	Computer Vision Fundamentals & Image Processing	AI-Based IoT Applications & Edge Computing	Advanced Computer Vision & IoT Applications
Duration (hour)	15	15	15	15	15
SO-1	Introduction to IoT, Definition& Characteristics of IoT	Communication Models in IoT, Device to Device Model	Computer Vision –Introduction Computer Vision Overview	Computer Vision Workflow Steps Business Problem Identification	Computer Vision Techniques an Overview Image Processing

SO-2	Physical design of IoT, Things in IoT, IoT protocols	Device to Cloud Model, De vice to Gateway Model, M2M,Differences between IoT and M2M	Computer Vision defined from an academic perspective, Computer Vision defined from Industry perspective	Success Criteria Definition, Right Computer Vision Techniques	Image Processing Techniques, Image Restoration, Linear, Filtering, Independent Component Analysis, Pixelation
SO-3	Logical Design of IoT, IoT Functional Blocks	Architecture of M2M, Software Defined Networking (SDN), SDN, Architecture of SDN	Signal Processing for Computer Vision, Pattern recognition of Computer Vision	Collect Training Data, Label Train and Test Datasets	Challenges and opportunities in integrating IoT with computer vision. Overview of edge computing and its role in IoT
SO 4-5	**Practice :1 Explain working of Raspberry Pi.**	**Practice 4: Describe gateway as a service deployment in Iot toolkit**	**Practice 7: Install OpenCV, Displaying images OpenCV**	**Practice 10: Text in Images**	**Practice 13: Image Edge Detection OpenCV**
SO-6	IoT Levels and Deployment Templates, Levels 0, Levels 1	Network Function, Virtualization (NFV), Architecture of NFV, NFV for IOT, YANG - NETCONF	Challenges of Computer Vision, Computer Vision Data, Requirements	Train the computer vision model Evaluate the computer vision model	Median Filter, Feature detection and matching
SO-7	Levels 2, Levels 3, Level 4, Level 5	IoT System Management. Advantages and Disadvantages of IoT System management NETCONF,YANG and NETOPEER	How much data is needed, Is your data good enough?	Test the model, Deploy the model	Security challenges in IoT deployments, Secure communication protocols and encryption techniques
SO-8	IoT Deployment Challenges Domain Specific IoT	IoT Systems and Devices Management with NETCONF-YANG, Purpose & Requirements, process model specification, domain model specification	Data Structure Data Format	Iterate the steps process Computer vision architecture	Problems that Computer Vision can Solve Text Classification
SO 9-10	**Practice 2: Controlling LED with Raspberry Pi**	**Practice 5: Weather Monitoring System**	**Practice 8: Reading &Writing images OpenCV**	**Practice 11: Color Space OpenCV** **Thresholding OpenCV**	**Practice 14: Image Scaling & Rotation using OpenCV**
SO-11	Home, Cities Environment, Energy systems	Information model specifications, service specifications, IoT level, Specifications, Functional view specifications, operational view specifications	Data Type, Training Data	Data Ingestion, Data Pre-processing	Privacy concerns in computer vision applications, Implementing secure communication for IoT devices
SO-12	Industry Agriculture	Device & component Integration, Application development, IoT	Validation Data, Test Data	Multiprocessing, Transfer Learning/Model, Processing	Introduction to edge devices: Raspberry Pi, Arduino, NVIDIA Jetson Nano, Hands-on exercises:

		System for Agriculture			Implementing secure communication for IoT devices
SO-13	Health and Lifestyle IoT components	Functional view specifications, operational view specifications IoT Security and Interoperability, Risks and Attacks, and Tools for Security	Image Processing Techniques Filtering Techniques in Image Processing Linear Filter, Non-Linear Filter	Data Transformation, Popular Computer Vision frameworks: OpenCV, TensorFlow, Matlab	Hands-on exercises: Setting up an edge device, installing OpenCV Hands-on exercises: Implementing object detection on IoT devices
SO 14-15	**Practice 3: Interfacing Light Sensor with Raspberry pi**	**Practice 6: IoT based Soil Moisture Monitoring Device**	**Practice 9: Draw a Rectangle, Draw a Circle**	**Practice 12: Finding Contours**	**Practice 15: Image Translation OpenCV, Image Filtering OpenCV**

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	ArshdeepBahga and Vijay Madisetti, “Internet of Things - A Hands-on Approach”, Universities Press, 2015.	2	Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, Wiley, 2014.
3	R. Jain, R. Kasturi, and B. G. Schunck, Machine Vision, McGraw-Hill, Inc. 1995.	4	Digital Image Processing and Analysis: Application with MATLAB and CVIPtools, 3rd Edition, SE Umbaugh, Taylor&Francis/CRC Press, 2018
5	Computer Vision: Algorithms and Applications by Richard Szeliski. Available for free online.	6	Computer Vision: A Modern Approach (Second Edition) by David Forsyth and Jean Ponce. Available for free online.

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. P. Chanthini, SRMIST, chanthip@srmist.edu.in*

Code	PGI25G04T	Title	Data Engineering and 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	To introduce the role and components of data engineering in the modern data lifecycle.
CR-2	To enable students to design and build scalable data pipelines using industry-relevant tools.
CR-3	To impart knowledge on distributed data storage, processing frameworks, and analytics.
CR-4	To provide hands-on exposure to data ingestion, transformation, and visualization.
CR-5	To explore real-time data processing tools, governance, and real-world case studies.

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 architecture and processes involved in data engineering.	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Design and implement data pipelines using modern tools and platforms.	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Apply analytics techniques to gain insights from large data sets.		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Utilize various storage solutions and processing frameworks.	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Demonstrate the ability to work on real-world data engineering problems.	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Introduction to Data Engineering	Data Storage and Processing Frameworks	Data Pipelines and Workflow Orchestration	Data Analytics and Visualization	Real-time Data Processing and Case Studies
Duration (hour)	**06**	**06**	**06**	**06**	**06**
SO-1	Overview of Data Engineering and its role in the data lifecycle	Relational databases (RDBMS): SQL, indexing, normalization	Data pipeline architecture and components	Descriptive, diagnostic, predictive, and prescriptive analytics	Real-time vs. batch processing

SO-2	Data types and sources: structured, semi-structured, unstructured	NoSQL databases: MongoDB, Cassandra, HBase	Building ETL/ELT pipelines using Apache NiFi, Airflow, or similar tools	Data exploration using Python/R (Pandas, NumPy, Matplotlib)	Stream processing using Apache Kafka, Apache Flink, Spark Streaming
SO-3	Data ingestion techniques: batch vs. streaming	Data Lakes and Warehouses: Redshift, BigQuery, Snowflake, Delta Lake	Data ingestion from APIs, logs, and streaming platforms (Kafka, Flume)	Statistical methods for data analysis	Case Study 1: Building a real-time analytics dashboard
SO-4	Data formats: CSV, JSON, Parquet, Avro	Distributed file systems: Hadoop HDFS	Handling schema evolution, late arriving data, and data quality	Introduction to machine learning for analytics (regression, classification)	Case Study 2: Implementing a scalable data pipeline
SO-5	Data modeling basics: relational, dimensional, and NoSQL models	Apache Spark and MapReduce: architecture and use cases	Monitoring and logging in data pipelines	BI tools: Tableau, Power BI, Looker basics	Data governance, privacy, and security in analytics
SO-6	Overview of ETL (Extract, Transform, Load) processes	Data partitioning and sharding concepts	Introduction to CI/CD in data pipelines	Dashboard creation and storytelling with data	Industry trends in Data Engineering and Analytics

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.	Data Engineering with Python – Paul Crickard	2.	Designing Data-Intensive Applications – Martin Kleppmann
3	Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence”, Addison-Wesley	4	Fundamentals of Data Engineering – Joe Reis and Matt Housley
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	PGI25G05T	Title	Distributed Data Processing Systems	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		
		1	2	3	4	1	2	3
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)
CR-1	Gain knowledge of Distributed Databases							
CR-2	Understand Query Processing & Optimization							
CR-3	Gain knowledge of Transaction Management							
CR-4	Understand Fault Tolerance & Recovery							
CR-5	Gain knowledge of Distributed Storage & Replication							

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment		
		1	2	3	4	1	2	3
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)
CO-1	Understand Distributed Databases	✓				*5*	*85*	*75*
CO-2	Gain knowledge of Query Processing & Optimization	✓	✓	✓		*4*	*85*	*75*
CO-3	Understand Transaction Management		✓			*6*	*85*	*75*
CO-4	Gain knowledge of Fault Tolerance & Recovery	✓	✓	✓	✓	*3*	*85*	*75*
CO-5	Understand Distributed Storage & Replication	✓	✓			*2*	*85*	*75*

Outcomes (CO)	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*

Title & Session Outcomes	Overview	Data Storage, NoSQL, and Indexing	Query Processing	Transactions	Security
Duration (hour)	**6**	**6**	**6**	**6**	**6**
SO-1	**Overview of Distributed Databases** – Definition and characteristics	**Distributed File Systems** – Concepts, architecture, examples (HDFS, GFS)	**Distributed Query Processing** – Query decomposition and execution	**Distributed Transactions and Commit Protocols** – 2PC, 3PC, Paxos	**Security in Distributed Databases** – Authentication,
SO-2	Advantages, challenges	**NoSQL Databases** – Types: key-value, document, column-family, graph databases	**Join Processing** – Hash join, Nested-loop join	**Consistency Models**– Models and trade-offs	Encryption, Access control

SO-3	**Distributed Database Architectures** – Client-server, peer-to-peer, multi-tier models, Distributed data storage and management	**Indexing in Distributed Databases** – B-Trees, Hash-based indexing, LSM Trees	**Query Optimization Techniques** – Cost-based and rule-based optimization	**Fault Tolerance Techniques** – Replication, backups, data recovery	**Distributed Databases in Cloud Computing** – Concepts and architectures
SO-4	**Data Distribution and Fragmentation** – Horizontal, vertical, and hybrid fragmentation	**Sharding and Partitioning Strategies** – Range-based, Hash-based, Consistent Hashing	**Concurrency Control Mechanisms** – Locking, Timestamp ordering, MVCC	**Scalability in Distributed Databases** – Vertical vs Horizontal scaling	**Edge Computing and Federated Databases** – Modern distributed data management
SO-5	**Replication and Consistency** – Types of replication, eventual consistency	**Replication Techniques** – Synchronous vs Asynchronous replication	**Deadlocks and Resolution Strategies** – Detection and Prevention techniques	**Blockchain Integration**– Decentralization and consensus models	**Future Trends in Distributed Databases** – AI integration,
SO-6	**CAP Theorem**– Trade-offs in distributed databases	**Performance Considerations** – Latency, throughput, load balancing	**Transaction Management**– ACID, isolation levels	**Load Balancing** – Techniques and strategies	Quantum databases

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	M. Tamer Özsu, Patrick Valduriez, Principles of Distributed Database Systems4ht Edition Springer 2019	2	Pramod J., NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence 1st Edition Addison-Wesley Professional 2012
3	Abraham Silberschatz, Henry F. Korth, S. Sudarshan "Database System Concepts 7th Edition McGrawHill 2019	4	Andrew S. Tanenbaum, Maarten Van Steen Distributed Systems: Principles and Paradigms 2nd edition Pearson 2006
5	William Stallings Cryptography and Network Security" 8th Edition Pearson 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.Srividhya.B, SRMIST, srividhb@srmisit.edu.in
2		2		2	Dr.S.Vanitha, SRMIST

Code	PGI25G06T	Title	Quantum Machine Learning	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		
		1	2	3	4	1	2	3
CR-1	Learn the aspects related to Machine learning is a subset of artificial intelligence in the field of computer science							
CR-2	Familiarize statistical techniques to give computers the ability to "learn" with data, without being explicitly programmed							
CR-3	Conceive the concept of model that assigns unseen inputs to one or more (multi-label classification) of these classes.							
CR-4	Identify and acquire knowledge in various Supervised learning, Un Supervised learning, Instance based Learning algorithms							
CR-5	Ability to identify the machine learning methods which identifies learns, or evolves "rules" to store, manipulate or apply knowledge.							

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	Acquire the basics of procedures for the Machine Learning algorithms	✓				*5*	*85*	*75*
CO-2	Apply appropriate data sets to the Machine Learning algorithms	✓	✓	✓		*4*	*85*	*75*
CO-3	Use Machine Learning algorithms to solve real-world problems.		✓			*6*	*85*	*75*
CO-4	To gain knowledge of Outline predictions using machine learning algorithms.	✓	✓	✓	✓	*3*	*85*	*75*
CO-5	To gain knowledge quantum computing techniques.	✓	✓			*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 & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
3	*2*	*3*	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
3	*3*	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
3	*2*	*2*	*3*	-	-	-	-	*3*	*3*	-	*3*
3	-	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
3	*3*	*3*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Overview	Data Storage, NoSQL, and Indexing	Query Processing	Transactions	Security
Duration (hour)	**6**	**6**	**6**	**6**	**6**
SO-1	Introduction to Quantum Computing, Quantum Uncertainty	Diagonal Representation of an Operator, Normal Operators	Grover's Algorithm, Quantum Fourier Transform and Related Algorithms	Quantum Linear Regression	Quantum Variational Optimization and Adiabatic Methods Variational Quantum Eigen solver

SO-2	Superposition, Entanglement Quantum bits (Qubits),	Unitary Operators Commutator and Anti-commutator Operators	Fourier Series Fourier Transform	Swap Test Implementation Quantum Euclidean Distance Calculation	Expectation Computation Isling Model and Its Hamiltonian
SO-3	Multiple Qubits Bell State	Postulates of Quantum Mechanics Hamiltonian Simulation and Trotterization	Kronecker Delta Function Quantum Fourier Transform	Quantum Euclidean Distance Quantum K-Means Clustering	VQE Algorithm Implementation of the VQE Algorithm
SO-4	Dirac Notation Single-Qubit Gates, Multiple-Qubit Gates	Overview of Qiskit / Cirq / PennyLane	Hadamard Transform as a Fourier Transform Quantum Phase Estimation	Quantum Support Vector Machines	Quantum Max-Cut Graph Clustering Quantum Adiabatic Theorem
SO-5	Bell States with Quantum Gates Quantum Teleportation	Simulation in Cirq with a Hadamard Gate Quantum Random Number Generator	Introduction to Quantum Machine Learning	Quantum Principal Component Analysis	Proof of the Adiabatic Theorem Quantum Approximate Optimization Algorithm
SO-6	Quantum Interference Qubits states	Bell's Inequality Test Simons Algorithm	HHL Algorithm	Introduction to Quantum Deep Learning Hybrid Quantum-Classical Neural Networks	Implementation of QAOA Quantum Random Walk

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	Quantum Machine Learning-Thinking and Exploration in Neural Network Models for Quantum Science and Quantum Computing, Claudio Conti, QST.	2	Machine Learning with Quantum Computers, Francesco Petruccione and Maria Schuld
3	An introduction to quantum machine learning, M. Schuld, I. Sinayskiy, F. Petruccione	4	Quantum Machine Learning with Python: Using Cirq from Google Research and IBM Qiskit, Santanu Pattanayak, 2021

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. J. Dhillipan, SRMIST, RMP
				2	Dr. R. Kiruthiga, SRMIST, KTR
				3	Mrs. M. Divya, SRMIST, RMP

Code	PGI25P01L	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:*
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 &	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	To get an insight 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	1	2	3	3	-	-	-	3	3	-	3
CO-5	To get an inside view of an industry and organization/company	✓	✓			2	85	75	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.

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

SEMSETER IV

Code	PGI25P02L	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:*	Depth				Attainment		
		1	2	3	4	1	2	3
CR-1	To understand the basics of software development	Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)
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:*							
CO-1	To conceptualize a novel idea / technique into a product	✓				*3*	*80*	*70*
CO-2	To think in terms of multi-disciplinary environment	✓	✓	✓		*3*	*80*	*75*
CO-3	To understand the management techniques of implementing a project		✓			*3*	*85*	*70*
CO-4	To experience on the challenges of teamwork	✓	✓	✓	✓	*3*	*85*	*80*
CO-5	To prepare a presentation in a professional manner	✓	✓			*3*	*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 & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
1	*3*	*1*	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
3	*3*	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
3	*3*	*1*	*3*	-	-	-	-	*3*	*3*	-	*3*
3	*3*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
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 %