FACULTY OF SCIENCE AND HUMANITIES

ACADEMIC CURRICULA

POSTGRADUATE DEGREE PROGRAMME

Master of Computer Application

(Generative Artificial Intelligence)

Two Years

M.C.A REGULATIONS 2020

Learning Outcomes Based Curriculum Framework (LOCF)

Choice Based Flexible Credit System

Academic Year
2024-2025 onwards

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

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

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India

Department of Computer Applications

1.	**Department Vision Statement**
Stmt - 1	Imparting quality education in Computer Applications and prepare young minds to serve community
Stmt - 2	Contributing effectively to produce globally competent quality professionals in the field of Computer Applications
Stmt - 3	Prioritizing adaptability and industry alignment for a unique learning experience

2.	**Department Mission Statement**
Stmt - 1	Impart student's essential knowledge and skills required for a successful career in Computer Applications
Stmt - 2	Cultivate and foster a conducive environment for scholarly research
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

*"Stmt" stands for Statement

3.	**Program Education Objectives (PEO)**
PEO - 1	Offer the students those skill sets and domain knowledge based on needs of Computer Applications 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	Encourage Entrepreneurial mindset to execute viable business ideas in the field of Computer Applications.
PEO - 5	Prepare the students into balanced individuals who are keen to leave a mark by excelling in their profession

4.	**Program Specific Outcomes (PSO)**
PSO - 1	Graduates will acquire a comprehensive knowledge and sound understanding of fundamentals of Computer Applications.
PSO - 2	Graduates will develop practical, analytical and programming skills.
PSO - 3	Graduates will be prepared to acquire a range of general skills, to solve problems, to evaluate information, to develop software tools, to communicate with society effectively and learn independently.

5.	**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	H	H	M	H	M
PEO - 2	H	M	H	H	H
PEO - 3	M	H	M	H	H
PEO - 4	H	H	H	L	M
PEO - 5	L	H	M	H	H

H – High Correlation, M – Medium Correlation, L – Low Correlation

6. Consistency of PEO's with Program Learning Outcomes (PLO)

	Program Learning Outcomes (PLO)														
	1. Fundamental Knowledge	2. Application of Concepts	3. Link with Related Disciplines	4. Procedural Knowledge	5. Skills in Specialization	6. Ability to Utilize Knowledge	7. Skills in Modeling	8. Analyze, Interpret Data	9. Investigative Skills	10. Problem Solving Skills	11. Communication Skills	12. Analytical Skills	13. ICT Skills	14. Professional Behavior	15. Life Long Learning
PEO - 1	H	H	H	H	H	M	-	L	-	M	L	L	-	-	M
PEO - 2	H	H	H	H	H	M	M	L	-	M	L	M	-	-	M
PEO - 3	H	H	H	H	H	M	H	M	-	M	L	M	-	-	M
PEO - 4	H	M	M	H	H	H	L	L	-	M	H	L	-	-	M
PEO - 5	M	M	H	H	M	H	M	H	-	H	M	M	L	M	M

H – High Correlation, M – Medium Correlation, L – Low Correlation

Program Regulation

MCA Generative Artificial Intelligence follows Master of Computer Application Regulations – 2020

A. Program Eligibility

Minimum Eligibility for Admission: The minimum qualification for admission to M.C.A Generative Artificial Intelligence degree programme (Regular) shall be mentioned as recognized by SRMIST as follows:

i) Passed BCA / B.Sc. in Computer Science / B.Sc. in Information Technology / B.Sc in Computer Technology / Bachelor Degree in Computer Science Engineering or equivalent Degree from a University recognized / certified by UGC / SRMIST / AIU

OR

ii) Passed B.Sc. / B.Com. / B.A. from University recognized/certified by UGC / SRMIST / AIU with Mathematics at 10+2 Level or at Graduation Level.

iii) The Minimum Percentage of Marks / CGPA prescribed by SRMIST.

iv) Notwithstanding the above, actual Admissions will also be based on the rules and regulations of the UGC / AICTE / Competent authorities.

B. Minimum Learning Credit

Minimum Learning Credits for the award of Degree: The curriculum of any branch of the M.C.A programme is designed to have a minimum of **80 credits** for the award of the M.C.A Generative Artificial Intelligence degree.

C. Eligibility for the Award of the Degree

Award of Degree: A Student shall be declared to be eligible for the award of the M.C.A Generative Artificial Intelligence Degree provided if,

i) Registered and successfully completed the courses and projects as per the curriculum and obtaining an aggregate of **learning credits totaling 80.**

ii) The student has successfully completed the course requirements and has passed all the prescribed examinations in all the four semesters within a maximum period of **FOUR** years reckoned from the commencement of the first semester to which candidate was admitted.

iii) No disciplinary action is pending against the student.

1. Programme Structure – MCA Generative Artificial Intelligence (Total Credits:80)

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

Course Code	Course Title	Hours/ Week			C
		L	T	P	
PGI20C01J	Object Oriented Programming using Java	3	0	3	4
PGI20C02J	Advanced Database Technology	3	0	3	4
PGI20C03J	Fundamentals of Generative AI and Working with Open AI	3	0	3	4
PGI20C04J	Python Programming for Data Science	3	0	3	4
PGI20C05J	Deep Neural Networks	3	0	3	4
PGI20C06T	Modern Optimization Techniques	4	0	0	4
PGI20C07J	Object Oriented Analysis and Design	3	0	2	4
Total Learning Credits					**28**

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

Course Code	Course Title	Hours/ Week			C
		L	T	P	
PGI20D01J	Foundations of Data Science	3	0	2	4
PGI20D02J	Artificial Intelligence and Machine Learning				
PGI20D03J	Web Application Development				
PGI20D04J	Intelligent Internet of Things (IIoT)				
PGI20D05J	Computer Vision				
PGI20D06J	Natural Language Processing				
PGI20D07J	Data Engineering and Knowledge Representation	3	0	2	4
PGI20D08J	Introduction to Robotics Automation				
PGI20D09J	Android Applications Development				
PGI20D10J	IOT Cloud Infrastructure and IOT Protocols				
PGI20D11J	Augmented Reality and Virtual Reality for Game development				
PGI20D12J	Working with Generative AI and Large Language Models				
PGI20D13J	Adaptive AI in Data Analytics and Predictive Modeling	3	0	2	4
PGI20D14J	Artificial Intelligence and Machine Learning for Robotics				
PGI20D15J	Full Stack Development				
PGI20D16J	IoT Devices with Computer Vision Technologies				
PGI20D17J	Computer Vision in Smart Robotics				
PGI20D18J	Building Conversational AI for Human Resources				
Total Learning Credits					**12**

3. Generic Elective Courses (G)
(Any 1 Course)

Course Code	Course Title	Hours/ Week			C
		L	T	P	
PGI20G01J	Blockchain Technology	3	0	2	4
PGI20G02J	Cyber Security				
PGI20G03J	Mobile Communication Network				
PGI20G04J	Quantum Machine Learning				
PGI20G05J	Cognitive Analytics Tools and Techniques				
PGI20G06J	Building GPT Powered Business Applications				
PGI20G07J	Development of Health care Generative AI (Lab: Google Generative AI Studio)				
Total Learning Credits					**4**

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

Course Code	Course Title	Hours/ Week			C
		L	T	P	
PGI20S01J	Prompt Engineering in Generative AI (Lab: Google Generative AI Studio)	2	0	2	3
PGI20S02J	Advanced Techniques in Generative AI with Open AI Models (Lab: Google Generative AI Studio)	3	0	2	4
Total Learning Credits					**7**

5. Project Work, Internship In Industry / Higher Technical Institutions(P)

Course Code	**Course Title**	**Hours/ Week**			**C**
		L	**T**	**P**	
PGI20P01L	Internship	-	-	-	2
PGI20P02L	Mini Project Work	0	0	12	6
PGI20P03L	Project Work	0	0	24	12
Total Learning Credits					**20**

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

Course Code	**Course Title**	Hours/ Week			C
		L	T	P	
PGI20AE1T	Career Advancement – I	3	0	0	3
PGI20AE2T	Career Advancement – II	3	0	0	3
PGI20AE3T	Career Advancement – III	3	0	0	3
Total Learning Credits					**9**

2. Discipline Elective Courses (D) – Groups

Semester	Group I Data Analytics	Group II Robotics	Group III Application Development	Group IV IoT	Group V Vision in AI	Group VI Conversional Computing
I	Foundations of Data Science	Artificial Intelligence and Machine Learning	Web Application Development	Intelligent Internet of Things (IIoT)	Introduction to Computer Vision	Natural Language Processing
II	Data Engineering and Knowledge Representation	Introduction to Robotics Automation	Android Applications Development	IOT Cloud Infrastructure and IOT Protocols	Augmented Reality and Virtual Reality for Game development	Working with Generative AI and Large Language Models
III	Adaptive AI in Data Analytics and Predictive Modeling	Artificial Intelligence and Machine Learning for Robotics	Full Stack Development	IoT Devices with Computer Vision Technologies	Computer Vision in Smart Robotics	Building Conversational AI for Human Resources

Course Structure

Semester	Professional Core Courses (PCC)	Discipline Electives Courses (DEC)	Generic Electives Courses (GEC)	Skill Enhancement Courses (SEC)	Ability Enhancement Courses (AEC)	Project Work, Internship (P)	Total Credits	Total Hours
Sem I	PCC-1(4) PCC-2 (4) PCC-3(4)	DEC-1 (4)		SEC 1 (3)	AEC 1 (3)		**22**	**30**
Sem II	PCC-4 (4) PCC-5 (4) PCC-6 (4)	DEC-2 (4)		SEC 2 (4)	AEC 2 (3)		**23**	**30**
Sem III	PCC-7(4)	DEC-3(4)	GEC-(4)		AEC 3 (3)	P (2) P (6)	**23**	**30**
Sem IV						P (12)	**12**	**30**
Total Credits	**28**	**12**	**4**	**7**	**9**	**20**	**80**	**120**

7. Implementation Plan

Semester - I

Course Code	Course Title	Hours/ Week			C
		L	T	P	
PGI20C01J	Object Oriented Programming using Java	3	0	3	4
PGI20C02J	Advanced Database Technology	3	0	3	4
PGI20C03J	Fundamentals of Generative AI and Working with Open AI	3	0	3	4
PGI20D01J	Foundations of Data Science	3	0	2	4
PGI20D02J	Artificial Intelligence and Machine Learning				
PGI20D03J	Web Application Development				
PGI20D04J	Intelligent Internet of Things (IIoT)				
PGI20D05J	Computer Vision				
PGI20D06J	Natural Language Processing				
PGI20S01J	Prompt Engineering in Generative AI (Lab: Google Generative AI Studio)	2	0	2	3
PGI20AE1T	Career Advancement – I	3	0	0	3
Learning Credits					**22**

Semester - II

Course Code	Course Title	Hours/ Week			C
		L	T	P	
PGI20C04J	Python Programming for Data Science	3	0	3	4
PGI20C05J	Deep Neural Networks	3	0	3	4
PGI20C06T	Modern Optimization Techniques	4	0	0	4
PGI20D07J	Data Engineering and Knowledge Representation	3	0	2	4
PGI20D08J	Introduction to Robotics Automation				
PGI20D09J	Android Applications Development				
PGI20D10J	IOT Cloud Infrastructure and IOT Protocols				
PGI20D11J	Augmented Reality and Virtual Reality for Game development				
PGI20D12J	Working with Generative AI and Large Language Models				
PGI20S02J	Advanced Techniques in Generative AI with Open AI Models (Lab: Google Generative AI Studio)	3	0	2	4
PGI20AE2T	Career Advancement – II	3	0	0	3
Learning Credits					**23**
Total Learning Credits of First Year					**45**

Semester – III					
Course Code	**Course Title**	**Hours/ Week**			**C**
		L	**T**	**P**	
PGI20C07J	Object Oriented Analysis and Design	3	0	2	4
PGI20D13J	Adaptive AI in Data Analytics and Predictive Modeling	3	0	2	4
PGI20D14J	Artificial Intelligence and Machine Learning for Robotics				
PGI20D15J	Full Stack Development				
PGI20D16J	IoT Devices with Computer Vision Technologies				
PGI20D17J	Computer Vision in Smart Robotics				
PGI20D18J	Building Conversational AI for Human Resources				
PGI20P01L	Internship	-	-	-	2
PGI20P02L	Mini Project Work	0	0	12	6
PGI20G01J	Blockchain Technology	3	0	2	4
PGI20G02J	Cyber Security				
PGI20G03J	Mobile Communication Network				
PGI20G04J	Quantum Machine Learning				
PGI20G05J	Cognitive Analytics Tools and Techniques				
PGI20G06J	Building GPT Powered Business Applications				
PGI20G07J	Development of Health Care Generative AI (Lab: Google Generative AI Studio)				
PGI20AE3T	Career Advancement – III	3	0	0	3
Learning Credits					**23**

Semester – IV					
Course Code	**Course Title**	**Hours/ Week**			**C**
		L	**T**	**P**	
PGI20P03L	Project Work	0	0	24	12
Learning Credits					**12**
Total Learning Credits of Second Year					**35**

8. Program Articulation Matrix

Course Code	Course Name	Programme Learning Outcomes														
		Fundamental	Application of	Link with Related	Procedural Knowledge	Skills in Specialization	Ability to Utilize	Skills in Modeling	Analyze, Interpret	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
PGI20C01J	Object Oriented Programming using Java	M	H	M	H	L	-	-	-	L	-	-	-	-	-	-
PGI20C02J	Advanced Database Technology	M	M	M	M	M	M	-	-	-	-	-	-	-	-	-
PGI20C03J	Fundamentals of Generative AI and working with Open AI	M	M	M	H	M	M	M	M	-	M	-	-	M	-	-
PGI20C04J	Python Programming for Data Science	M	M	M	H	M	M	M	M	-	M	-	-	-	-	-
PGI20C05J	Deep Neural Networks	L	H	-	H	H	H	-	-	-	-	-	-	-	-	-
PGI20C06T	Modern Optimization Techniques	M	M	M	-	M	-	M	-	H	M	H	M	M	M	M
PGI20C07J	Object Oriented Analysis and Design	L	H	H	H	H	M	-	M	M	L	-	H	-	-	-
PGI20D01J	Foundations of Data Science	H	H	H	H	H	-	-	-	-	H	-	-	M	-	L
PGI20D02J	Artificial Intelligence and Machine Learning	H	H	M	H	L	-	L	-	L	-	-	-	L	-	M
PGI20D03J	Web Application Development	L	H	L	M	-	H	-	-	-	-	-	-	M	-	M
PGI20D04J	Intelligent Internet of Things (IIoT)	H	H	H	H	H	-	-	-	M	-	-	-	-	-	-
PGI20D05J	Computer Vision	H	H	M	H	H	H	-	M	-	-	-	-	-	-	-
PGI20D06J	Natural Language Processing	L	H	-	H	H	H	-	-	-	H	-	M	-	-	L
PGI20D07J	Data Engineering and Knowledge Representation	M	M	M	L	M	H	-	M	-	H	-	-	M	-	-
PGI20D08J	Introduction to Robotics Automation	M	H	-	-	H	-	M	H	-	H	M	-	-	H	M
PGI20D09J	Android Applications Development	H	H	M	H	L	-	-	-	L	-	-	-	-	-	H
PGI20D10J	IOT Cloud Infrastructure and IOT Protocols	H	H	H	H	H	-	-	M	-	-	H	-	-	-	M
PGI20D11J	Augmented Reality and Virtual Reality for Game development	M	H	M	L	M	H	M	-	-	M	-	-	-	-	-
PGI20D12J	Working with Generative AI and Large Language Models	M	H	L	H	L	-	-	-	M	L	-	H	-	-	-
PGI20D13J	Adaptive AI in Data Analytics and Predictive Modeling	M	H	H	H	H	-	-	M	M	H	-	-	-	-	-
PGI20D14J	Artificial Intelligence and Machine Learning for Robotics	M	H	H	H	H	-	-	M	M	H	-	-	-	-	-
PGI20D15J	Full Stack Development	M	M	H	L	M	-	-	-	M	H	-	-	-	-	-
PGI20D16J	IoT Devices with Computer Vision Technologies	M	H	H	H	H	-	H	M	M	H	-	-	-	-	-
PGI20D17J	Computer Vision in Smart Robotics	H	H	H	H	H	M	-	M	M	M	M	H	M	L	H
PGI20D18J	Building Conversational AI for Human Resources	L	M	M	L	M	-	-	M	M	M	H	-	H	M	-
PGI20G01J	Blockchain Technology	M	H	H	H	H	-	-	M	M	H	-	-	-	-	-
PGI20G02J	Cyber Security	M	M	L	M	M	L	L	L	-	-	L	-	M	M	M
PGI20G03J	Mobile Communication Network	M	H	H	H	H	-	-	M	M	H	-	-	-	-	-
PGI20G04J	Quantum Machine Learning	H	M	H	M	-	-	-	-	-	-	-	L	H	M	-
PGI20G05J	Cognitive Analytics Tools and Techniques	M	H	H	H	H	-	M	M	M	H	-	M	-	-	-
PGI20G06J	Building GPT Powered Business Applications	M	H	H	H	H	H	-	M	M	H	-	H	-	-	-
PGI20G07J	Development of Health Care Generative AI (Lab: Google Generative AI Studio)	M	H	H	H	H	-	-	M	M	H	-	-	-	-	-
PGI20S01J	Prompt Engineering in Generative AI (Lab: Google Generative AI Studio)	H	M	M	-	H	H	-	-	-	H	-	-	-	-	-
PGI20S02J	Advanced Techniques in Generative AI with Open AI Models (Lab: Google Generative AI Studio)	M	H	M	L	M	-	M	M	-	-	M	-	-	-	-
PGI20P01L	Internship	M	H	M	H	L	-	-	-	M	L	-	H	-	H	H
PGI20P02L	Mini Project Work	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
PGI20P03L	Project Work	M	H	M	H	L	M	-	H	-	H	-	H	M	-	H
PGI20AE1T	Career Advancement – I	M	H	M	H	L	M	-	H	H	H	-	H	M	-	H
PGI20AE2T	Career Advancement – II	M	H	M	H	-	M	-	H	H	H	-	H	M	-	H
PGI20AE3T	Career Advancement – III	M	H	M	H	L	M	-	H	H	H	-	H	M	-	H
	Average	M	H	M	H	M	M	M	M	M	H	M	H	M	M	M

SEMESTER - I

Course Code	PGI20C01J	Course Name	Object Oriented Programming using Java	Course Category	C	Professional Core Course	L	T	P	C
							3	0	3	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	To learn the fundamentals of object-oriented programming
CLR-2 :	Learning to write object-oriented programs in Java.
CLR-3 :	Developing skills in creating graphical and database applications through Java.
CLR-4 :	Build Resilient code using Exception Handling mechanism
CLR-5 :	Be able to apply object oriented or non-object-oriented techniques to solve bigger Real World Computing problems.

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLO-1 :	Demonstrate the basic programming constructs of Java and OOP concepts to develop Java programs for a given scenario.	3	80	70	L	H	M	L	L	-	-	-	L	-	-	-	-	-	-
CLO-2 :	Apply the concepts of Polymorphism and implement multithreaded applications	3	85	75	H	H	H	M	L	-	-	-	L	-	-	-	-	-	-
CLO-3 :	Gain proficiency in GUI application development.	3	75	70	M	H	M	H	L	-	-	-	L	-	-	-	-	-	-
CLO-4 :	Build CRUD and distributed applications in Java	3	85	80	M	H	M	H	L	-	-	-	L	-	-	-	-	-	-
CLO-5 :	Build web application using Server-side programming	3	85	75	H	H	M	H	L	-	-	-	L	-	-	-	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Introduction to Object-oriented Programming	Inheritance in Java	GUI in Java	Java database connectivity	Servlets
	SLO-2	Classes, Instances, Methods	Multi-level and single inheritance, multiple inheritance of interfaces,	Applet Programming, Java applets-Life cycle of an applet	Different types of JDBC drivers	Overview of Servlet technology and its role in web development
S-2	SLO-1	Basic Pillars of Object-Oriented Programming (Abstraction, Encapsulation, Inheritance and Polymorphism, Dynamic Binding, Message Passing	Dynamic Method Dispatch	Adding images to an applet – Adding sound to an applet.	JDBC implementation	Servlet Life Cycle

	SLO-2	Static and non-static members, Final and abstract classes, Abstract methods	Abstract classes Interfaces	Passing parameters to an applet	Establishing connectivity and working with connection interface	Servlet Vs. CGI
S-3	**SLO-1**	Introduction to Java Programming	Comparable and Comparator Interfaces in Java - Nested and Inner Classes	Interacting with HTML Pages	querying a database and processing the results	Servlet API Overview
	SLO-2	Java Programming Language and its Features	Packages – Access Specifiers – importing packages	Applet Security Considerations	Types of statement objects (Statement, Prepared Statement and Callable Statement) Data Access Object (DAO)	Generic Servlet, HTTP Servlet
S-4-6	**SLO-1**	**Lab1: Discussing the real-world examples of OOP concepts and applications**	**Lab 4: Demonstrate Multi Level Inheritance Implement Dynamic Method Dispatch**	**Lab 7: Create an interactive applet that takes user input and performs some action based on it**	**Lab 10: Write a Java program to execute a simple SQL query to retrieve data from a table and display the results.**	**Lab 13: Write a servlet that demonstrates the usage of these key classes/interfaces for handling HTTP requests and responses.**
	SLO - 2					
S-7	**SLO-1**	The Java Development Kit	Exception Handling Model	AWT Programming	Networking basics	ServletConfig
	SLO-2	The Java Class Libraries.	User defined Exception, Built – in Exception	AWT Components: Frame, Panel, Label, Button, Text Field, Text Area, Checkbox, Checkbox Group, Choice, List	Sockets, port	ServletContest
S-8	**SLO-1**	The Scope and Lifetime of Variables, operators, Shorthand Assignments,	Multithreading-Thread creation	AWT Layout Manager	Proxy servers, Internet addressing	Reading user request Data
	SLO-2	Type conversion in Assignments, Using Cast.	Thread class - Runnable interface	AWT Menus and Menu Bar	networking classes and interfaces,	Session tracking in servlets
S-9	**SLO-1**	Enumerated types, Control flow-block scope,	Java File Handling (Overview of different Stream, Byte Stream, Character Stream	Exploring Font Handling in AWT applications	Implementing TCP/IP based Server and Client	Writing thread safe servlet
	SLO-2	Conditional statements, Loops, break and continue statements	Readers Class and Writers Class	Designing Frames and adding GUI Components	URL connections	Servlet and JDBC
S-10-12	**SLO-1**	**Lab 2: Implement a program to demonstrate the use of casting for converting data types.**	**Lab: 5 Write a Java program that demonstrates the use of try-catch blocks to handle built-in exceptions**	**Lab 8:Develop a real-world AWT applications such as calculators, text editors, and image viewers**	**Lab 11: Write a Java program to establish a socket connection between a client and a server on different machines using Socket and Server Socket classes.**	**Lab 14: Develop a servlet that interacts with a database using JDBC to retrieve data from a table and display it in a web page.**
	SLO-2					
S-13	**SLO-1**	Arrays, One Dimensional array, creating an array, Two-Dimensional array, passing arrays as parameters, Recursion.	File Class: File Input Stream – File Output Stream	Swing Components. The Swing library	RMI - Introduction	JSP – Java Server Pages
	SLO-2	Introducing Classes, Objects and Methods. Class Fundamentals, How Objects are Created?	Input Stream Reader and Output Stream Writer Class	Managing layout using Swing	Architecture of RMI	Life cycle of JSP

S-14	**SLO-1**	Constructor: Constructor Overloading, Method: Method Overloading	File Reader and Writer class	Layout manager types – border, grid and flow	Understanding the role of stubs and skeletons in RMI communication	Creating static content
	SLO-2	Garbage collection and finalize method,	File Writer – Buffered Reader class	Swing Vs. AWT	Generating stub and skeleton classes using rmic tool	Creating dynamic content,
S-15	**SLO-1**	string and mutable string, String class, Important String Methods	Collection Classes- List Class (Abstract List), Array List class	Event handling	Java.rmi classes and interfaces	JSP scripting elements
	SLO-2	String Buffer and String Tokenizer class in Java	Linked List Class, Enumeration Iterative Statement	Events, Event sources, Event classes, Event Listeners, Delegation event model,	Parameter passing in remote methods (marshalling and unmarshalling)	JSP directives
S-16-18	**SLO-1**	**Lab 3: Implement the concept of String Handling functions**	**Lab 6: Develop a program that converts the character encoding of a text file using InputStreamReader and OutputStreamWriter.**	**Lab 9: Handling Mouse and Key events, Adapter classes (Demonstrate)**	**Lab 12: Develop a Java RMI application with a clear separation of client and server components.**	**Lab 15: Implement a JSP page that displays the current date and time dynamically using JSP script lets.**
	SLO-2					

Learning Resources	1. Herbert Schildt, Java Complete Reference Tata McGraw Hill, 11th edition	1. E. Balguruswami , Programming with Java, A Primer, ISBN-0070617139. 2. Dustine R Callway , Inside Servlets, ISBN-9788131715451. 3. Dietel, - Java How to program, 7th edition; Pearson Education, New Delhi. 4. Java Programming – A Practical Approach – C Xavier, Tata McGraw-Hill Edition.

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	**Remember**	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	**Apply**	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	**Evaluate**	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	**100 %**		**100 %**		**100 %**		**100 %**		**100 %**	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, and Conf. Paper etc.

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Mrs. K. Kanmani, Assistant Professor, SRMIST KTR

Course Code	PGI20C02J	Course Name	Advanced Database Technology	Course Category	C	Professional Core Courses	L	T	P	C
							3	0	3	4

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

Course Learning Rationale (CLR): The purpose of learning this course is to,

		Learning
CLR-1 :	To understand the basic concepts and terminology related to DBMS and Relational Database Design	
CLR-2 :	To understand the SQL concepts to construct tables and write effective queries	
CLR-3 :	To understand the PL/SQL for enhancing SQL functionality and managing transactions.	
CLR-4 :	To impart working methodology of Transaction Management, Concurrency Control and Recovery Management	
CLR-5 :	To gain knowledge in Different types of databases.	

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

		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
		1	2	3
CLO-1 :	Understand the fundamental concepts of database management systems (DBMS).	2	85	80
CLO-2 :	Gain proficiency in Structured Query Language	3	85	80
CLO-3 :	Apply to PL/SQL (Procedural Language/Structured Query Language)	3	85	80
CLO-4 :	Understand transaction management concepts	3	85	80
CLO-5 :	Familiarize MongoDB Database	3	85	80

Program Learning Outcomes (PLO)

		1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	Understand the fundamental concepts of database management systems (DBMS).	M	H	H	M	M	M	-	-	-	-	-	-	-	-	-
CLO-2 :	Gain proficiency in Structured Query Language	M	L	L	M	M	M	-	-	-	-	-	-	-	-	-
CLO-3 :	Apply to PL/SQL (Procedural Language/Structured Query Language)	M	M	M	M	M	M	-	-	-	-	-	-	-	-	-
CLO-4 :	Understand transaction management concepts	M	M	M	H	M	M	-	-	-	-	-	-	-	-	-
CLO-5 :	Familiarize MongoDB Database	L	M	M	M	H	H	-	-	-	-	-	-	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Introduction to Database systems – Architecture of DBMS	SQL: Introduction to SQL	PL/SQL Overview	Transaction Management	Introduction to Parallel Database
	SLO-2	Data Models	SQL Syntax, SQL Data Types	PL/SQL blocks	ACID Property	Parallel Database Architecture
S-2	SLO-1	Structure of Relational Databases	SQL Operators	PL/SQL: Variables, Constants	Transaction States	Key Elements for Parallel Database
	SLO-2	Database Schema - Schema Diagrams	SQL Expression	PL/SQL Data Types	Transaction Isolation	Query Parallelism
S-3	SLO-1	Relational Query Languages	Data Definition Language Commands	PL/SQL: Conditional Statements	Transaction Isolation Levels	Distributed System: Architecture of Distributed System

	SLO-2	Relationships And Relationship Sets	Data Manipulation Language Commands	PL/SQL: Case, Lop	Serializability	Distributed Database System Processing
S 4-6	**SLO-1**	**Lab:1: Createa Database Schema for University Database**	**Lab 4: Implement DDL, DML commands**	**Lab 7: Implementing PL/SQL Conditional Statements, Looping Statements**	**Lab 10: Write functions/procedures to begin, commit, and rollback transactions.**	**Lab 13: Parallel Database**
	SLO-2					
S-7	**SLO-1**	Keys	Transaction Control Language Commands	PL/SQL: Procedure	Concurrency Control: Types of locks	Introduction to Distributed Database System
	SLO-2	Key Constraints: Primary Key Constraint:	Data Control Language Commands	PL/SQL: Function	Two phase locking Protocol	Distributed Database System Architecture
S-8	**SLO-1**	Unique Constraint	Aggregate Functions	PL/SQL: Cursor	Timestamp based Protocols.	Distributed Query Processing
	SLO-2	Foreign Key Constraint	Set Operations	PL/SQL: Exception	Lock based Protocols	Spatial Database
S-9	**SLO-1**	Database Design and ER Diagrams	SQL functions	PL/SQL: Trigger	Graph based Protocol	Object based Database
	SLO-2	Entities, Attributes, And Entity Sets	SQL Clauses	PL/SQL Trigger Example	Tree based Protocol for Concurrency Control	Multimedia Database
S 10-12	**SLO-1**	**Lab 2: Create ER Model University Database**	**Lab 5: Implement DCL, TCL**	**Lab 8: Write a program to implement PL/SQL functions**	**Lab 11: Develop test cases to demonstrate how timestamp-based protocols prevent conflicts and ensure serializability.**	**Lab14: CaseStudy : distributed Database**
	SLO-2					
S-13	**SLO-1**	Normalization:	SQL Queries	File Organization:	Recovery Control	Introduction to MongoDB • MongoDB architecture
	SLO-2	Functional Dependency	SQL Subqueries	Indexing: Primary index – Secondary indices	Types of failure	Data modelling in MongoDB • Advantages of MongoDB over RDBMS
S-14	**SLO-1**	First, Second, Third Normal Forms	SQL Joins	B tree Index	Log based recovery -	JSON File format for storing documents
	SLO-2	Boyce Code Normal Form	SQL Views, SQL Indexes	B+ tree Index	Recovery based on deferred	Database Commands in Mongodb
S-15	**SLO-1**	Multi-valued Dependencies and Fourth Normal Form	SQL Triggers	Hashing: Static indexing – Dynamic indexing	Recovery based on immediate Update	CRUD operation
	SLO-2	Join Dependencies and Fifth Normal Form	SQL Procedures	Query Optimization: Algebraic query, Heuristic Query Optimization	Shadow paging.	Querying MongoDB
S 16-18	**SLO-1**	**Lab 3: Implement Integrity Constraints**	**Lab 6: Implement SQL subqueries, Joins and Clauses**	**Lab 9: Study the structure and properties of B-tree index and its variants**	**Lab 12: Case Study: Analyze different types of failures such as transaction failures, system crashes, and disk failures.**	**Lab 15: Creating database employee in MongoDB**

Learning Resources	.1.A. Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2008.	Kevin Loney (Fifth RePrint-2007), Oracle Database 10G: The Complete Reference, McGraw Hill, New Delhi.

Learning Assessment			
Level		**Continuous Learning Assessment (50% weightage)**	**Final Examination**

	Bloom's Level of Thinking									(50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.D.Helen, Assistant Professor, SRMIST KTR

Course Code	PGI20C03J	Course Name	Fundamentals of Generative AI and Working with Open AI	Course Category	C	Professional Core Courses	L	T	P	C
							3	0	3	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Understand Generative AI
CLR-2:	Introduction to Generative models
CLR-3:	Understanding OpenAI Technology
CLR-4:	Generative Adversarial Networks
CLR-5:	OpenAI tools

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1:	Understand the basic concepts of Generative AI	3	80	70
CLO-2:	Design and implement VAE generative models.	3	85	75
CLO-3:	Apply and understand appropriate data modeling techniques	3	75	70
CLO-4:	Perform appropriate modeling techniques to implement text generation	3	85	80
CLO-5:	Implement Image synthesis using OpenAI	3	85	75

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
H	H	M	H	M	-	M	M	-	M	-	-	L	-	-
H	H	M	M	H	-	M	M	-	M	-	-	M	-	-
M	M	M	H	M	M	H	M	-	M	-	-	M	-	-
M	M	H	H	M	-	M	H	-	M	-	-	M	-	-
M	M	M	M	H	-	H	M	-	M	-	-	L	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to Generative AI: Definition and scope of generative AI.	Introduction to Autoencoders: Definition and intuition behind autoencoders.	Introduction to GANs: Definition and motivation behind Generative Adversarial Networks (GANs).	Introduction to Text Generation: Explanation of different types of text generation tasks, such as language modeling, text completion, and dialogue generation.	Introduction to DALL-E: DALL-E's origin, developed by OpenAI, and its pioneering role in AI-driven image generation.
	SLO-2	Significance of generative AI in various industries.	Applications of autoencoders in dimensionality reduction and feature learning.	Overview of Generative Adversarial Networks (GANs).	Applications of text generation	Overview of the core principles behind DALL-E's ability to generate diverse and contextually relevant images based on textual input.
S-2	SLO-1	Generative Models Overview: Explanation of autoencoders and their applications.	Autoencoder Architecture Explanation of the encoder and decoder architecture in autoencoders.	GANs Architecture: generator and discriminator networks' architectures.	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.	DALL-E Architecture Overview: DALL-E's architecture, transformer-based design and attention mechanisms.

	SLO-2	Introduction to Generative Adversarial Networks (GANs) and their architecture.	Discussion on different activation functions and layer configurations used in autoencoder architectures	Role of activation functions and normalization techniques in GAN architecture.	Impact of each GPT model	Transformer-based design and attention mechanisms.
S-3	**SLO-1**	Types of Generative Models Understanding Variational Autoencoders (VAEs) and their probabilistic interpretation.	Training Autoencoders: Overview of the backpropagation algorithm for training autoencoders.	Training GANs: Overview of the minimax game framework used for training GANs.	GPT Architecture Overview: the transformer architecture and its components	Training Process of DALL-E: data collection, preprocessing, and model optimization.
	SLO-2	Overview of Flow-based models and their advantages.	Understanding techniques for optimizing reconstruction loss, such as gradient descent and stochastic gradient descent.	Understanding the challenges of GAN training, such as mode collapse and convergence issues.	Self-attention mechanisms and feed-forward neural networks.	Understanding DALL-E's Capabilities
S-4,5,6	**SLO-1**	**Lab1: Simple programs on Open API**	**Lab 4: on implementing a basic autoencoder using TensorFlow or PyTorch.**	**Lab 7: GAN model using TensorFlow or PyTorch.**	**Lab 10: Fine-tuning GPT for Text Generation.**	**Lab 13: generating images using DALL-E**
	SLO-2					
S-7	**SLO-1**	Generative Models Applications: Applications of generative models in image generation and manipulation.	VAEs: Explanation of the probabilistic nature of VAEs and the role of the latent space.	Training Dynamics: Exploration of the iterative process of generator and discriminator updates during GAN training.	Pretraining Objectives: autoregressive language modeling	Image Representation in DALL-E: interpretation and representation of textual descriptions
	SLO-2	Utilization of generative models in natural language processing tasks such as text generation and translation.	Comparison between traditional autoencoders and VAEs in terms of generating new data samples.	Analysis of the Nash equilibrium and convergence properties in GAN training dynamics.	masked language modeling	latent space representation used by DALL-E
S-8	**SLO-1**	Understanding OpenAI: History and evolution of OpenAI as a research organization.	Latent Space Representation: Exploration of the properties of the latent space and its dimensionality.	Loss Functions in GANs: Explanation of the adversarial loss and the role of the generator and discriminator loss functions.	Fine-tuning GPT Models: Techniques for fine-tuning pre-trained GPT models sentiment analysis, question answering, and text summarization.	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.
	SLO-2	OpenAI's collaborations and partnerships with industry and academia.	Techniques for visualizing and interpreting the latent representations learned by VAEs.	Introduction to additional loss functions like feature matching and gradient penalty in GAN training.	Hyperparameters and optimizing fine-tuning performance.	
S-9	**SLO-1**	OpenAI's Technologies: Overview of GPT (Generative Pre-trained Transformer) models and their capabilities.	Loss Functions in VAEs: reconstruction loss and the KL divergence loss in VAEs.	Mode Collapse and Solutions: Definition and causes of mode collapse in GANs.	Transfer Learning with GPT: Overview of transfer learning approaches such as feature extraction and fine-tuning	Conditioning DALL-E for Image Synthesis: DALL-E's image generation process
	SLO-2	Introduction to DALL-E and its applications in image generation.	trade-off between reconstruction fidelity and regularization in VAE training.	mode collapse, including minibatch discrimination and diversity regularization.	benefits and challenges of transfer learning with GPT	DALL-E's image synthesis using conditioning
S-10,11,12	**SLO-1**				**Lab 11 conditioning GPT models for specific text generation tasks**	**Lab 14 conditioning DALL-E to generate images**

	SLO-2	**Lab 2 :training a simple autoencoder model on a dataset.**	**Lab 5: implementing a variational autoencoder using TensorFlow or PyTorch.**	**Lab 8: implementing a DCGAN for image generation**		
S-13	**SLO-1**	Ethical Considerations in AI: Discussion on bias and fairness issues in generative AI.	Applications of Autoencoders and VAEs: Real-world examples of using autoencoders for image denoising and anomaly detection.	Progressive Growing GANs (PGGANs): Overview of the progressive growing strategy for training GANs on high-resolution images.	Text Generation Techniques: Exploration of techniques such as greedy decoding, beam search, and nucleus sampling used for text generation with GPT models.	Ethical Considerations in Image Synthesis: ethical considerations and potential risks
	SLO-2	Consideration of privacy concerns in the generation of realistic synthetic data	Applications of VAEs in generating novel images and performing image-to-image translation tasks.	Understanding the benefits of progressive growing in generating realistic and diverse images.	Evaluation Metrics for Text Generation	Limitations and Challenges of DALL-E
S-14	**SLO-1**	Challenges related to interpretability and control in generative AI models.	Comparison with Other Models: Comparison of the training stability and sample quality between autoencoders, VAEs, and GANs.	Self-Attention GANs (SAGANs): Introduction to self-attention mechanisms and their integration into GAN architectures.	Ethical Considerations in Text Generation: Discussion on ethical concerns related to bias, fairness, and misinformation in text generation using GPT models.	Applications of DALL-E: design automation, content creation, and visual storytelling.
	SLO-2	Limitations of current generative models in capturing complex data distributions	interpretability and controllability of generated samples in autoencoders versus GANs.	Wasserstein GAN (WGAN) and WGAN-GP	Real-world Applications of GPT: Case studies and examples demonstrating the use of GPT models in applications such as content generation, virtual assistants, and personalized recommendation systems.	Future Directions in DALL-E Research
S-15	**SLO-1**	Future Trends Exploration of reinforcement learning-based generative models and their potential.	Ethical Considerations Workshop:Identification of potential biases in autoencoder models and their impact on downstream tasks.	Conditional GANs: class-conditional and image-to-image translation GANs.	Advanced GPT Architectures: Overview of advanced transformer-based architectures such as XLNet, T5, and BERT, and their unique features for text generation tasks.	Comparison with Other Image Synthesis Models: Comparative analysis of DALL-E GANs (Generative Adversarial Networks) and VAEs (Variational Autoencoders).
	SLO-2	democratization of generative AI through accessible tools and frameworks	fairness, transparency, and accountability in the deployment of autoencoder-based systems.	Applications of conditional GANs	Comparison of different GPT variants based on architecture, training objectives, and performance metrics.	strengths, weaknesses, and unique capabilities of DALL-E
S-16,17,18	**SLO-1**	**Lab 3 : Implementing a basic GAN architecture for generating synthetic images using a pre-trained model.** **Top of Form**	**Lab 6: VAEs for anomaly detection in datasets**	**Lab 9: implementing a Progressive Growing GAN**	**Lab 12: interpreting and analyzing the output of GPT models for text generation tasks.**	**Lab 15: Preprocessing and formatting datasets for training and fine-tuning DALL-E models.**
	SLO-2					

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

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr..Srividhya B, Assistant Professor, SRMIST, KTR

Course Code	PGI20D01J	Course Name	Foundations of Data Science	Course Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning
CLR-1 :	Understand the basics of Data Science	1
CLR-2 :	Learning and implementing the fundamentals of Python for data science	
CLR-3 :	Exploring python libraries and data analysis methodologies like Exploratory Data Analysis	
CLR-4 :	Learning basic and advanced concepts in Machine Learning and Deep Learning	
CLR-5 :	Understanding Computer Vision and Data Visualization	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Learn the fundamentals of Data Science and its methodologies	3	80	70
CLO-2 :	Implementation of data science concepts using python	3	85	75
CLO-3 :	Execution of various libraries in python	3	75	70
CLO-4 :	Knowledge of Machine Learning and Deep Learning using python libraries	3	85	80
CLO-5 :	Exploring the data using various OpenCV and Matplotlib	3	85	75

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
H	-	M	-	-	-	-	-	-	H	-	-	M	-	-
H	H	H	-	-	-	-	-	-	H	-	-	-	-	L
H	H	-	H	H	-	-	-	-	H	-	-	-	-	-
H	H	H	-	-	-	-	-	-	M	-	-	M	-	-
H	-	M	M	M	-	-	-	-	H	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Data Science Defined, Data Science Overview	Modelling Data, Modelling Evaluation	Creating Numpy Array Slicing, Numpy Data Types	Getting Exploratory with Data Analysis	Text Processing In NLTK
	SLO-2	Data Science Methodologies Overview	Data Science Essential Skill Matrix	Numpy Array Shape and Reshape	Initial Data Exploration with Simple Pandas Functions	Text Processing – Tokenizing, Text Processing – Stop Words
S-2	SLO-1	Data Science Pipeline	Introduction to Data Science Essential Skill Matrix, Mathematics and Statistical Skills	Numpy Data Joins, Split, Search	Univariate Analysis, Bivariate Analysis	Text Processing – Stemming, Text Processing – Part of Speech
	SLO-2	Data Engineering, Data Preparation, Exploration	Essential Programming Skills	Scientific Computing with Python (Scipy)	Machine Learning with Scikit-Learn, Getting started with Machine Learning with Scikit-Learn	Text Processing – Lemmatizing
S-3	SLO-1	Data Science vs. Business Intelligence vs Artificial Intelligence	Data Engineering Skills	Getting Started with SciPy	Getting started with Scikit-Learn	Computer Vision with OpenCV
	SLO-2	Data Science vs. Business Intelligence	Data Visualization Skills	SciPy Constants, SciPy Optimizers	Exploring the Famous Iris Dataset	Getting started with Computer Vision

S-4 to S-5	**SLO-1& 2**	**Lab 1: Perform Analysis on Simple Dataset I for Data Science and Business Intelligence Applications**	**Lab 4: Perform Analysis on Simple Data for Mathematical, Numerical, Data Engineering Processing**	**Lab 7: Apply Scientific functions on a given dataset with SciPy**	**Lab 10: Install, Import Scikit Learn and Explore Iris Dataset with Pandas for ML Modelling**	**Lab 13: Install, Import OpenCV and Explore an Simple Image for Image Processing**
S-6	**SLO-1**	Data Science vs. Artificial Intelligence, Types of Analysis	Business and Communication Skills	SciPy Sparse Data	Machine Learning Workflow	Getting started with Computer Vision library OpenCV
	SLO-2	Similarities Between Data Science and Business Intelligence	Ethical Skills	SciPy Graphs	Simple Machine Learning Implementation with the Iris Dataset	NumPy and Image Basics
S-7	**SLO-1**	Data Science alignment with Business Intelligence,	Python for Data Science	SciPy Spatial Data Overview	Deep Learning with Tensor Flow and Keras	Image Processing with OpenCV
	SLO-2	Data Science Reinforcement with Business Intelligence, Data Science and Business Intelligence Together: Future	Introduction to Python, Expression and Variables, Python String Operations	SciPy Spatial Data Processing, SciPy Spatial Matlab Arrays,	Getting started with Deep Learning with Tensor Flow and Keras	Video Processing with OpenCV
S-8	**SLO-1**	Three Features for Data Science and Business Intelligence	Python Data Structures: List, Tuple, Dictionary, Sets.	SciPy Interpolation	Getting started with Tensor Flow	Object Detection with OpenCV, Object Tracking with OpenCV
	SLO-2	Getting Started with Data Science, Business Intelligence and AI Journey	Python Conditional Statements	Data Manipulation with Pandas	Getting started with Keras , Deep Learning Framework	Data Visualization in Python using Matplotlib
S-9 to S-10	**SLO-1& 2**	**Lab 2: Perform Analysis on Simple Dataset II for Data Science and Business Intelligence Applications**	**Lab 5: Install Python and apply all basic python functions**	**Lab 8: Install, Import Pandas Learn and Explore a Sample Dataset with it**	**Lab 11: Install, Import Tensor flow and Keras. Create a Basic Neural Network with few layers.**	**Lab 14: Install, Import Matplotlib. Explore all the Data Visualization Graphs.**
S-11	**SLO-1**	Data Science Methodologies, Introduction to Data Science Methodologies	Python Branching Statements, Python Case Statements	Getting Started with Data Manipulation with Pandas	Deep Learning Workflow, Deep Learning Model Features	Getting started with Data Visualization
	SLO-2	Business Understanding, Problem Statement Formulation	Loops, Functions and Exception Handling, Objects and Classes	Installing and Using Pandas, Exploring a data file Using Pandas	Deep Learning Model Performance	Getting started with Data Visualization Library Matplotlib
S-12	**SLO-1**	Analytic Understanding,	Mathematical Computing with Python (Numpy)	Reading Data from a Excel file, Reading Data from a .csv file	Simple Deep Learning Implementation with the Iris Dataset	Bar. Column, Pie Graph using matplolib, Box Plot using matplolib
	SLO-2	Understanding Data Requirements	Getting Started with Numpy	Reading Data from a .txt file	Natural Language Processing with NLTK	Histogram using matplolib
S-13	**SLO-1**	Data Collection	Creating Numpy Arrays	Exploratory Data Analysis	Getting started with Natural Language Processing	Line plots and Sub Plots Using Matplotlib
	SLO-2	Data Understanding	Creating Numpy Array Indexing	Getting Exploratory with Data Analysis	Getting started with NLP library NLK	Scatter Plot Using Matplotlib, Plot Customizations, Saving Plots
S-14 to S-15	**SLO-1& 2**	**Lab 3: Collect and understand a simple data for a Data Science Application.**	**Lab 6: Install and perform a Numerical Array Processing using NumPy**	**Lab 9: Install and perform a simple Exploratory Data Analysis using Pandas**	**Lab 12: Install and perform a simple text processing using NLTK**	**Lab 15: Create all Data Visualization Plots using Matlotlib**

Learning Resources	.1. https://deepsphereai.litmos.com/ 2. Kenneth A. Lambert, (2011), "The Fundamentals of Python: First Programs", Cengage Learning	1.Jojo Moolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016. 2. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015. 3. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013

Learning Assessment											
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%) #**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.R.SHANTHI, Assistant Professor, SRMIST KTR

Course Code	PGI20D02J	Course Name	Artificial Intelligence and Machine Learning	Course Category	D	Discipline Elective Courses	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning

		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	To understand the basic concepts and principles of Artificial Intelligence			
CLR-2 :	To learn Basic code of Prolog for AI			
CLR-3 :	To study the concepts of Supervised Machine Learning Algorithms			
CLR-4 :	Introduce the Boosting Algorithms			
CLR-5 :	Implement and apply supervised and unsupervised machine leaning Algorithms			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Delineate Artificial Intelligence and Machine Learning	3	80	70
CLO-2 :	Practical Understanding about Prolog	3	85	75
CLO-3 :	Recognize the characteristics of machine learning strategies	3	75	70
CLO-4 :	Apply various supervised learning methods to appropriate problems	3	85	80
CLO-5 :	Identify and integrate more than one Machine Learning Algorithms to enhance the performance	3	85	75

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
L	M	-	-	M	-	L	-	-	M	M	-	-	-	-
M	M	-	-	M	-	M	M	-	H	-	-	-	H	-
M	H	-	-	H	-	M	H	-	H	-	-	-	H	M
M	H	-	-	H	-	M	H	-	M	-	-	-	H	M
H	H	-	-	H	-	H	-	-	H	-	-	-	H	H

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Definition and Scope of AI	Uninformed Search: Breadth First Search	What is Machine Learning and Why should we care about it?	Models for Classifications	Dimensionality Reduction and Evolutionary Models
	SLO-2	Historical Evolution of AI	Depth First Search, Depth Limited Search	Applications of Machine Learning	Logistic Regression	Linear Discriminant Analysis
S-2	SLO-1	The Turing Test, The Cognitive modeling approach	Iterative Deepening Depth First Search, Bidirectional Search	Where ML is used in the Data Science Process	Decision Tree Learning	Principal Component Analysis
	SLO-2	Intelligent Agents and its Types	Comparison of Uninformed search Strategies	Python Tools Used in ML	Random Forest, K-NN	Factor Analysis

S-3	**SLO-1**	problem solving agents	Informed Search: Generate & test, Hill Climbing	Components of Machine Learning Models	Ensemble Learning	Independent Component Analysis
	SLO-2	Knowledge based systems	A* and AO* Algorithm, Constraint satisfaction	Learning Models, Geometric Models	Bagging: Random Forest Trees	Locally Linear Embedding, Isomap
S 04 - S 05	**SLO-1**	**Lab 1: Solving Problems using AI**	**Lab 4: Working on Uninformed Search**	**Lab 7: Supervised Learning**	**Lab10: Ensemble Learning**	**Lab 13: Working with Dimensionality Reduction Models**
	SLO-2					
S-6	**SLO-1**	Wumpus world	Greedy Best-First Search	Probabilistic Model, Logic Models	Boosting: Adaboost	Evolutionary Learning, Genetic algorithms
	SLO-2	Propositional Logic: Representation, Inference	Iterative Deepening A	Grouping and Grading	Gradient Boosting	Genetic Operators
S-7	**SLO-1**	Reasoning Patterns, Resolution	Beam Searching	Types of Learning	Reinforcement Learning	Particle Swarm Optimization-PSO
	SLO-2	Forward and Backward Chaining	Game playing: Minimax Search	Supervised, Unsupervised and Reinforcement Learning	Introduction, Learning Task	Ant Colony Optimization-ACO
S-8	**SLO-1**	Syntax of First order Logic Representation	Alpha-Beta Cutoffs, Waiting for Quiescence	Linear Models for Regression	Q Learning	Advanced Learning Models: Sampling
	SLO-2	Semantics of First order Logic Representation	Examples	Logistic Regression, SVM, LDA	Non deterministic Rewards and actions	Basic Sampling Methods: Markov Chain Monte Carlo Methods
S 9 - S 10	**SLO-1**	**Lab2: Propositional Logic and Reasoning**	**Lab5: Working on Informed Search**	**Lab8: Bayesian Learning**	**Lab11: Reinforcement Learning**	**Lab 14: Working with Advanced Learning Models**
	SLO-2					
S-11	**SLO-1**	Architecture of expert systems	PROLOG: Representation	Bayesian Learning- Naïve Bayes	Temporal-difference learning	Gibbs Sampling
	SLO-2	Role of expert systems	Structure, Backtracking	Linear Models for Clustering	Active reinforcement learning	Graphical Models
S-12	**SLO-1**	Types of Expert system: Rule Based, Frame Based	Unification	K-Means, Hierarchical Clustering	Generalization in reinforcement learning	Evaluation Metrics: Classification Metrics
	SLO-2	Case Based, Fuzzy Logic Systems, Hybrid Systems	Input / Output in Prolog	Agglomerative Clustering	Deep Q-Network	Clustering Metrics
S13	**SLO-1**	Knowledge Acquisition	Control Structures and Recursion in Prolog	Gaussian Mixture Models	Actor-Critic	Regression Metrics
	SLO-2	Meta knowledge, Heuristics	Debugging and Error Handling in Prolog	Spectral Clustering	A3C, SAC	ROC Curves
S 14 - S 15	**SLO-1**	**Lab3: Experts System in Prolog**	**Lab 6: Working with Prolog**	**Lab9: Linear Models for Clustering**	**Lab 12: Working with Deep-Q Network**	**Lab15: Evaluating the performance metrics of the models**
	SLO-2					

Learning Resources	1.StuartRussell&PeterNorvig:"ArtificialIntelligence:AModernApproach", Pearson Education, 2ndEdition 2. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014	1. IvanBratko,"PrologProgrammingForArtificialIntelligence",2ndEdition Addison Wesley. 2. EthemAlpaydin, Introduction to Machine Learning, MIT Press, Third Edition, 2014. 3. Kevin P. Murphy ”Machine Learning: A Probabilistic Perspective”, The MIT Press, 2012

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.A.Thilaka, Assistant Professor, SRMIST KTR

Course Code	PGI20D03J	Course Name	Web Application Development	Course Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning

CLR-1 :	Understand the current technologies in Internet world
CLR-2 :	Implement client side programming using CSS
CLR-3 :	Knowledge with Basics of HTML and XML Structure
CLR-4 :	Learn and implement java server-side programming like PHP
CLR-5 :	Learn and implement advanced and current technologies like AJAX

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)
CLO-1 :	Use the various HTML tags with appropriate styles to display the various types of contents effectively	2	85	80
CLO-2 :	Develop the dynamic web pages using HTML, CSS and JavaScript applying web design principles to make pages effective	3	85	80
CLO-3 :	Design the client-side scripts using various features for creating customized web services	3	85	80
CLO-4 :	Develop the server-side PHP scripts using various features for creating customized web services	3	85	80
CLO-5 :	Create the server side scripts for designing web-based services with database connectivity and develop a web application using advanced web programming concepts	3	85	80

Program Learning Outcomes (PLO)

	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	L	H	-	M	-	H	-	-	-	-	-	-	L	-	-
CLO-2 :	M	H	-	M	-	-	-	-	-	-	-	-	M	-	M
CLO-3 :	L	H	-	M	-	M	-	-	-	-	-	-	-	-	M
CLO-4 :	M	H	M	L	-	-	-	-	-	-	-	-	M	-	-
CLO-5 :	L	H	L	M	-	-	-	-	-	-	-	-	M	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to Website Basics	Introduction to Cascading Style Sheets (CSS)	Introduction to XML	Introduction to PHP	Introduction To AJAX and WEB SERVICES
	SLO-2	Understanding the internet: Client-server model, DNS, HTTP/HTTPS protocols	CSS syntax and basic selectors: Element selectors, class selectors, ID selectors	Syntax and structure of XML documents XML elements, attributes, and entities	Setting up a PHP development environment	History and evolution of AJAX in web development
S-2	SLO-1	Introduction to web browsers and their functionalities	Styling text: Fonts, colors, text properties	Document Type Definitions (DTD)	Basic syntax and structure of PHP scripts	Understanding the XMLHttpRequest object in JavaScript

	SLO-2	Overview of web development tools: Text editors, browsers, developer tools	Box model: Margin, padding, border, width, height	XML Schema Definition (XSD)	Variables in PHP: naming conventions, scope, and data types	Making asynchronous requests to the server, Handling response data from the server
S-3	**SLO-1**	Introduction to HTML5	Working with backgrounds and gradients	Validating XML documents against DTD and XSD	Working with strings, numbers, arrays, and boolean values in PHP	AJAX with JSON-Introduction to JSON (JavaScript Object Notation)
	SLO-2	History and evolution of HTML	CSS3 selectors: Pseudo-classes, pseudo-elements, attribute selectors	Introduction to XPath for navigating XML documents	Conditional statements: if, else, elseif	Sending and receiving JSON data with AJAX
S-4 S-5	**SLO-1**	**Lab 1: Create a simple HTML page with a header, footer, navigation bar, and main content section. Include text, images, and links within the content section.**	**Lab 4: Create a simple HTML page and apply CSS styles to elements like headings, paragraphs, and links. Experiment with properties such as color, font-family, font-size, text-align, and text-decoration.**	**Lab 7: XML Document Creation**	**Lab 10: Create a simple PHP page that outputs the current server's PHP configuration using phpinfo() function.** **Create PHP variables of different data types (string, integer, float, boolean, array).**	**Lab 13: Create a form with input fields. Use AJAX to send form data to a server for processing and display the response without refreshing the page.**
	SLO-2					
S-6	**SLO-1**	HTML5 document structure	Introduction to Flexbox: Flex container, flex items, alignment properties	Basics of XQuery for querying XML data	Looping structures: for, while, do-while, foreach	Implementing AJAX with callbacks, promises, and async/await
	SLO-2	Text formatting with headings, paragraphs, lists, and emphasis tags	Introduction to CSS Grid: Grid container, grid items, grid lines, grid tracks	XSL (eXtensible Stylesheet Language)	Functions and Includes	Error handling in AJAX requests
S-7	**SLO-1**	Working with links: <a> tag, internal and external links, anchor elements	CSS3 transitions and animations: Transition properties, keyframes, animation properties	XSLT (XSL Transformations) for XML to XML transformations	Defining and calling functions in PHP	Best practices for writing maintainable AJAX code
	SLO-2	Images and multimedia: <img>, <audio>, <video> tags	Responsive Web Design and Media Queries	Rendering XML data using XSL-FO (Formatting Objects)	Passing arguments to functions and returning values	Overview of web APIs and their importance
S-8	**SLO-1**	Forms and user input: <form>, <input>, <textarea>, <button>, form elements	Introduction to responsive web design principles	DOM (Document Object Model) parsing	PHP Forms and User Input	Consuming RESTful APIs with AJAX
	SLO-2	Advanced form elements: <select>, <option>, <input> types (date, email, number, etc.)	Media queries: Syntax, breakpoints, viewport meta tag	SAX (Simple API for XML) parsing	Processing HTML forms with PHP	Authentication and authorization when accessing APIs
S-9 S-10	**SLO-1**	**Lab 2: Build a table to display tabular data. Experiment with different attributes like <thead>, <tbody>, <tfoot>, <th>, and <td>.**	**Lab 5: Design a webpage that adapts to different screen sizes using media queries.**	**Lab 8: create an XML document representing a collection of products with elements like name, price, category, and quantity.**	**Lab 11: Implement a PHP script to check if a number is even or odd using if-else statement.**	**Lab 14: Build a webpage that retrieves user information from the GitHub API using AJAX. Display user details such as name, profile picture, and repositories.**
	SLO-2	**Experiment with different types of lists (, , <dl>) and link styles (<a>).**	**Create different types of layouts using CSS, such as fixed-width, fluid, and responsive layouts. Use techniques like floats, flexbox, and CSS Grid to arrange elements on the page.**	**Write an XSLT stylesheet to transform an XML document representing a list of students with elements like name, age, and grade, into an HTML table for display on a webpage.**	**Write a PHP program to print the multiplication table of a given number using a for loop.**	**Develop a currency converter application that fetches exchange rates from a currency exchange API using AJAX. Allow users to convert between different currencies dynamically.**

S-11	**SLO-1**	Semantic elements: <header>, <footer>, <nav>, <article>, <section>	Creating responsive layouts with CSS3 techniques	Introduction to XHTML	Retrieving user input from form fields	Introduction to Web Services
	SLO-2	HTML5 structural elements: <aside>, <figure>, <fig caption>, <main>	Applying HTML5 and CSS3 knowledge to create a complete website project	XHTML syntax and document structure	Validating and sanitizing user input in PHP scripts	Overview of SOAP (Simple Object Access Protocol) and REST (Representational State Transfer) Differences between SOAP and RESTful web services
S12	**SLO-1**	Web Storage API: Local Storage and Session Storage for client-side data storage	CSS Architecture BEM (Block Element Modifier) methodology	XHTML attributes and their values	Working with Files and Directories	RESTful Web Services Principles of RESTful architecture
	SLO-2	Geo location API: Obtaining user location, handling location-based content	Atomic CSS, SMACSS (Scalable and Modular Architecture for CSS)	Using semantic elements in XHTML (e.g., <header>, <nav>, <article>, <footer>)	Reading from and writing to files in PHP	Creating RESTful APIs with HTTP methods (GET, POST, PUT, DELETE) Designing resource URIs and handling CRUD operations
S13	**SLO - 1**	Drag and Drop API: Creating drag-and-drop interfaces for web applications	CSS preprocessors and post-processors	Creating forms in XHTML	File handling functions: fopen, fclose, fwrite, etc.	SOAP Web Services Understanding SOAP protocol and messaging structure
	SLO - 2	Introduction to SVG (Scalable Vector Graphics): Basics of SVG syntax, embedding SVG in HTML	CSS linting tools	Linking CSS to XHTML documents Styling XHTML elements using CSS selectors and properties	Manipulating directories and file paths in PHP	Implementing SOAP-based web services with WSDL (Web Services Description Language) Consuming SOAP web services in web applications
S-14 S-15	**SLO-1**	**Lab 3: Design a form using HTML elements like <form>, <input>, <select>, <textarea>, and <button>.**	**Lab 6: Implementing BEM methodology in a project.**	**Lab 9: Write a XQuery to transform an XML document representing a list of movies into a new XML document containing only the movie titles and their corresponding release years.**	**Lab 12: Implement PHP includes to separate header, footer, and navigation sections in a webpage.**	**Lab 15: Design and implement a simple RESTful API for managing a list of products. Include endpoints for CRUD operations (Create, Read, Update, Delete) using AJAX to interact with the API.**
	SLO-2	**Create a form with input fields that require specific formats or validations (e.g., email address, phone number).**	**Converting CSS code to Sass and utilizing Sass features.**	**Develop an XML document representing a customer profile with elements such as name, email, address, and phone number.**	**Create a PHP form to accept user input for basic information (name, email, age) and display the entered data**	**Extend the RESTful API to include user authentication using JWT (JSON Web Tokens). Implement AJAX-based login and registration functionality on a web page.**

Learning Resources	Text Book: Getting MEAN with Mongo, Express Angular and Node, Simon Holmes Practical Node JS: Building a Real World Scale Web Apps, Basarat Syed, A Press, 2014. Learning Angular JS: A Guide to Angular JS Development, Ken Williamson, O' Reilly, 2015	Reference Book: 1. MEAN Web Development, AMOS Q. HAVIV 2. AngularJS: https://angular.io/docs 3. MongoDB: https://docs.mongodb.com/manual/tutorial/getting-started/

Learning Assessment											
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember Understand	20%	20%	15%	15%	15%	15%	15%	15%	20%	20%
Level 2	Apply Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Evaluate Create	10%	10%	15%	15%	15%	15%	15%	15%	10%	10%
	Total	100 %		100 %		100 %		100 %		100 %	

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.S.Arunarani, Assistant Professor, SRMIST KTR

Course Code	PGI20D04J	Course Name	Intelligent Internet of Things (IIoT)	Course Category	D	Discipline Elective Courses	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1:	Demonstrate the design, communication model and enabling technologies for IoT.	
CLR-2:	Explore the system management and domain for various applications of IoT	
CLR-3:	Categorize the various protocols that are used for developing IoT applications.	
CLR-4:	Deploy an IoT application and connect to the cloud.	
CLR-5 :	Develop IoT application for real time scenario	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom's)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related	Procedural Knowledge	Skills in Specialization	Ability to Utilize	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLO-1 :	Understand IoT basics: definitions, architectures, challenges, and promises	2	85	80	H	H	H	H	H	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Master IoT protocols and software	3	85	80	H	-	M	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Gain hands-on experience with IoT hardware	3	85	80	-	H	H	-	-	-	-	-	M	-	-	-	-	-	-
CLO-4 :	Explore real-world IoT applications in different industries	3	85	80	-	-	H	-	H	-	-	-	M	-	-	-	-	-	-
CLO-5 :	Learn to handle and analyze IoT data, including using machine learning for predictions	3	85	80	-	H	H	H	H	-	-	-	M	-	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	IoT Fundamentals: Definitions, Architectures, Challenges, and Promises: What is IoT?	IoT protocols and software:	The Smart "Things" in IoT:Definition and Architecture of Smart Things	Principles and Foundations of IoT and AI: IoT reference model, IoT platforms.	Generative Models for IoT:
	SLO-2	Impact of IoT, Benefits of IoT	MQTT, UDP	Sensors	Big data and IoT	Generating images using VAEs
S-2	SLO-1	IoT Challenges, IoT and Big Data	MQTT brokers, publish subscribe modes	Actuators	Cross-industry standard process for data mining,	GANs
	SLO-2	IoT and Cloud Computing, IoT and Industry 4.0	HTTP, AMQP	Electrical Motors	AI platforms and IoT platforms	Personal and Home IoT
S-3	SLO-1	Architectures and Reference Models of IoT: IoTWF Reference Model of IoT	COAP	Processing Unit: Microcontroller, Classifications of Microcontrollers	TensorFlow, Keras, Datasets	IoT and smart homes
	SLO-2	Simplified Reference Model of IoT	XMPP and gateway protocols	Three Main Types of Microcontrollers	Data Access and Distributed Processing for IoT: TXT format	Smart lighting
S-4 to S-5	SLO-1	**Lab1: Arduino Installation and Blink LED using Node MCU Esp8266**	**Lab 4: Interfacing Temperature Humidity Sensor with Node MCU Esp8266**	**Lab 7: Create a an Access point and a Webserver using Node MCU Esp8266**	**Lab 10: Create a Voice Controlled Switch Using Arduino IoT Cloud**	**Lab 13: Integrating IR sensor with Raspberry pi and control an LED using python**

S - 6	**SLO-1**	IoT Applications in Vertical Market: Smart Agriculture,	IoT point to point communication technologies: IoT Communication Pattern	ARM Microcontrollers	CSV format, XLSX format	Microcontrollers for IoT: Introduction to Arduino, ESP8266 Node MCU, Arduino IDE, Raspberry pico
	SLO-2	Logistics and Transportation	IoT protocol Architecture	Architecture	Working with the JSON format, HDF5 format	Getting Started with the ESP8266 , Installing the Arduino IDE for the ESP8266
S-7	**SLO-1**	Smart Grid, Smart Building, Smart Factory, Smart City	Selection of Wireless technologies : 6LoWPAN, Zigbee, WIFI	GPIOs and Interfaces: General-Purpose Input/Output (GPIO), Analog Inputs, Analog Outputs	Machine Learning for IoT: ML and IoT	Connecting your module to your Wi-Fi network
	SLO-2	Standards: “Traditional” Internet Review	BT, BLE,SIG,NFC, LORA, Lifi, Widi	Parallel Interfaces vs Serial Interfaces, Universal Asynchronous Receiver/Transmitter(UART)	Prediction using linear regression, Logistic regression for classification	First Projects with the ESP8266 Controlling an LED
S-8	**SLO-1**	Physical/Link Layer	Evolution of Cloud Computation,	Serial Peripheral Interface (SPI), I2C (Inter-integrated Circuit)	Classification using support vector machines	Reading data from a GPIO pin Grabbing the content from a web page
	SLO-2	Network Layer	Commercial clouds and their features	Universal Synchronous Asynchronous Receiver Transmitter	Naive Bayes, Decision trees	Reading data from a digital sensor
S-9 to S-10	**SLO-1**	**Lab2: Interfacing Light Sensor with ESP8266 NODE MCU WiFi Board**	**Lab 5: Interfacing MQ 4 GAS Sensor with Node MCU Esp8266**	**Lab 8: Interfacing Temperature Humidity Sensor and Visualize data in Cloud Server with Node MCU Esp8266**	**Lab 11: ESP8266 NodeMCU Data Logging to Firebase Realtime Database**	**Lab 14: Raspberry Pi: Send an Email using Python**
S-11	**SLO-1**	Transport Layer	open source IoT platforms, cloud dashboards	IoT Frameworks and Platforms:FIWARE, SmartThings, AWS IoT	Deep Learning for IoT -Artificial neuron, Modelling single neuron in TensorFlow	Cloud Data Logging with the ESP8266
	SLO-2	Application Layer	Fog computing: Need for Fog computation	Microsoft Azure IoT	Convolutional neural networks	Hardware and software requirements Hardware
S-12	**SLO-1**	The Internet of Things: Designing the Architecture of an IP-based Internet of Things	Fog applications	Azure IoT Edge	Different layers of CNN	configuration Testing the sensor Logging data to Cloud server, Displaying data using Cloud Application
	SLO-2	Network Layer	Edge computing:Need for edge computation	Azure Stream Analytics	Some popular CNN model	Control Devices from Anywhere, Hardware and software requirements
S-13	**SLO-1**	Transport Layer	Edge computing architectures	Azure Machine Learning	LeNet to recognize handwritten digits on IoT Device	Configuring the ESP8266 module
	SLO-2	Application Layer	Edge Applications	Azure Logic Apps	Recurrent neural networks	Controlling an LED Controlling the LED from a cloud dashboard Controlling the lamp from anywhere in the world
S-14 to S-15	**SLO-1**	**Lab 3: Interfacing Infrared (IR) Sensor with Node MCU Esp8266**	**Lab 6: Interfacing Relay and Control LIGHT with Node MCU Esp8266**	**Lab 9: Create a Smart Switch to Control Light from Internet**	**Lab 12: Install OS and Configure Raspberry pi**	**Lab 15: Install Mosquitto MQTT Broker on Raspberry Pi**

Learning Resources	Text: 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.	Reference; 1. Hands-On Artificial Intelligence for IoT, Amita Kapoor, 2019, Packt Publishing Ltd. 2. Kamal, R.,”Internet of Things – Architecture and Design Principles,” 1st Edition, Mcgraw Hill,2017. 3. Internet of Things with ESP8266, Marco Schwartz, 2019, Packt Publishing Ltd. 4. https://randomnerdtutorials.com/projects-raspberry-pi/

Learning Assessment											
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	20%	20%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	10%	10%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.L. SELVAM, Assistant Professor, SRMIST KTR

Course Code	PGI20D05J	Course Name	Computer Vision	Course Category	D	Discipline Elective Courses	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning	Program Learning Outcomes (PLO)

		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Recognize and describe both the theoretical and practical aspects of computing with images,			
CLR-2 :	Describe the foundation of image formation and image analysis			
CLR-3 :	Understand the shape and region analysis			
CLR-4 :	Understand the Hough Transform and its applications to detect lines, circles, ellipses			
CLR-5 :	Understand the Three-dimensional image analysis techniques and Motion Analysis			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	Understand computer vision including fundamentals of image formation	2	85	80	H	L	-	M	H	H	-	-	-	-	-	-	-	-	-
CLO-2 :	Learn about image formation	3	85	80	L	H	-	H	H	-	-	M	-	-	-	-	-	-	-
CLO-3 :	Apply image processing techniques	3	85	80	H	H	-	-	H	H	-	M	-	-	-	-	-	-	-
CLO-4 :	Calibrate Computational photography	3	85	80	H	M	L	H	-	H	-	-	-	-	-	-	-	-	-
CLO-5 :	Learn about image rendering	3	85	80	M	-	H	H	H	H	-	-	-	-	-	-	-	-	-

Duration(hour)		15	15	15	15	15
S-1	SLO-1	Definition and scope of computer vision	Object labeling and counting, size filtering	Segmentation: Active contours, Snakes, Dynamic snacks and Condensation	Spline- based motion	Image Rendering: Interpolation view
	SLO-2	Historical overview Applications of computer vision	Distance functions, Skeletons and thinning	Scissors, Level Sets	Multi-frame motion estimation	Layered images
S-2	SLO-1	Image acquisition, sampling and quantization	Deformable shape analysis, boundary tracking procedures	Split and merge	Layered Motion Motion Models: Planar Perspective motion	Light fields and Lumigraph
	SLO-2	neighbors of pixels and connectivity, Basic Transformation,	Shape models and shape recognition	Mean shift and mode finding		
S-3	SLO-1	Image enhancement,	Feature detectors	Normalized cut, Graph cuts	Rotational panoramas	Video based rendering: Video base animation
	SLO-2	Color Image processing.	Feature descriptors	Energy based methods	Gap closing	Video textures, 3D Video

S-4 & S- 5	**SLO-1**	**Implementation of 2D and 3D Projections**	**Implement feature detection algorithms such as Harris corner detection, SIFT, or FAST.**	**Build a simple object detection system using Haar cascades or HOG features Detect and localize objects in images or video streams.**	**Implement Motions models**	**Implement a light field or lumigraph rendering system**
	SLO-2					
S-6	**SLO-1**	Image Formation: Geometric primitives and transformations	Matching Feature tracking	2D and 3D feature based alignment	Cylindrical and spherical coordinates	Recognition: Object detection, Face detection
	SLO-2	Photometric image formation The digital camera	Edge detection	Pose estimation, Geometric intrinsic calibration	Global adjustment: Bundle adjustment	Pedestrian detection
S-7	**SLO-1**	Image processing: Point Operators	Edge linking	Motion Structure: Triangulation Two-frame structure from motion	Parallax removal, Recognizing panoramas	Face recognition: Eigen faces
	SLO-2	Linear filtering	Hough Transforms	Factorization	Composting: Choosing a composting surface	Active appearance and 3D shape models
S-8	**SLO-1**	More neighborhood operators	Hough Transform (HT) for line detection	Bundle adjustment	Pixel selection and weighting	Instance recognition : Geometric alignment, Large databases
	SLO-2	Fourier transforms	foot-of-normal method	Constrained structure and motion	Blending	Application : Location recognition
S-9 & S-10	**SLO-1**	**Build a color constancy algorithm that uses the assumption that the spatial average of reflectance is constant. Use finite-dimensional linear models**	**implementation of Canny's edge detector**	**program that produces a Gaussian pyramid from an image**	**Implement optical flow algorithms to estimate motion vectors in video sequences**	**Develop a facial recognition system using OpenCV or deep learning frameworks and Train a model to recognize faces from images or video streams**
	SLO-2					
S-11	**SLO-1**	Pyramids and wavelets	line localization &line fitting	Motion Estimation: Translational alignment,	Methods for 3D vision: Projection schemes	Category recognition, Bag of words, Part-based models
	SLO-2	Geometrics transformations	RANSAC for straight line detection	Hierarchical motion estimation	Shape from shading	Recognition with segmentation
S-12	**SLO-1**	Global Optimization	HT based circular object detection	Fourier- based alignment	Photometric stereo, Shape from focus	Application: Intelligent photo editing
	SLO-2	Feature Detection: Points and patch	Accurate center location	Incremental refinement	Active range finding	Understanding Context and scene
S-13	**SLO-1**	Binary shape analysis	Speed problem	Parametric motion	Surface representations, point based representation	Learning and Large image collection
	SLO-2	Connectedness	Ellipse detection	Learned motion models	Volumetric representation	Application : Image Search
S-14 & S-15	**SLO-1**	**Implementation Two-dimensional Fourier transforms, Wiener filtering**	**Implement a Hough transform based line finder**	**Implement a mean shift segmenter**	**Implement 3d Reconstruction.**	**Implement an Object detection**
	SLO-2					

Learning Resources	Text: RichardSzeliski,"Computer Vision: Algorithms and Applications", Springer, 2010. Forsyth/Ponce,"ComputerVision: AModernApproach", PearsonEducationIndia;2edition (2015) S. Nagabhushana,"Computer Vision and Image Processing", NewAge International Pvt Ltd; First edition (2005)	Reference 1. Rafael C. GonzaLez'"Digital Image Processing", Pearson Education; Fourth edition (2018) 2.Computer Vision: Principles, Algorithms, Applications , Learning Hardcover, E.R.Davies 5th edition (2017) 3. Digital Image Processing and Analysis, Application with MAtLab, CVIPtools Scott E Umbaugh 3rd edition , 2018

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50%weightage)								Final Examination 50% Weightage	
		CLA–1(10%)		CLA–2(10%)		CLA–3(20%)		CLA–4(10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level1	Remember	10%	15%	10%	15%	10%	15%	10%	15%	10%	15%
	Understand										
Level2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level3	Evaluate	20%	15%	20%	15%	20%	15%	20%	15%	20%	15%
	Create										
	Total	100%		100%		100%		100%		100%	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.S.Usha, Assistant Professor, SRMIST KTR

Course Code	PGI20D06J	Course Name	Natural Language Processing	Course Category	D	Discipline Elective Courses	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	Understand fundamentals of Natural Language Processing	
CLR-2 :	Understand Named Entity Recognition and Parsing techniques in NLP	
CLR-3 :	Understand NLP algorithms for parsing and topic modeling	
CLR-4 :	Explore advanced text processing techniques in NLP	
CLR-5 :	Develop practical skills in implementing NLP based Applications	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Demonstrate a comprehensive understanding of NLP Pipeline	2	85	80
CLO-2 :	Demonstrate a comprehensive understanding of the principles and different approaches in NLP	3	85	80
CLO-3 :	Develop practical skills in implementing NLP based pipeline	3	85	80
CLO-4 :	Apply NLP concepts to solve variety of real-world problems in text processing	3	85	80
CLO-5 :	Critically evaluate the performance and ethical implications of different NLP Real world applications	3	85	80

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related	Procedural Knowledge	Skills in Specialization	Ability to Utilize	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
H	-	-	H	H	H	-	-	-	H	-	-	-	-	-
L	-	-	H	H	H	-	-	-	H	-	M	-	-	-
L	H	-	H	H	H	-	-	-	H	-	-	-	-	-
L	H	-	H	H	H	-	-	-	H	-	-	-	-	L
L	-	-	H	H	H	-	-	-	H	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Overview of NLP	Introduction to Named Entity Recognition (NER)	Probabilistic Context-Free Grammar (PCFG)	Introduction to Word Vectors	Information Extraction and its approaches
	SLO-2	Definition and Scope of NLP	Types of Named Entities	Applications of PCFG	Role and applications of word vector	
S-2	SLO-1	Uses of NLP	NER Approaches and Algorithms	Chunking and Segmentation	Word2Vec Model-CBOW and Skip Gram	Introduction to Text Summarization
	SLO-2	Challenges of NLP		Chunking techniques and approaches		Extractive vs. Abstractive Summarization
S-3	SLO-1	Linguistics for NLP-Morphology, Syntax, Semantics, Pragmatics	NER Applications	Hidden Markov Models	GloVe (Global Vectors for Word Representation):	Summarization in Real-world Applications
	SLO-2	Corpus and Corpus Linguistics	Challenges in NER		FastText:	Ethical and Social Implications of Summarization:
S-4-5	SLO-1		**Lab 4: Building a Named**		**Lab 9: Python implementation**	**Lab 11: Case Study: Analyzing Twitter**

	SLO-2	**Lab1: NLP Library Exploration - NLTK, SpaCy, CoreNLP and others**	**Entity Recognition System**	**Lab7: Implement a simple rule-based chunker that identifies noun phrases (NP) in a given sentence.**	**of Word Similarity Exploration with Word Vectors**	**Data for Sentiment Analysis**
S-6	**SLO-1**	Tokenization	Introduction to Stopwords	Conditional Random Field and its implementation	ELMo (Embeddings from Language Models):	Introduction to Chatbots
	SLO-2	Lemmatization	Common Stopword Lists in Various NLP Applications		BERT (Bidirectional Encoder Representations from Transformers):	Types of Chatbots
S-7	**SLO-1**	Stemming	Introduction to Regular Expression	Introduction to Topic Modeling:	Introduction to Information Retrieval	Natural Language Understanding (NLU)
	SLO-2	stemming Algorithm	Splitting text into tokens based on regex patterns	Generative vs. Discriminative Models in NLP	Information Retrieval Models-Vector space model and other models	Natural Language Generation (NLG):
S-8	**SLO-1**	Introduction to Text encoding	Regex libraries and functions for text processing tasks	Latent Dirichlet Allocation (LDA)	Query Processing and Evaluation	Retrieval based and Conversation based NLU and NLG
	SLO-2	Various text encoding techniques	Regular expression Applications in NLP		Semantic Search and Knowledge Graphs:	
S-9-10	**SLO-1**	**Lab2: perform tokenization, stemming, and lemmatization on any text dataset**	**Lab 5: To perform stop word removal from text**	**Lab8: Implement of basic LDA topic model using Python's gensim library and apply it to a small corpus of text documents.**	**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**
	SLO-2					
S-11	**SLO-1**	Introduction to POS tagging	Introduction to Syntax analysis in NLP	Latent Semantic Analysis (LSA)	Multimodal Information Retrieval	Machine Translation
	SLO-2	POS tagging in NLP applications	Syntax tree	Latent Semantic Analysis (LSA) implementation	Challenges in Information Retrieval	Rule-based Machine Translation (RBMT)
S-12	**SLO-1**	POS Tagging Algorithm and Techniques	Context Free Grammars	Applications in Topic modeling	Information Fusion	Statistical Machine Translation (SMT)
	SLO-2		Syntax rules and productions in CFGs	Challenges in Topic modeling	Methods of Information Fusion-cross model information fusion	Neural Machine Translation (NMT) Challenges in Machine Translation
S-13	**SLO-1**	POS Tagging Libraries and Tools	Parsing in NLP	Sentiment Analysis	Applications of Information Fusion in NLP:	Question Answering Systems
	SLO-2	Challenges in POS tagging	Dependency Parsing	Types of Sentiment Analysis	Challenges in Information Fusion	
S-14-15	**SLO-1**	**Lab3 :Hands-on experience with POS tagging tasks.**	**Lab6: Python script to validate the strength of passwords based on certain criteria using regular expressions and extract username in email address using RE**	**Lab9:Impement 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**
	SLO-2					

Learning Resources	1. "Speech and Language Processing" by Daniel Jurafsky and James H. Martin: 2. Practical Natural Language Processing, By Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta and Harshit Surana, June 2020 3. Natural Language Processing with Python and spacy, Vasiliev, April 2020.	1 C.Manning and H.Schutze, ―Foundations of Statistical Natural Language Processing‖, MIT Press. Cambridge,MA:,1999 2. Natural Language Processing with Python Quick Start Guide, NirantKasliwal, November 2018 3. YoavGoldberg, Neural Network Methods for Natural Language Processing.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr. M. Pandiyan, Assistant Professor, SRM IST

Course Code	PGI20S01J	Course Name	Prompt Engineering in Generative AI (Lab: Google Generative AI Studio)	Course Category	S	Skill Enhancement	L	T	P	C
							2	0	2	3

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	To generate new content based on variety of inputs	
CLR-2 :	To enhance the ability to use generative AI effectively	
CLR-3 :	To apply various models in AI	
CLR-4 :	To know the various Prompts	
CLR-5 :	To build variety of AI powered Applications	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3
		Level of Thinking (Bl...)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	To acquire the knowledge to get best output from the right question.	3	80	70
CLO-2 :	To work efficiently with ChatGPT, UM-GPT and DALL-E.	3	85	75
CLO-3 :	To able to craft the prompt for the various conditions.	3	75	70
CLO-4 :	To implement the encoding and Decoding of Text	3	85	80
CLO-5 :	To construct variations of AI Applications using Web Interface	3	85	75

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related	Procedural Knowledge	Skills in Specialization	Ability to Utilize	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
H	L	M	-	H	L	-	-	-	H	-	-	-	-	-
H	L	M	-	H	M	-	-	-	H	-	-	-	-	-
H	M	M	-	H	H	-	-	-	H	-	-	-	-	-
H	H	M	-	H	H	-	-	-	H	-	-	-	-	-
H	H	M	-	H	H	-	-	-	H	-	-	-	-	-

Duration(hour)		12	12	12	12	12
S1	SLO-1	Prompt Engineering: Introduction	Standard Practices for Text Generation with Chat GPT: Generating List and Hierarchical List Generation	Advanced Techniques for Text Generation with LangChain : Introduction to LangChain	Autonomous Agent with Memory and Tools: Chain of Thought	Image Generation :What are diffusion Models
	SLO-2	Role of Prompts in AI Model	Generating JSON	Chat Models	Agents	Open AI DALL-E
S2	SLO-1	What is Generative AI?	Diverse Format Generation with Chat GPT	Streaming Chat Models	Using LLMs as an API (Open AI functions)	Stable Diffusion
	SLO-2	Principles of Prompting	Chunking Test	Creating Multiple LLM Generations	Comparing Open AI functions and reAct	Format Modifiers
S3- S4	SLO-1	**LAB 1- Apply 5 Principles of prompting and Generate a Image Prompt**	**LAB 4- Build a simple chunking algorithm in Python**	**LAB 7- Creating a generator in LangChain**	**LAB 10- Implement Simple reAct**	**LAB 14- Generate a AI with various Format Modifiers**

S5	**SLO-1**	Evolution of AI: From Rule-Based to Generative Models	Chunking Strategies	LangChain Prompt Template	Agent Toolkits	Art Style Modifiers
	SLO-2	Text Generation Models	Encoding	LangChain Expression Language (LCEL)	Customizing Standard Agents	Reverse Engineering Prompts
S6	**SLO-1**	Open AI's Generative Pre- Trained Transformers(Chat GPT,Google Bard, LSTMs and others)	Sentiment Analysis	Vector Database	Understanding and Using Memory	Quality Booster
	SLO-2	Popular Use Cases for Generative AI	Least to most	Retrieval Augmented Generation	Memory in LangChains	Negative Prompt
S7-S8	**SLO-1**	LAB 2- Working with Chat GPT Prompt-I	LAB 5- Implement Encoding and Decoding of Text	LAB 8- Working with Prompt Template and Vector Database	LAB 11- Custom and Build the Agent	LAB 14- Generate a AI with various Prompts
S9	**SLO-1**	Designing Effective prompt	Role Prompting	Embedding	Other Popular Memory types in LangChains	Prompting with an Image
	SLO-2	Prompt Generation Strategies	GPT Best Practices	Document Loading	Open AI functions Agents with memory	Inpainting and Outpainting
S10	**SLO-1**	Chat GPT Examples	Classification Model	Memory Retrieval with FAISS	Advanced Agent Framework	Running Stable Diffusion
	SLO-2	Prompt for specific domain	Mets Prompting	Self Querying	Callbacks	Automatic1111 Web User Interface
S11-S12	**SLO-1**	**LAB 3- Working with Chat GPT Prompt-II**	**LAB 6- Build a Classification Model**	**LAB 9- Working with FAISS**	**LAB 12- Implement Callbacks with Constructors**	**LAB 15- Build AI powered Applications**

LearningResources	Text Book: Prompt Engineering for generative AI by James Phoenix and Mike Taylor, O'Reilly Media, Inc Publication, July 2024. Prompt Engineering for generative AI by Johnny M Hill	References: https://www.tutorialspoint.com/prompt_engineering/prompt_engineering_translate_prompt.html https://datasciencehorizons.com/pub/Mastering_Generative_AI_Prompt_Engineering_Data_Science_Horizons_v1.pdf

Learning Assessment

	Bloom's Level of Thinking	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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Course Code	PGI20AE1T	Course Name	Career Advancement – I	Course Category	AE	Ability Enhancement Course	L	T	P	C
							3	0	0	3

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,
CLR-1 :	Demonstrate various principles involved in solving mathematical concepts
CLR-2 :	Develop interest and awareness in students regarding profit/ loss, interest calculations and average
CLR-3 :	Critically evaluate basic mathematical concepts related to mixtures and alligations, permutation and combination and Statistics
CLR-4 :	Provide students with skills necessary to generate and interpret data and concepts related to Series, Direction Sense and blood relation.
CLR-5 :	Enable students to understand reasoning skills
CLR-6 :	Create awareness in students regarding the various concepts in quantitative aptitude and reasoning skills and also its importance in various competitive exams

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning: 1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)	Program Learning Outcomes (PLO): 1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	Understand, analyze and solve questions based on numbers, logarithms.	3	80	70	H	H	M	H	L	M	-	H	-	H	-	H	M	-	H
CLO-2 :	Create, solve, interpret and apply basic mathematical models which are applicable in our day to day life	3	80	75	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-3 :	Understand the concepts of mixtures and alligations, permutation and combinations, probability, time and work and to approach questions in a simpler and innovative method	3	85	70	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-4 :	Understand the concept in Word Series, Number Series, Symbol Series and Direction Sense	3	85	80	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-5 :	Ability to solve the problems on Logical Reasoning	3	85	75	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-6 :	Able to face different competitive exams	3	80	70	M	H	M	H	-	M	-	H	H	M	-	H	M	-	H

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Classification of numbers	Profit and Loss-Introduction	Permutation –Introduction& Basics	Word problems on Line equations-Introduction	Number Puzzles
	SLO-2	Tests of divisibility	Profit and Loss- Basic Problems	Permutation – Problems	Word problems on Line equations-Basic problems	Number Puzzles - Problems
S-2	SLO-1	Unit digit	Statistics-Introduction	Combination-Introduction& Basics	Syllogisms - Basics	Number Puzzles - Problems
	SLO-2	Tailed zeroes	Statistics-Mean, Median, Mode	Combination- Problems	Syllogisms - Problems	Number Puzzles – Tricky Problems

S-3	**SLO-1**	Series Formulae	Averages-Introduction & Basics	Probability- Introduction &Basics	Word series - Introduction	Logical Puzzles
	SLO-2	Arithmetic Progression Geometric Progression	Averages- Problems	Probability- Basics	Word series – Problems	Logical Puzzles - Problems
S-4	**SLO-1**	Highest Common Factor (HCF) Greatest Common Measure	Averages- Problems	Probability- Problems	Number series - Introduction	Logical Puzzles –Problems
	SLO-2	Least Common Multiples (LCM)	Averages-Tricky Problems	Probability- Tricky Problems	Number series - Problems	Logical Puzzles - Tricky Problems
S-5	**SLO-1**	HCF, LCM	Averages-Tricky Problems	Set Theory Introduction	Symbol Series - Introduction	Sequential output tracing- Basics
	SLO-2	HCF, LCM - Solving problems	Averages-Tricky Problems	Set Operation	Symbol Series - Problems	Sequential output tracing- Problems
S-6	**SLO-1**	Simplification	Ratio – Basics and Formulas	Set - Problems	Direction Sense - Introduction	Sequential output tracing- Problems
	SLO-2	Simplification - Problems	Ratio - Problems	Set - Tricky Problems	Direction Sense - Problems	Sequential output tracing- Tricky Problems
S-7	**SLO-1**	Virnaculum	Proportions – Basics and Formulas	Time and work-Introduction	Blood relation-Introduction	Inductive, Logical, Abstract
	SLO-2	Virnaculum - Problems	Proportions - Problems	Time and work-Men and Work	Blood relation-Problems	Inductive, Logical, Abstract- Problems
S-8	**SLO-1**	Logarithm –Introduction of log rules	Mixtures and Alligations-Introduction	Time and work - Problems	Coding – Decoding-Introduction	Diagrammatic Reasoning
	SLO-2	Logarithm – Problems	Mixtures and Alligations-Problems	Time and work - Tricky Problems	Coding – Decoding-Different types	Diagrammatic Reasoning-Problems
S-9	**SLO-1**	Logarithm –Applications of log rules	Boats and Streams	Pipes &Cisterns- Introduction	Coding – Decoding - Problems	Spatial Reasoning
	SLO-2	Logarithm Application – Problems	Boats and Streams- Problems	Pipes &Cisterns-Problems	Coding – Decoding – Tricky Problems	Spatial Reasoning- Problems

Learning Resources	Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Tata McGraw Hill, 5th Edition Dr. Agarwal.R.S, Quantitative Aptitude for Competitive Examinations, S. Chand and Company Limited, 2018 Edition Archana Ram, PlaceMentor: Tests of Aptitude for Placement Readiness, Oxford University Press, Oxford, 2018	Edgar Thrope, Test Of Reasoning for Competitive Examinations, Tata McGraw Hill, 6th Edition Dinesh Khattar, The Pearson Guide to Quantitative Aptitude for competitive examinations, Pearson, 3rd Edition P A Anand, Quantitative Aptitude for competitive examinations, Wiley publications, e book, 2019

Learning Assessment					
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (100% weightage)**			
		CLA-1 (20%)	**CLA-2 (20%)**	**CLA-3 (30%)**	**CLA-4 (30%) ##**
		Theory	**Theory**	**Theory**	**Theory**
Level 1	Remember	10%	10%	30%	15%
	Understand				
Level 2	Apply	50%	50%	40%	50%
	Analyze				
Level 3	Evaluate	40%	40%	30%	35%
	Create				
	Total	100 %	100 %	100 %	100 %

#CLA-1,CLA-2andCLA-3canbefromanycombinationofthese:OnlineAptitudeTests,ClassroomActivities,CaseStudies,PosterPresentations,Power-pointPresentations,MiniTalks,GroupDiscussions,Mockinterviews,etc.
##CLA–4canbefromanycombinationofthese:Assignments,Seminars,ShortTalks,Mini-Projects,Case-Studies,Self-Study,MOOCs,Certifications,Conf.Paperetc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr. P. Chockalingam, Senior Lead Software Engineer, Virtusa Consulting Services Private Ltd, DLF IT Park SEZ, Chennai - 600089	Dr. G. Saravana Prabu, Asst. Professor, Department of English, Amrita Vishwa Vidhyapeetham, Coimbatore - 641112	Dr. Sathish K, HOD, Department of Career Guidance Cell, FSH, SRMIST
		Dr. Aarthi S, Assistant Professor, Department of Career Guidance Cell, FSH, SRMIST

SEMESTER II

Course Code	PGI20C04J	Course Name	Python Programming for Data Science	Course Category	C	Professional Core Course	L	T	P	C
							3	0	3	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning

CLR-1 :	To understand why Python is a useful scripting language for developers.	
CLR-2 :	To Learn Python data structures – lists, tuples, dictionaries to represent complex data.	
CLR-3 :	To learn how to design object-oriented programs with Python classes.	
CLR-4 :	To learn Error and Exception handling in Python applications.	
CLR-5 :	To learn Data Analysis Using NumPy and Pandas, database connectivity and Graphical User Interface Components	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Appreciate the basic and advanced features of core language-built ins	3	80	70
CLO-2 :	Handle and control system/OS level features	3	85	75
CLO-3 :	Implementing OOP Concepts in Python Applications	3	75	70
CLO-4 :	Data Analysis Using NumPy and Pandas	3	85	80
CLO-5 :	Design and implement basic applications with database connectivity.	3	85	75

Program Learning Outcomes (PLO)

	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	H	H	M	H	M	M	M	M	-	M	-	-	-	-	-
CLO-2 :	H	H	M	M	H	M	M	M	-	M	-	-	-	-	-
CLO-3 :	M	M	M	H	M	H	H	M	-	M	-	-	-	-	-
CLO-4 :	M	M	H	H	M	M	M	H	-	H	-	-	-	-	-
CLO-5 :	M	M	M	M	H	H	H	M	-	H	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to Python	Object Oriented Programming in Python	Modules and Packages in Python	Introduction to Data Analysis	Python - GUI.
	SLO-2	Python Interpreter	Classes, Objects	Creating and Importing Modules	Machine Learning Basics	Introduction to TKinter
S-2	SLO-1	Python IDE-Interactive Mode	Methods	Uses of Standard Modules in Python -OS.	Arrays in Python-Importing and Creating an Array,	Top Level Windows
	SLO-2	Script Mode	Constructors	Sys modules	Array Operations	Dialogs, Message and Entry
S-3	SLO-1	Elements of Python Language	Inheritance	Random Module	Introduction to NumPy-Array Creation in NumPy, NumPy Properties,	Event handling, Menus

	SLO-2	Python Block Structure	Types of Inheritance	Statistics Module	Arithmetic Operations on NumPy, Data Analysis using NumPy	List boxes and Scrollbars
S-4,5,6	**SLO-1**	**Lab1: Simple programs**	**Lab 4: Implementing Inheritance**	**Lab 7: Implementing Modules**	**Lab 10: Descriptive Statistics Using NumPy**	**Lab 13: Building GUI Application with tKinter**
S-7	**SLO-1**	Data Types	Method Overloading	Threads	Pandas	SQLite -Introduction
	SLO-2	Variables & Assignment	Method Overriding	Advantages of Threading	CRUD Operations with Pandas	SQLite Commands
S-8	**SLO-1**	Operators & Expressions	Class Method	Threading Functions	Series Indexing	SQLite Operators and Expressions
	SLO-2	Tuples, Lists	Static Method	Creating threads	Series Statistical Methods	Database Creation
S-9	**SLO-1**	Sets, Dictionaries	Errors and Exceptions	Binary Files	Data Frames with Pandas,	Table Creation
	SLO-2	Iterators, Generators and Comprehensions	Built-in Exceptions	Reading Binary Files	Indexing in Data Frames	CRUD Operations-Insert, Select,Update,Delete
S-10,11,12	**SLO-1**	**Lab 2: Programs Using Tuples,List,Dictionary and Sets**	**Lab 5: Implementing Method Overloading**	**Lab 8: Implementing Threads**	**Lab 11: Illustrate Indexing Operations in data frame**	**Lab 14: Creating Tables Using SQLite**
	SLO-2					
S-13	**SLO-1**	Decision Making and Branching	Handling Exceptions with try and except statement	Command Line Arguments	Data Manipulation in Data Frames	SQLite Aggregate Functions
	SLO-2	Break and continue	Handling Exceptions with Finally Statement	Shell variables	Data Analysis Using Pandas	Date and Time Functions
S-14	**SLO-1**	Decision Making and Looping Statements	User Defined Exceptions	Parallel System Tools	Data Analysis and Visualization with Python	SQLite Keys
	SLO-2	Functions	Creating User Defined Exception Class	Python Libraries for Parallel Processing	Data Visualization Using Pandas	Conditions
S-15	**SLO-1**	Lambda Expressions	File Handling	Regular Expressions	Data Visualization using Matplotlib	Database Connectivity
	SLO-2	Filter Function	Reading & Writing Files	RegEx Functions	Scikit-learn	Connect SQLite with Python
S-16,17,18	**SLO-1**	**Lab 3 : Illustration on Lambda and Filters Top of Form**	**Lab 6: Illustration on how to raise an Exception**	**Lab 9: Illustration on Command Line Arguments and Regular Expressions**	**Lab 12: Illustrate various Plots using Pandas and Matplotlib**	**Lab 15: Illustration on Database Connectivity**
	SLO-2					

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

Learning Assessment											
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.J.Anita Smiles, Assistant Professor, SRMIST KTR

Course Code	PGI20C05J	Course Name	Deep Neural Networks	Course Category	C	Professional Core Course	L	T	P	C
							3	0	3	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	Understand fundamentals of deep learning	
CLR-2 :	Understand principles and algorithms of deep neural networks.	
CLR-3 :	Understand optimization algorithms, and training procedures.	
CLR-4 :	Explore advanced architectures of deep neural networks	
CLR-5 :	Develop practical skills in implementing deep neural networks	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bl...)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Demonstrate a comprehensive understanding of algorithms of deep neural networks.	2	85	80
CLO-2 :	Demonstrate a comprehensive understanding of the principles and algorithms of deep neural networks.	3	85	80
CLO-3 :	Develop practical skills in implementing, training, and evaluating deep learning models using popular frameworks.	3	85	80
CLO-4 :	Implement advanced architectures of deep neural networks	3	85	80
CLO-5 :	Critically evaluate the performance and ethical implications of deep learning models and make informed decisions when designing and deploying AI systems.	3	85	80

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related	Procedural Knowledge	Skills in Specialization	Ability to Utilize	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
H	L	-	H	H	H	-	-	-	-	-	-	-	-	-
L	L	-	H	H	H	-	-	-	-	-	-	-	-	-
L	H	-	H	H	H	-	-	-	-	-	-	-	-	-
L	H	-	H	H	H	-	-	-	-	-	-	-	-	-
L	H	-	H	H	H	-	-	-	-	-	-	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	An Introduction to Neural Networks	Recurrent Neural Networks	Hierarchical Softmax for Many Classes	Feature Preprocessing,Initialization	Recurrent Neural Networks - Introduction
	SLO-2	Humans Versus Computers: Stretching the Limits of Artificial Intelligence	Convolutional Neural Networks	Backpropagated Saliency for Feature Selection	The Vanishing and Exploding Gradient Problems-Geometric Understanding of the Effect of Gradient Ratios	Architecture of Recurrent Neural Networks
S-2	SLO-1	The Basic Architecture of Neural Networks	Hierarchical Feature Engineering and Pretrained Models	Matrix Factorization with Autoencoders	A Partial Fix with Activation Function Choice	Language Modeling Example of RNN-Generating a Language Sample
	SLO-2	Single Computational Layer: The Perceptron	AdvancedNeural Architectures-Reinforcement Learning	Autoencoder: Basic Principles	Dying Neurons and “Brain Damage” , Leaky ReLU , Maxout	Backpropagation Through Time , Bidirectional Recurrent Networks, Multilayer Recurrent Networks

S-3	**SLO-1**	Multilayer Neural Networks	Generative Adversarial Networks	Autoencoder with a Single Hidden Layer	Gradient-Descent Strategies	The Challenges of Training Recurrent Networks - Layer Normalization
	SLO-2	The Multilayer Network as a Computational Graph	The MNIST Database of Handwritten Digits, The ImageNet Database	Connections with Singular Value Decomposition	Learning Rate Decay	Echo-State Networks
S-4-6	**SLO-1**	**Lab1:Implement the perceptron in a programming language.**	**Lab4:Implement a basic feedforward neural network with one or more hidden layers. Train the network on a simple dataset for binary classification**	**Lab7:Implement a simple autoencoder neural network for unsupervised learning tasks such as dimensionality reduction or image denoising.**	**Lab10:Implement gradient descent for a simple linear regression problem in Python:**	**Lab13:Implement an RNN for sequential data tasks such as time series prediction or text generation. Train the RNN on datasets like the IMDB movie review dataset or stock price data.**
	SLO-2					
S-7	**SLO-1**	Training a Neural Network with Backpropagation	Machine Learning with Shallow Neural Networks	Sharing Weights in Encoder and Decoder	Radial Basis Function Networks - Introduction	Long Short-Term Memory (LSTM)
	SLO-2	Practical Issues in Neural Network Training	Neural Architectures for Binary Classification Models	Nonlinear Activations	Training an RBF Network	Gated Recurrent Units (GRUs)
S-8	**SLO-1**	The Problem of Overfitting	Revisiting the Perceptron	Deep Autoencoders	Training the Hidden Layer- Training the Output Layer - Expression with Pseudo-Inverse	Applications of Recurrent Neural Networks
	SLO-2	The Vanishing and Exploding Gradient Problems	Least-Squares Regression	Application to Outlier Detection	Orthogonal Least-Squares Algorithm - Fully Supervised Learning.	Convolutional Neural Networks - Introduction
S-9	**SLO-1**	Difficulties in Convergence	Widrow-Hoff Learning	When the Hidden Layer Is Broader than the Input Layer-Sparse Feature Learning	Variations and Special Cases of RBF Networks	Basic Structure of a Convolutional Network
	SLO-2	Local and Spurious Optima	Closed Form Solutions	Simple Neural Architectures for Graph Embeddings	Relationship with Kernel Methods	Training a Convolutional Network
S-10-12	**SLO-1**	**Lab2: Implement the perceptron in a programming language of your choice.**	**Lab5:Implement the softmax classifier using a deep-learning library of your choice**	**Lab8: Implement a simple autoencoder neural network for unsupervised learning tasks such as dimensionality reduction or image denoising. Train the autoencoder on datasets like the MNIST handwritten digit dataset.**	**Lab11: Implement the basic architecture of an RBF network, consisting of an input layer, a hidden layer with radial basis functions, and an output layer.**	**Lab14: Implement a CNN for image classification tasks using libraries like TensorFlow or PyTorch. Train the CNN on datasets MNIST**
	SLO-2					
S-13	**SLO-1**	Computational Challenges	Logistic Regression	Training Deep Neural Networks- Introduction	Restricted Boltzmann Machines - Introduction	Generative Adversarial Networks (GANs)- Training a Generative Adversarial Network ., Comparison with Variational Autoencoder
	SLO-2	The Secrets to the Power of Function Composition	Support Vector Machines	Backpropagation- Backpropagation with the Computational Graph Abstraction	Hopfield Networks	Using GANs for Generating Image Data , Conditional Generative Adversarial Networks
S-14	**SLO-1**	Common Neural Architectures	Neural Architectures for Multiclass Models	Dynamic Programming to the Rescue	The Boltzmann Machine	Competitive Learning -Vector Quantization

	SLO-2	Simulating Basic Machine Learning with Shallow Models	Multiclass Perceptron	Backpropagation with Post-Activation Variables	Restricted Boltzmann Machines	Kohonen Self-Organizing Map
S-15	**SLO-1**	Radial Basis Function Networks	Weston-Watkins SVM	Backpropagation with Pre-activation Variables	Applications of Restricted Boltzmann Machines	Limitations of Neural Networks -One-Shot Learning
	SLO-2	Restricted Boltzmann Machines	Multinomial Logistic Regression (Softmax Classifier)	Examples of Updates for Various Activations -The Special Case of Softmax	Stacking Restricted Boltzmann Machines	Energy-Efficient Learning
S-16-18	**SLO-1**	**Lab3: Implement a basic feedforward neural network with one or more hidden layers.**	**Lab6: Implement a basic feedforward neural network with one or more hidden layers. Train the network on a simple dataset for regression tasks.**	**Lab9:Implementation of a feedforward neural network trained using backpropagation for binary classification task**	**Lab12: Implement the training algorithm for the RBF network, such as the k-means clustering algorithm for determining the centers of the radial basis functions, and the least squares method for computing the weights.**	**Lab15: Implement a basic GAN for generating synthetic data samples. Train the GAN on datasets like the MNIST dataset for generating handwritten digits.**
	SLO-2					
	SLO-2					

Learning Resources	**Text;** 1. Text book – "Neural Networks and Deep Learning" 2. Springer International Publishing, June 2023 3. Aggarwal, Charu C. 4. Ian Goodfellow, Yoshua Bengio, Aaron Courville. ―Deep Learning‖, MIT Press Ltd, 2016 5. Li Deng and Dong Yu, ―Deep Learning Methods and Applications‖, Publishers Inc. 6. Satish Kumar "Neural Networks A Classroom Approach" Tata McGraw-Hill.	**Reference:** 1. JM Zurada ―Introduction to Artificial Neural Systems‖, Jaico Publishing House 2. M. J. Kochenderfer, Tim A. Wheeler. ―Algorithms for Optimization‖, MIt Press. **3.** Reference: "Deep Learning with Python" First Edition by Francois Chollet

Learning Assessment

	Bloom's Level of Thinking	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr Sathya K, Assistant Professor, SRM IST

Course Code	PGI20C06T	Course Name	Modern Optimization Techniques	Course Category	C	Professional Core Course	L	T	P	C
							4	0	0	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning
CLR-1 :	To impart the overall view of the subject of operations Research	
CLR-2 :	To apply mathematical models for solving real life problems	
CLR-3 :	To develop the student's ability and help to solve quantitative issues in information technology	
CLR-4 :	This mathematical modelling, provides the knowledge in planning, controlling and scheduling to the network analysis	
CLR-5 :	To develop the decision-making knowledge.	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1:	To understand the mathematical models and its limitations.	3	85	80
CLO-2 :	To have skill in analysis of data by graphical and other methods.	3	80	70
CLO-3 :	To enable the student to apply the technique in solving problem	3	70	65
CLO-4 :	To provide the students with opportunity of using various software package for solving linear programming and integer programming models	3	70	70
CLO-5 :	To introduce the students to the use of basic methodology for the solution of linear programs and integer programs	3	80	70

Program Learning Outcomes (PLO)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	ICT Skills	Leadership Skills	Life Long Learning
CLO-1:	M	L	L	-	L	-	L	-	M	L	L	L	M	M	L
CLO-2 :	-	L	H	-	H	-	L	-	H	M	H	M	L	M	L
CLO-3 :	M	M	H	-	H	-	M	-	M	M	H	M	L	M-	M
CLO-4 :	H	H	M	-	M	-	M	-	H	L	M	L	M	H	H
CLO-5 :	-	M	M	-	M	-	M	-	H	M	H	M	M	H	M

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Introduction to operations research	Introduction of Transportation	Introduction of game theory Basic definitions and Examples.	Introduction of Network Analysis	Introduction of Queuing theory, Basic Definitions
	SLO-2	Basic Definitions	Basic Definitions	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
S-2	SLO-1	Meaning of Operations Research	Mathematical formulation of LPP	Pure Strategies: Maximin -Minimax Principle	Advantages of Network Analysis	Elements of Queuing System
	SLO-2	Advantages of Operations Research	Finding initial Solution by Row-minima Method & Column-minima Method	Problems based on saddle point	limitations of Network Analysis	Kendal's Notation for representing Queuing models
S-3	SLO-1	Uses of Operations Research	Finding initial Solution by matrix-minima Method	Mixed strategy-based problems	Rules for constructing a project network	The average number of units in the system
	SLO-2	Nature of Operations Research	Finding initial Solution by North-West Corner Method	Finding value of the games with saddle points	Constructing project network	Finding probability of waiting time in the Queue

S-4	**SLO-1**	Role of Operations Research in computer science	Finding initial Solution by VAM Method	Finding value of the games without saddle points	Network computations by Critical path method	. Problems on (M/M/1)
	SLO-2	Role of Operations Research in Information technology	Find the initial solution for unbalanced transportation problem	Solving 2X2 games	Earliest start time of a project network	Introduction to Inventory, Types of Inventory
S-5 to S-8	**SLO-1**	Formulating the problem	Finding the optimum solution to maximize the profit	Solving 2X2 games	Earliest completion time of a project network	Application of Inventory
	SLO-2	Some Basic Assumptions	Calculating Optimum Solutions by MODI method	Matrix oddment method for nxn games	Latest start time of a project network	Some basic formulas
S-9	**SLO-1**	Standard form of LPP and Canonical form of LPP	Optimum Solution without Loop, ii) Optimum Solution with Loop	Matrix oddment method for nxn games	Latest completion time of a project network	Cost involved in inventory problem
	SLO-2	Graphical solution of a LPP	Introduction of Assignment problem	Introduction of Dominance property, Rules of Dominance	Network computations by PERT	Deterministic inventory models
S-10	**SLO-1**	Working Procedure for Graphical method	Hungarian procedure for solving Assignment Problem	Solving Games by Dominance property	Basic difference between PERT and CPM	Economic order quantity (E.O.Q)
	SLO-2	Solving LPP by Graphically	Mathematical Form & Difference between Transportation and Assignment Problems	Solving Games by Dominance property	Time estimates-Expected duration of each activity	Purchasing model with no shortages
S-11	**SLO-1**	Graphical Method, (i)Feasible Solution	Unbalanced Assignment Problem	solving game- Graphical method,	Time estimates-Expected variance of each activity and variance of project lengh	Problems on Purchasing model with no shortages
	SLO-2	, ii) Infeasible Solution, ii) Unbounded Solution	Finding the optimum solution to Restriction assignment method	Graphical Solutions of 2xM	Total float	Manufacturing model with no shortages
S-12	**SLO-1**	Simplex Method	Finding the optimum assignment to maximize the profit	Graphical Solutions of N x2	Free float andindependent float	Manufacturing model with no shortages
	SLO-2	Simplex Method	Solving the Travelling Salesmen Problem	.Limitations of Game Theory	**Problems on** Total float Free float andIndependent float	**Problems on** Manufacturing model with no shortages

Learning Resources	1.	C.R.Kothari, (2013)"Quantitative Techniques'' Third Revised Edition S.ChandLtd,NewDelhi.
	2.	V.Sundaresan, K.S.Ganapathy Subramanian, K. Ganesan (2017) "Resource Management Techniques" Eleventh Edition, A.R Publication.
	3.	Kallavathy.S, (2014) "Operations Research" Fourth Edition, Vikas publishing house.

Learning Assessment											
Level	**Bloom's Level of Thinking**	**(50% Continuous Learning Assessment weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (15%)**		**CLA – 3 (15%)**		**CLA – 4 (5%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	30%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	30%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100%	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers	
Experts from Higher Technical Institutions	**Internal Experts**
Dr.M.A.Baskar, Professor & Head, Dept. Of Mathematics, Loyola college, Chennai	**S.LAKSHMI PRIYA SRMIST Assistant Professor, Dept. Mathematics and Statistics, FSH, SRMIST**
Dr.P.Dhanavanthan, Professor & Head, Dept. Of statistics, Pondicherry University	

Course Code	PGI20D07J	Course Name	Data Engineering and Knowledge Representation	Course Category	D	Discipline Elective Courses	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	Introduction to data engineering	
CLR-2 :	Learn Data Modeling and Database Design	
CLR-3 :	Learn Big Data Processing and Analytics	
CLR-4 :	Learn Knowledge Representation	
CLR-5 :	Learn Advanced data engineering and knowledge representation	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related	Procedural Knowledge	Skills in Specialization	Ability to Utilize	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLO-1 :	Understand the basics of data engineering	3	80	70	H	H	M	L	M	M	-	M	-	L	-	-	M	-	-
CLO-2 :	Understand data modeling, ERD,Normalization,De-normalization,Index strategies	3	85	75	H	H	M	L	M	M	-	M	-	L	-	-	L	-	-
CLO-3 :	Apply the concepts of Big Data Technologies	3	75	70	M	M	L	L	L	H	-	M	-	H	-	-	L	-	-
CLO-4 :	Perform different knowledge representation techniques	3	85	80	M	M	L	L	L	H	-	M	-	H	-	-	M	-	-
CLO-5 :	Implement techniques for data quality and data governance	3	85	75	M	M	M	L	M	H	-	M	-	H	-	-	M	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Overview of Data Engineering: Definition and scope of data engineering in modern data ecosystems.	Introduction to Data Modelling: Fundamentals of data modelling and its importance in database development.	Introduction to Big Data Technologies: Overview of Big Data: Introduction to the concept of Big Data, its characteristics, and significance in modern data analytics.	Basics of Knowledge Representation Introduction to knowledge representation paradigms and models	Data Quality and Data Governance Techniques for data quality assessment and improvement
	SLO-2	Evolution of data engineering and its role in enabling data-driven decision-making.	Overview of different data modeling approaches and methodologies.	Evolution of Big Data Technologies: Historical overview of the development of Big Data technologies and frameworks.	Fundamentals of symbolic representation and semantic networks	Implementing data governance frameworks and policies
S-2	SLO-1	Importance of Data Engineering: Understanding the significance of data engineering in handling large volumes of data efficiently.	Conceptual, Logical, and Physical Data Models: Explanation of conceptual data models and their role in capturing high-level business requirements.	Batch Processing vs. Stream Processing: Batch Processing Overview: Explanation of batch processing, its principles, and applications in handling large volumes of data.	Ontologies and Knowledge Graphs Understanding ontology creation and management	Data Integration and ETL (Extract, Transform, Load) Processes Designing and implementing ETL pipelines for data integration

	SLO-2	Impact of effective data engineering on business intelligence, analytics, and machine learning initiatives.	Understanding logical and physical data models and their transformation process from high-level concepts to database implementation.	Stream Processing Overview: Introduction to stream processing, its advantages, and use cases in real-time data analytics.	Practical applications of knowledge graphs in various domains	Strategies for handling data transformations and data cleansing in ETL processes
S-3	**SLO-1**	Data Engineering Lifecycle: Phases involved in the data engineering lifecycle, including data ingestion, processing, transformation, and analysis.	Entity-Relationship Diagrams (ERD): Basics of ER modeling and its components such as entities, attributes, and relationships.	Hadoop Ecosystem (HDFS, MapReduce, Hive, Spark): Hadoop Distributed File System (HDFS): Overview of HDFS, its architecture, and role in storing and processing large datasets.	Semantic Web Technologies (RDF, OWL) Overview of Resource Description Framework (RDF) and its role in semantic web	Data Security and Privacy Implementing data encryption and access control measures
	SLO-2	Best practices for orchestrating and managing data workflows throughout the data engineering lifecycle	Practical techniques for creating ER diagrams to represent database structures and relationships.	MapReduce and Hive: Explanation of MapReduce programming model, Hive query language, and their integration with Hadoop ecosystem.	Introduction to Web Ontology Language (OWL) and its usage for expressing ontologies	Privacy-preserving techniques for data processing and sharing
S-4,5	**SLO-1** **SLO-2**	**Setting Up a Data Engineering Environment** **Data Ingestion Using Apache Kafka** **Data Processing with Apache Spark** **Data Storage with Hadoop Distributed File System (HDFS)**	**Lab 4 Creating Entity-Relationship Diagrams** **Designing Relational Database Schemas** **Normalization and Denormalization**	**Lab 7: NoSQL Database Implementation**	**Lab 10: Semantic Web Technologies (RDF, OWL)**	**Lab 13: Data Integration and ETL (Extract, Transform, Load) Processes**
S-6	**SLO-1**	Data Ingestion, Processing, Storage, and Retrieval: Techniques and methodologies for ingesting data from diverse sources into data storage systems.	Relational Database Design Principles: Principles of relational database design including atomicity, consistency, isolation, and durability (ACID).	NoSQL Databases (MongoDB, Cassandra): MongoDB Overview: Introduction to MongoDB, a document-oriented NoSQL database, its features, and use cases.	Reasoning and Inference in Knowledge Representation Types of reasoning mechanisms in knowledge representation systems	Machine Learning for Data Engineering Leveraging machine learning for data cleansing and anomaly detection
	SLO-2	Strategies for processing, storing, and retrieving structured and unstructured data at scale.	Designing normalized relational database schemas to minimize redundancy and ensure data integrity.	Apache Cassandra Overview: Overview of Apache Cassandra, a distributed NoSQL database, its architecture, and benefits.	Techniques for logical inference and deduction in knowledge-based systems	Incorporating machine learning models into data engineering pipelines for predictive analytics
S-7	**SLO-1**	Tools and Technologies in Data Engineering: Overview of popular data engineering tools and platforms, such as Apache Spark, Hadoop,	Normalization and Denormalization Techniques: Explanation of normalization forms (e.g., 1NF, 2NF, 3NF) and their significance in database design.	Data Warehousing and OLAP: Data Warehousing Concepts: Introduction to data warehousing, its architecture, and role in decision support systems.	Knowledge Representation Languages Comparison of different knowledge representation languages (e.g., Prolog, CycL)	Emerging Trends in Data Engineering Adoption of data mesh architecture for decentralized data management
	SLO-2	Comparison of different tools and technologies	Understanding denormalization techniques to optimize query performance and facilitate data retrieval.	In OLAP (Online Analytical Processing): Explanation of OLAP concepts, multidimensional data analysis, and OLAP cube design.	Syntax and semantics of Description Logics (DL) for knowledge representation	Integration of MLOps practices for streamlining machine learning model deployment and management

S-8	**SLO-1**	Data Engineering in Cloud Environments: Advantages and challenges of implementing data engineering solutions in cloud environments, such as AWS, Azure, and Google Cloud Platform.	Indexing Strategies: Overview of indexing concepts and their importance in optimizing query performance.	Stream Processing Frameworks: Introduction to stream processing frameworks such as Apache Flink and Apache Kafka Streams.	Knowledge Extraction and Acquisition Methods for extracting structured knowledge from unstructured data sources	Graph Databases and Knowledge Graph Technologies Designing and querying graph databases for knowledge representation
	SLO-2	Best practices for leveraging cloud-based services and infrastructure for data storage, processing, and analytics.	Strategies for selecting appropriate indexing techniques based on query patterns and data access patterns.	Real-time Analytics: Real-time Data Processing: Overview of real-time data processing techniques, their importance, and applications.	Techniques for knowledge acquisition from domain experts and external repositories	Utilizing knowledge graph technologies for semantic search and recommendation systems
S-9,10	**SLO-1**	**Lab 2 : Building ETL Pipelines**	**Lab 5: Indexing and Query Optimization Database Implementation with SQL**	**Lab 8: OLAP Cube Design and Implementation**	**Lab 11 Knowledge Representation Languages Knowledge Extraction and Acquisition**	**Lab 14 Anomaly Detection with Machine Learning**
S-11	**SLO-1**	Real-time Data Processing: Techniques and architectures for processing streaming data in real-time, including stream processing frameworks like Apache Flink and Apache Storm.	Constraints and Data Integrity: Types of constraints (e.g., primary key, foreign key, unique constraint) and their role in maintaining data integrity.	Data Lake Architecture: Data Lake Overview: Explanation of data lake architecture, its components, and benefits for storing and analyzing large volumes of data.	Knowledge Representation in Machine Learning Integration of symbolic knowledge representation with machine learning algorithms	Quantum Computing and Knowledge Representation Exploring the potential impact of quantum computing on knowledge representation algorithms
	SLO-2	Data Quality Management: Strategies and frameworks for ensuring data quality throughout the data engineering lifecycle, including data profiling, cleansing, and validation.	Techniques for enforcing constraints and ensuring data consistency within a database.	Data Lake Implementation: Considerations and best practices for designing and implementing a data lake architecture.	Hybrid approaches for combining statistical learning with symbolic reasoning	Explainable AI in Knowledge Representation Techniques for enhancing the interpretability of knowledge representation models
S-12	**SLO-1**	Scalability and Performance Optimization: Techniques for scaling data engineering solutions to handle growing volumes of data and increasing workloads.	Data Modeling Tools: Overview of popular data modeling tools such as ERwin, Lucidchart, and MySQL Workbench.	Scalable Data Storage Solutions: Scalable Storage Architectures: Overview of scalable storage architectures such as distributed file systems and object storage.	Knowledge Graph Embeddings Introduction to knowledge graph embedding techniques (e.g., TransE, DistMult)	Augmented Data Management Leveraging augmented reality interfaces for data visualization and exploration
	SLO-2	Optimization strategies for improving the performance of data processing pipelines, including parallelization, caching, and resource allocation.	Advanced Database Design Patterns: Exploration of advanced database design patterns such as star schema, snowflake schema, and graph database modeling.	Cloud Storage Solutions: Introduction to cloud storage services like Amazon S3, Google Cloud Storage, and their scalability features.	Applications of knowledge graph embeddings in link prediction and entity classification	Integrating AI-driven data management tools for automating data governance tasks

S-13	**SLO-1**	Emerging Trends in Data Engineering: Exploration of emerging technologies and trends shaping the future of data engineering, such as serverless computing, edge computing, and AI-driven data management.	Big Data Modeling Considerations: Considerations for modeling data in big data environments, including schema-on-read vs schema-on-write approaches.	Emerging Trends in Big Data Technologies: - Edge Computing: Explanation of edge computing concepts, its role in processing data closer to the source, and its impact on Big Data analytics.	Applications of Knowledge Representation in AI Use of knowledge representation techniques in natural language processing (NLP) tasks	Continuous Intelligence and Real-time Decision Making Implementing real-time analytics systems for continuous intelligence
	SLO-2	Emerging Trends in Data Engineering: Exploration of emerging technologies and trends shaping the future of data engineering, such as serverless computing, edge computing, and AI-driven data management.	Techniques for designing flexible and scalable data models to accommodate the volume, velocity, and variety of big data sources.	Server less Computing: Introduction to server less computing models such as AWS Lambda, Azure Functions, and their applications in Big Data processing.	Knowledge-based systems for decision support and expert systems	Enabling real-time decision-making through event-driven architectures and stream processing frameworks Top of Form
S-14,15	**SLO-1** **SLO-2**	**Lab 3 : Real-time Data Processing with Apache Flink** **Top of Form**	**Lab 6: Data Migration and Conversion**	**Lab 9: Data Lake Implementation**	**Lab 12: Knowledge Representation in Machine Learning**	**Lab 15: Graph Databases and Knowledge Graph Technologies**

Learning Resources	1."Data Science for Business" by Foster Provost and Tom Fawcett 2."Designing Data-Intensive Applications" by Martin Kleppmann 3."Semantic Web for the Working Ontologist" by Dean Allemang and James Hendler

Learning Assessment

Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.B.Srividhya, Assistant Professor, SRMIST KTR

Course Code	PGI20D08J	Course Name	Introduction to Robotics Automation	Course Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning	Program Learning Outcomes (PLO)

		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	To Understanding the Evolution and Classification of Robotics			
CLR-2 :	To Exploring Automation Principles and Technologies			
CLR-3 :	To Developing Proficiency in Python Programming for Robotics			
CLR-4 :	To Hands-On Experience with Raspberry Pi and Python Integration			
CLR-5 :	To Understanding Robot Kinematics, Dynamics, and Control			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLO-1 :	Demonstrate Proficiency in Python Programming for Robotics	3	80	70	L	H	M	L	L	-	L	-	L	-	-	-	L	-	-
CLO-2 :	Apply Kinematics and Dynamics Principles to Robot Systems	3	85	75	H	H	H	M	L	-	L	-	L	-	-	-	-	-	-
CLO-3 :	Utilize Python for Advanced Robot Control Techniques	3	75	70	M	H	M	H	L	-	-	-	L	-	-	-	L	-	-
CLO-4 :	Develop and Implement Machine Learning Algorithms for Robotics	3	85	80	M	H	M	H	L	-	-	-	L	-	-	-	L	-	-
CLO-5 :	Contribute to Ethical and Responsible Robotics Development	3	85	75	H	H	M	H	L	-	-	-	L	-	-	-	L	-	M

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Fundamentals of Robotics	Robot Kinematics and Dynamics - Homogeneous Transformations	Robot Control Systems- Advanced Control Techniques	Advanced Robotics : Machine Learning for Robotics	Robotics, Automation, and Society
	SLO-2	History and evolution of robotics (from early automata to modern robots)	-Representing positions and orientations in 3D space	Model predictive control (MPC)	Introduction to supervised and reinforcement learning	The Future of Work and Robotics

S-2	**SLO-1**	Classification of robots (industrial, service)	Homogeneous transformation matrices	Adaptive control	Applications of machine learning in robot control	Impact of automation and robotics on the future of work
	SLO-2	Classification of robots mobile, special-purpose)	Forward and inverse kinematics of serial manipulators	Nonlinear control	Applications of machine learning in robot perception, and decision-making	Job displacement with robotics
S-3	**SLO-1**	Robot anatomy (arms, manipulators, end-effectors, sensors, actuators)	Implement homogeneous transformation calculations in Python for basic robot kinematics.	Introduce advanced control techniques and their potential applications in robotics	Deep learning techniques for robotics	Reskilling opportunities with robotics
	SLO-2	Kinematics and dynamics (position, velocity, acceleration analysis)	Robot Dynamics-Lagrangian and Newtonian mechanics	scikit-learn for machine learning components	Implement basic machine learning algorithms (e.g., decision trees, reinforcement learning) in Python for robot control tasks.	Ethical considerations in workforce automation
S-4-5	**SLO-1**	**Lab:1 Introduction to Raspberry Pi -Setting up and configuring Raspberry Pi**	**Lab: 4 Kinematics and Dynamics Simulation -Using simulation software (e.g., V-REP, Gazebo) to model and simulate robot kinematics and dynamics**	**Lab:7 Advanced Control System Implementation -Design and implement advanced control systems (MPC) for robot control tasks using Python.**	**Lab:10 Machine Learning for Robot Control: Train and implement machine learning models using Python for specific robot control tasks (e.g., object recognition, path planning).**	**Lab:13 Robotics Project** **Students will select a project topic related to robotics or automation, applying the knowledge and skills acquired throughout the program**
	SLO-2	**Introduction to Raspberry Pi operating system** **GPIO (General Purpose Input/Output) programming with Raspberry Pi-Interfacing sensors and actuators with Raspberry Pi**	**Implement Python scripts to interact with simulation software and analyze robot behavior.**	**Experiment with different control strategies and evaluate their performance.**	**Evaluate the performance of machine learning models and refine them for improved results.**	
S-6	**SLO-1**	Python concepts	Equations of motion for robots	Motion Planning and Navigation	Human-Robot Interaction (HRI)	Robotics and Social Responsibility
	SLO-2	Introduce Python concepts for basic robot control.	Trajectory planning and control	Path planning algorithms (A*, Rapidly-exploring Random Trees (RRT))	Principles of user-centered design for robotics	Algorithmic bias and fairness in robotics
S-7	**SLO-1**	Automation Fundamentals - Automation principles and benefits (increased efficiency, productivity, and safety)	Introduce basic concepts of robot dynamics and relate them to Python-based control algorithms.	Trajectory planning (kinematic and dynamic considerations)	Human factors and ergonomics in robot interaction	Safety and security concerns
	SLO-2	Types of automation (fixed, programmable, flexible)	Robot Perception-Fundamentals of robot vision (cameras, image processing)	Obstacle avoidance and navigation strategies	Safe and effective collaboration between humans and robots	Safety and security concerns in autonomous systems
S-8	**SLO-1**	Automation technologies (sensors, actuators, control systems)-	Sensor fusion for robots (combining data from multiple sensors)	motion planning algorithms in Python	Design and implement user interfaces for robot interaction using Python.	Responsible development of robotics technologies
	SLO-2	Industrial automation applications (manufacturing, assembly, logistics)-	Localization and mapping techniques (SLAM)	simulate robot navigation scenarios	Explore ethical considerations in HRI	Deployment of robotics technologies.

S-9-10	**SLO-1**	**Lab2:Python Programming for Robotics Applications - Controlling simple robots (e.g., line following robots) using Python and Raspberry Pi.**	**Lab 5:Robot Vision with Raspberry Pi Camera -Image acquisition and processing using Raspberry Pi camera.**	**Lab:8 Robot Navigation Simulation -Utilize simulation software (ROS with Gazebo) to develop and test robot navigation algorithms using Python.**	**Lab:11 HRI Project :Design and develop a project that demonstrates effective human-robot interaction using Python or other suitable platforms.**	**Lab: 14 The project will involve: Defining the project scope and objectives.**
	SLO-2	**Data acquisition and processing from sensors using Python**	**Object detection and recognition using Python libraries (OpenCV).**	**Design and simulate various navigation scenarios with obstacles and dynamic environments.**	**Emerging Trends in Robotics:Bio-inspired robotics.**	**Researching the chosen topic and identifying relevant ethical considerations.**
S-11	**SLO-1**	The role of Python in automation scripting and	The role of Python libraries like OpenCV in robot vision and image processing.	Motion Planning Algorithms - Overview of motion planning algorithms: A*, RRT, PRM, Dijkstra's algorithm,	Swarm robotics	Legal and Regulatory Frameworks
	SLO-2	control systems	Perception Algorithms - Object detection(YOLO, SSD) and recognition.	Explanation of each algorithm with examples and pseudocode	Soft robotics	Existing and emerging legal frameworks for robotics
S-12	**SLO-1**	Introduction to Python Programming -Python basics (data types, variables, operators, control flow)	Semantic segmentation algorithms (FCN, U-Net)	Pros and cons of different motion planning techniques	Ethical and societal implications	Emerging legal frameworks for automation
	SLO-2	Functions, modules, and libraries (NumPy, Pandas, Matplotlib)	Tracking and localization - Mapping	Introduction to robot simulation environments	Ethical and societal implications of advanced robotics	Regulatory requirements for safe and ethical deployment of robots
S-13	**SLO-1**	Object-oriented programming concepts	Object tracking algorithms (Kalman filter, particle filter)	Setup and configuration of a basic robot model in the simulation environment	Analyze and discuss the trends in robotics	Analyze legal and regulatory frameworks
	SLO-2	Introduction to numerical computing and data analysis with Python libraries (NumPy, Pandas)	Applications and Future Trends	Integration of motion planning algorithms with the simulation environment	Explore the challenges of emerging trends in robotics and their impact on society.	Explore the frameworks relevant to the chosen field of specialization within robotics and automation.
S-14-15	**SLO-1**	**Lab:3 Implementing basic control algorithms (e.g., PID control) in Python.**	**Lab:6 Develop Python programs for camera interfacing, image capture. Basic object recognition using Raspberry Pi.**	**Lab:9 Autonomous Navigation-Integrate mapping, localization, path planning, and obstacle avoidance.**	**Lab:12 Design and develop a project that demonstrates effective human-robot interaction using Raspberry Pi or other suitable platforms.**	**Lab: 15 Designing and implementing the project using Python, Raspberry Pi, or other suitable tools and technologies.**
	SLO-2	**Develop Python programs for robot communication, sensor data acquisition, and control using Raspberry Pi.**		**Design and simulate various navigation scenarios with obstacles and dynamic environments.**		**Testing and evaluating the project's performance and addressing any ethical concerns, Documenting the project and presenting the findings.**

Learning Resources	Text book: 1."Robotics: Principles and Practice" Authors: Kamen, Stephen J., Frank C. Sup Publisher: Pearson Edition: Third Edition. 2. "Python Robotics: A Guide to Develop Intelligent Robots Using Python and TensorFlow". Authors: Prof. Diwakar Vaish, Publisher: Apress. 3."Robot Modeling and Control", Authors: Mark W. Spong, Seth Hutchinson, M. Vidyasagar, Publisher: Wiley.	Reference Book: 1. "Computer Vision: Algorithms and Applications", Authors: Richard Szeliski, Publisher: Springer. 2. "ROS Robotics By Example", Authors: Carol Fairchild, Dr. Thomas L. Harman, et al., Publisher: Packt Publishing.

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.R.Thilagavathy Department of Computer Applications, SRMIST

Course Code	PGI20D09J	Course Name	Android Applications Development	Course Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	To understand mobile application development trends and Android platform	
CLR-2 :	To utilize the features in android studio and analyze the need of simple applications	
CLR-3 :	Implement innovative ideas into Android applications for diverse purposes.	
CLR-4 :	To empower learners to pursue careers in the field of Android mobile application development.	
CLR-5 :	To strategize, organize, and construct a unique Android application from inception to functionality.	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Recognize current mobile development trends and Android platform advancements effectively.	3	80	70
CLO-2 :	Employ Android Studio features to assess and create basic applications.	3	85	75
CLO-3 :	Apply creative concepts to develop versatile Android applications for various needs.	3	75	70
CLO-4 :	Enable learners to pursue Android app development careers confidently.	3	85	80
CLO-5 :	Strategically plan, organize, and execute Android app projects proficiently.	3	85	75

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related	Procedural Knowledge	Skills in Specialization	Ability to Utilize	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
H	H	M	L	L	-	-	-	L	-	-	-	-	-	-
H	H	H	M	L	-	-	-	L	-	-	-	-	-	-
M	H	M	H	L	-	-	-	L	-	-	-	-	-	-
M	H	M	H	L	-	-	-	L	-	-	-	-	-	H
H	H	M	H	L	-	-	-	L	-	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Getting started with android programming-Introduction	Understanding the component of a screen	Data persistence	Messaging and networking	Location based services
	SLO-2	Understanding Android OS	Views and view groups	Saving and loading user preferences	SMS messaging	Displaying maps
S-2	SLO-1	Android versions and its feature set and Android architecture	Absolute layout, table layout, relative layout, frame and scrollview	Using getSharedPreferences() and getPreferences()	Sending SMS messages programmatically	Creating the project
	SLO-2	Android devices in the market	Adapting to display orientation	Persisting data to files	Getting feedback after sending the message	Obtaining the maps API key
S-3	SLO-1	Obtaining the required tools	Managing changes to screen orientation	Saving to internal storage	Sending SMS messages using intent	Displaying the map
	SLO-2	Eclipse, Android SDK, Android Development Tools (ADT)	Persisting State Information during Changes in Configuration Detecting orientation changes, Controlling the orientation activity	Saving to external storage,	Receiving SMS messages, Updating an activity from Broadcast Receiver,	Displaying the Zoom control

S-4-5	**SLO-1**	**Lab1: Login page creation with Toast message**	**Lab 4: implement implicit Intent**	**Lab 7: Student Registration form using Basic and List view**	**Lab 10: Shared preferences**	**Lab 13: Simulate paintbrush applications**
	SLO - 2					
S-6	**SLO-1**	Creating Android Virtual Devices (AVD)	Creating the user interface programmatically, Listening for UI notifications	SQLite database	Invoking an activity from Broadcast Receiver	Changing views
	SLO-2	Example: Creating android application	designing user interface using views	SQLite database Creating and using databases,	Example program: SMS messages	Satellite View
S-7	**SLO-1**	Anatomy of an Android Application and Real time applications	Basic views	Insert, display and delete	Sending E-mail	Navigating to a specific location
	SLO-2	Understanding Activities	Picker views	Creating the DB Adapter helper class	Example: How to send email in android application	Adding markers
S-8	**SLO-1**	Linking activities using intents	List views	Using the database programmatically	Networking	Getting the location that was touched
	SLO-2	Resolving intent filter collision	Displaying pictures using Image View	Example: Add, retrieve, update, delete a contact	Binary data and Text data	Get coding and reverse geocoding, getting location data
S-9-10	**SLO-1**	**Lab 2: Student registration form with Toast message**	**Lab 5: Implement Time Picker**	**Lab 8: Implement Context menu**	**Lab 11: Storing data to file in Internal storage**	**Lab 14: Draw an object**
	SLO-2					
S-11	**SLO-1**	Returning results from an intent	Using menus with views	Content providers	Downloading text files	Preparing for publishing APK files
	SLO-2	Passing data using an intent object	Option menu, Context Menu	Sharing data in android using content provider	Example program for downloading textiles	Versioning, Digitally Signing Your Android Applications
S-12	**SLO-1**	Implicit Intent	Example for menus with views	Predefined query string constants	downloading binary data	Deploying apk files
	SLO-2	Explicit Intent	Some additional views-	Projections, Filtering, sorting	Example program for downloading binary data	Using adb.exe tool and web server
S-13	**SLO-1**	Calling Built-in Applications Using Intent	Analog Clock view	Creating your own content providers	Accessing Web services	Publishing on the Android market
	SLO-2	Understanding intent object	Digital Clock View	Using the content providers	Performing Asynchronous Calls	Creating a Developer Profile, Submitting Your Apps
S-14-15	**SLO-1**	**Lab3: Implement Explicit Intent**	**Lab 6: Implement Date Picker**	**Lab 9: Implement Option Menu**	**Lab 12: SQLite database**	**Lab 15: Implement WebView**
	SLO-2					

Learning Resources	1.WeiMeng Lee (2012), "Beginning Android Application Development", Wrox Publications (John Wiley, New York) (For 1 to 5 units).	1.Ed Burnette (2010), "Hello Android: Introducing Google's Mobile Development Platform", The Pragmatic Publishers, 3rd edition, North Carolina USA 2.Reto Meier (2012), "Professional Android 4 Application Development", Wrox Publications (John Wiley, New York). 3.ZigurdMednieks, Laird Dornin, Blake Meike G, Masumi Nakamura (2011), "Programming Android: Java Programming for the New Generation of Mobile Devices", OReilly Media, USA

Learning Assessment											
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%) #**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr. P. Chanthini, Assistant Professor, SRMIST KTR

Course Code	PGI20D10J	Course Name	IOT Cloud Infrastructure and IOT Protocols	Course Category	D	Discipline Elective Courses	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning	Program Learning Outcomes (PLO)

		1	2	3
CLR-1 :	Understanding cloud basics is vital for IoT.			
CLR-2 :	Knowing IoT protocols ensures effective device communication.			
CLR-3 :	Security is crucial in cloud-based IoT setups.			
CLR-4 :	Familiarity with cloud IoT platforms streamlines IoT development.			
CLR-5 :	Staying updated with IoT trends is essential for future readiness.			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	Explain what cloud computing is and its importance in IoT.	2	85	80	M	-	-	-	M	-	-	-	-	-	-	-	-	-	L
CLO-2 :	Compare and select IoT protocols for different IoT applications.	3	85	80	H	-	H	H	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Implement security measures for safeguarding IoT data in the cloud.	3	85	80	-	H	M	H	-	-	-	-	-	-	H	-	-	-	-
CLO-4 :	Manage and integrate IoT devices with leading cloud platforms.	3	85	80	-	-	H	H	H	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Analyze emerging trends and research areas in IoT cloud infrastructure and protocols.	3	85	80	-	H	-	-	H	-	-	-	-	-	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	**Introduction to IoT Cloud Infrastructure:**Definition and significance of cloud computing	**Cloud Platforms for IoT:** Overview of AWS IoT Core	**IoT Protocols:** Introduction to IoT communication protocols	**Security and Data Management in IoT Cloud :**Security challenges in cloud-based IoT deployments	**Advanced Topics in IoT Cloud:** Block chain technology for secure IoT transactions
	SLO-2	Characteristics of cloud services	Key features and services offered by AWS IoT	MQTT (Message Queuing Telemetry Transport): Overview and applications	Data encryption techniques for IoT communication	IoT standards and interoperability
S-2	SLO-1	Cloud service models: IaaS, PaaS, SaaS	Microsoft Azure IoT Suite: Introduction and features	CoAP (Constrained Application Protocol): Features and benefits	Ensuring data integrity in cloud-based IoT solutions	DevOps practices in IoT cloud deployments
	SLO-2	Overview of major cloud service providers	Google Cloud IoT Core: Overview and capabilities	HTTP and HTTPS protocols for IoT applications	Role-based access control (RBAC) in IoT cloud environments	Continuous integration and continuous deployment (CI/CD) in IoT
S-3	SLO-1	IoT applications and cloud computing	Comparison of major cloud IoT platforms	AMQP (Advanced Message Queuing Protocol) in IoT	IoT security best practices	Case studies of innovative IoT deployments

	SLO-2	Cloud-based IoT architecture	Device provisioning and management on cloud platforms	Comparison of IoT protocols: Performance, scalability, and security	Data management strategies for IoT applications	Ethical considerations in IoT cloud deployments
S-4 to S-5	SLO-1	**Lab1: 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**	**Lab 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.**	**Lab 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).**	**Lab 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.**	**Lab 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.**
S - 6	SLO-1	Challenges in implementing IoT on cloud infrastructure	Message brokering and routing in cloud-based IoT solutions	Interoperability challenges in IoT protocol implementations	Data storage options: Databases, data lakes, and data warehouses	Privacy concerns in IoT cloud deployments
	SLO-2	Edge computing vs. cloud computing in IoT	IoT analytics and insights using cloud services	MQTT vs. CoAP: Choosing the right protocol for IoT applications	Real-time data processing and analytics in IoT cloud environments	Future directions in IoT cloud infrastructure and protocols
S-7	SLO-1	Fog computing and its role in IoT	Integration of IoT devices with cloud platforms	Securing IoT communication using TLS/SSL	Data visualization and dashboards for IoT applications	IoT ecosystem and industry trends
	SLO-2	Scalability and elasticity in cloud-based IoT solutions	Security measures in cloud-based IoT deployments	Authentication and authorization mechanisms in IoT	Edge computing and its role in IoT	Challenges and opportunities in IoT cloud deployments
S-8	SLO-1	Cost considerations for deploying IoT on cloud platforms	IoT security best practices	Data integrity in cloud-based IoT solutions	Serverless computing for IoT applications	IoT security regulations and compliance
	SLO-2		Role-based access control (RBAC) in IoT cloud environments	Data storage options for IoT applications	Hybrid cloud architectures for IoT deployments	Sustainable IoT cloud solutions
S-9 to S-10	**SLO-1**	**Lab2: MQTT Subscriber: Create a program to subscribe to MQTT topics on Node MCU**	**Lab 5: Security Measures: Secure communication between Node MCU and cloud services using TLS/SSL encryption and implement authentication mechanisms**	**Lab 8: Data Visualization: Interface Node MCU with a cloud-based data visualization platform (e.g., Thing Speak, Grafana) to visualize sensor data in real-time.**	**Lab 11: MQTT Publisher: Develop a Python script on Raspberry Pi to publish data from sensors connected to GPIO pins to an MQTT broker hosted on a cloud platform**	**Lab 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 storage service (e.g., Google Cloud Storage, AWS S3).**
S-11	SLO-1	Case studies of successful IoT deployments on cloud infrastructure	Real-time data processing and analytics in IoT cloud environments	Data streaming and event processing in IoT applications	Containerization and micro services in IoT cloud solutions	Emerging technologies in IoT cloud infrastructure
	SLO-2	Future trends in cloud-based IoT	Data encryption techniques for IoT communication	Implementing firmware updates over-the-air (OTA)	IoT platforms and frameworks for rapid development	Industry partnerships and collaborations in IoT cloud deployments
S-12	SLO-1	Ethical considerations in IoT cloud deployments	Data visualization and dashboards for IoT applications	Implementing RESTful APIs for IoT data exchange	Machine learning and AI in cloud-based IoT solutions	Research directions in IoT cloud infrastructure and protocols
	SLO-2	Regulatory compliance in IoT cloud deployments	AWS IoT Greengrass	Message Queueing Protocol (MQP)	Compliance, Governance, and Risk Management	Smart cities and urban IoT deployments
S-13	SLO-1	Cloud Service Deployment Models	Azure IoT Edge	Message Queueing Telemetry Transport (MQTT)	Physical Security and Environmental Controls	IoT for environmental monitoring and sustainability
	SLO-2	IoT Edge Device Management	Google Cloud IoT Edge	Extensible Messaging and Presence Protocol (XMPP)	IoT Endpoint Security	Wearable technology and healthcare IoT applications
S-14 to S-15	SLO-1	**Lab 3: HTTP Client: Implement an HTTP client on NodeMCU to send sensor data to a cloud-based server**	**Lab 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.**	**Lab 9: Device Shadowing: Implement device shadowing functionality on NodeMCU to synchronize device states and configurations with a cloud-based IoT platform.**	**Lab 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.**	**Lab 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.**

Learning Resources	1. "Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry" by Maciej Kranz. 2. "IoT Solutions in Microsoft's Azure IoT Suite: Data Acquisition and Analysis in the Real World" by Scott Klein, Manisha Yadav, and Nishith Pathak	1. "Hands-On MQTT Programming with Python: Work with the lightweight IoT protocol in Python" by Gastón C. Hillar. 2. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" by David Hanes, Gonzalo Salgueiro, and Patrick Grossetete. 3. "Practical IoT Projects with AWS: IoT Analytics, Machine Learning, and a Serverless Architecture with Amazon Web Services" by Sunil Gupta.

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	20%	20%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	10%	10%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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Course Code	PGI20D11J	Course Name	Augmented Reality and Virtual Reality for Game Development	Course Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning

		1	2	3
		Level of Thinking (Bl...)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Gain introductory experience in Unity Programming with C#			
CLR-2 :	To provide a strong theoretical grip on AR technology			
CLR-3 :	Implement augmented reality apps from the developer's perception.			
CLR-4 :	Use Unity to efficiently create AR apps for Android, iOS, and Windows platforms			
CLR-5 :	Navigate the Unreal Engine interface and understand its key features.			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:			
CLO-1 :	Discover the potential of immersive VR & AR	3	80	70
CLO-2 :	Understand the techniques, processes , applications in immersive AR	3	85	75
CLO-3 :	Gain the Practical Understanding of Unity software	3	75	70
CLO-4 :	Handle scripting and events using Unity	3	85	80
CLO-5 :	Gain a high-level understanding of game engine principles along with an overview of the Unreal's basic operation logic.	3	85	75

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related	Procedural Knowledge	Skills in Specialization	Ability to Utilize	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
H	L	-	L	-	-	L	-	-	-	-	-	-	-	-
H	H	-	M	L	-	-	-	-	-	-	-	-	-	-
M	M	M	L	M	H	M	-	-	-	-	-	-	-	-
M	H	-	L	M	H	H	-	-	M	-	-	-	-	-
M	H	M	L	H	H	L	-	-	L	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Virtual Reality: An Overview	What is AR?	Unity for AR & VR	Scripting in Unity	Overview of Unreal Engine
	SLO-2	Introduction	Terminologies	Unity Interface	Setting up the Scripting Environment	Installing and Setting up Unreal Engine
S-2	SLO-1	History and Tech Developments	Types of AR	Create Gameplay	Creating and Using Scripts	UI and Navigation
	SLO-2	Types of VR	Current AR Technologies	Scenes, GameObjects	Instantiating Prefabs at runtime	Working with Unreal projects and templates
S-3	SLO-1	Pros and Cons of VR	Hardware	Prefabs, Layers, Constraints	Order of Execution for event functions	Unreal Editor Interface
	SLO-2	Types of VR systems and hardware	Tracking System for AR	Lights , Cameras, Publishing Builds	Event Functions	Content Browser
S-4-5	SLO-1	**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**
	SLO - 2					

S-6	**SLO-1**	Components of VR systems	AR Displays	Assets Workflow-Importing Assets	Coroutines	Assets and Packages
	SLO-2	VR Software and Tools	Softwares	Assets Database	Namespaces	Working with Assets, Migrating Assets
S-7	**SLO-1**	VR Tracking Systems	AR Development tools	Asset Bundles	Attributes	Actors and Geometry
	SLO-2	Comparing Immersive and Non-immersive VR UI	Benefits	Scripting with Assets	UnityEvents	Select, Place, Transform, Group,Snap and Merge Actors
S-8	**SLO-1**	Visual Perception of VR	Disadvantages	Introduction to 2D game development	Few important Classes in Unity	Components of Unreal: AI, Audio, Camera, Light Components
	SLO-2	Acoustic Perception of VR	Examples of AR applications	2D Sorting	Unity Architecture	Components of Unreal: Rendering, Shape, Mesh and Widget components
S-9-10	**SLO-1**	**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.**
	SLO-2					
S-11	**SLO-1**	Haptic Perception of VR	Gamification for Education5.0	Working with Sprites	Multiplayer	Levels-Work with Level Assets
	SLO-2	How AR & VR works together?	AR games for Education	Tilemaps	Audio Files, Mixers. Profilers	Managing Multiple Levels
S-12	**SLO-1**	Impact of VR on Human Lives	General Software Tools for Gamification	Tilemaps Workflow	Video Overview	World Settings
	SLO-2	Gesture Interaction in VR	AR Apps for Education	World Building	Animation Clips	Playing & Simulating
S-13	**SLO-1**	Enabling Technologies in VR	Multidisciplinary use of AR	Terrain & Tools	Animation Controllers	Building Virtual Worlds-Water, foliage , Fog Effects
	SLO-2	Applications of VR	Future of AR in Education	Tree Editor	Playables API	Blueprint Visual Scripting
S-14-15	**SLO-1**	**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., health bar, score display).**	**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**
	SLO-2					

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/

Learning Assessment											
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%) #**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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Course Code	PGI20D12J	Course Name	Working with Generative AI and Large Language Models	Course Category	D	Discipline Specific Elective Courses	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the Gen AI and LLMs
CLR-2 :	To acquire the basic concept of LLM
CLR-3 :	Gain foundational knowledge, practical skills and functional understanding of how generative AI works
CLR-4 :	To build applications using LLMs
CLR-5 :	To impart knowledge of LLM

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Understand the basic concept of LLMs	3	80	70
CLO-2 :	To gain knowledge for developing LLM applications	3	85	75
CLO-3 :	Implement and train a neural language model	3	75	70
CLO-4 :	Explore techniques for fine tuning pre-trained language models	3	85	80
CLO-5 :	Understand how to apply LLMs to a variety of applications	3	85	75

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
L	H	-	H	L	-	-	-	M	-	-	H	-	-	-
M	H	L	M	L	-	-	-	M	-	-	H	-	-	-
M	H	-	H	L	-	-	-	M	L	-	H	-	-	-
M	H	-	H	L	-	-	-	M	L	-	H	-	-	-
L	H	-	H	L	-	-	-	M	L	-	H	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to Language Model- Distributions over Strings	Neural Network Language Models	Large Language Models- Examples GPT-3, BERT, RoBERTa, BLOOM	Introduction to BERT	Introduction to BART
	SLO-2					
S-2	SLO-1	Global and Local Normalization	Recurrent Neural Language Models	GPT-3 Architecture	What is a Bidirectional encoder representations from Transformer (BERT)	Architecture of BART
	SLO-2					
S-3	SLO-1	Tight Language Models Modeling Foundations -Representation-based Language Models -Estimating a Language model from Data	Human Language is not Context free	The need for Fine -tuning LLMs Benefits of Multitask instruction Fine Turning	BERT Training Phrases	Pre-training
	SLO-2		General Results and Tightness Elman and Jordan Networks		Pretrain Fine tune	
S-4 S-5	SLO-1	**Lab 1: Write a python program to implement statistical language model.**	**Lab 4: Sentiment analysis using Recurrent Neural Network**	**Lab7: Generate text using OpenAi's GPT-3 with python.**	**Lab 12:Using Pre-trained BERT model for Summarization**	**Lab 15: Write a python program for text generation using BART model.**
	SLO-2					

		LAB: Write a python program to implement Finite State Machine for a traffic light				
S-6	**SLO-1**	Classical Language Models	Variations on Recurrent Networks Representational capacity of Recurrent Neural Networks	Fine-Tuning GPT-3 using the OpenAI API and python LLMs Use Cases Code generation	How a BERT model can be reused for different purpose How can use a pre-trained BERT model?	Fine turning for Downstream Tasks Challenges and Limitations of BART Applications of BART
	SLO-2	Finite state Language Models				
S-7	**SLO-1**	Normalized Finite state Language Models Tightness of Finite-state Models	Transformer -based Language Models Informal Motivation of the Transformer Architecture	PEFT- Parameter Efficient Fine tuning Transfer learning	What can BERT do?	
	SLO-2					
S-8	**SLO-1**	The n-gram Assumption and Sub regularity Representation based n-gram Models	Definition of transformers Tightness of Transformer-based Language Models Self-Attention Self-Attention Deep Dive	Debugging and Documentation of code Question Answering	From Transformer Model to BERT	Comparison with other transformer Models like BERT, GPT, Multi-head Attention
	SLO-2					
S9 S10	**SLO-1**	**Lab 2: Write a python program using the Recursive Descent Parser for analyzing the sentence with NLTK tool**	**Lab 5: How to implement self-attention mechanism in python using Numpy.**	**Lab 8: How to generate text using LangChain and OpenAI** **Lab 9: Text Summarization using LLM**	**Lab 13: Chatbot and Virtual Assistance**	**Lab 16: Write a python program for auto texting using BART**
	SLO-2					
S11	**SLO-1**	Pushdown language models Context free Grammars	Introduction to LLM How do Large Language Models work?	Language Transfer Content generation	Attention mechanism	Meta learning and Few-short Learning Adaptive Fine -tuning techniques
	SLO-2					
S12	**SLO-1**	Weighted Context free Grammars	Architecture of LLM Important components to influence LLM architecture	Language Translation	BERT Variants and Models	Domain adaptation
	SLO-2					
S13	**SLO-1**	Normalizing Weighted Context free Grammar	Transformer Based LLM model Architecture	Advantages of LLMs Difference between NLP and LLM Challenges in training LLMs	Fine turning BERT for Downstream Tasks ROBERTa: A Robustly optimized BERT Pretraining Approach ELECRA- Pre training text encoders as Discriminators Rather Than Generators	Continual learning Lifelong Learning
	SLO-2	Push down automata Pushdown Language Models Multi-stack Pushdown Automata				Adversarial training Transfer learning across languages
S14 S15	**SLO-1**	**Lab 3: Write a python program to implement pushdown automata.**	**Lab 6: Develop an LLM Application using OpenAI and Streamlit**	**Lab 10: Sentimental analysis using LLM**	**Lab 14: -Movie Prediction**	**Lab 17: Write a python program for text summarization using BART model.**
	SLO-2					

Learning Resources	1.Formal Aspects of Language Modeling Ryan Cotterell,AnejSvete,ClaraMeister,Tianyu Liu and Li Du	2.Language Models for NLP" by Sebastian Ruder

LearningAssessment											
	Bloom'sLevel ofThinking	**ContinuousLearningAssessment(50%weightage)**								**FinalExamination(50%weightage)**	
		CLA–1(10%)		**CLA–2(10%)**		**CLA–3(20%)**		**CLA–4(10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100%		100%		100%		100%		100%	

Course Designers		
ExpertsfromIndustry	**ExpertsfromHigherTechnicalInstitutions**	**InternalExperts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.S.Lakshmi,SRMIST

Course Code	PGI20S02J	Course Name	Advanced Techniques in Generative AI with Open AI Models(Lab: Google Generative AI Studio)	Course Category	S	Skill Enhancement Courses	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning
CLR-1 :	To understand the advance topics of Generative AI	
CLR-2 :	To enhance the concept of meta learning	
CLR-3 :	To Learn about self-supervised.	
CLR-4 :	To know about various domain which used Generative AI	
CLR-5 :	To Learn about various concept of Reinforcement learning with Generative AI	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	To understand the architecture and functioning of generative models.	2	80	85
CLO-2 :	To Apply generative AI models to create text, images.	2	75	80
CLO-3 :	To Analyze the performance of generative models.	2	85	80
CLO-4 :	To Understand Meta model and Reinforcement Learning	2	80	75
CLO-5 :	To Understand the Integration Generative Models and RL	2	80	75

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
H	H	M	H	-	-	M	L	-	-	-	-	-	-	-
M	-	H	L	M	-	M	L	-	-	M	-	-	-	-
M	L	M	L	L	-	M	M	-	-	M	-	-	-	-
M	H	M	L	M	-	M	-	-	-	M	-	-	-	-
L	H	M	M	M		M	M	-	-	H				

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Overview of ChatGPT , Setting up an Account	Deep Metric Learning, Contrastive Learning Framework	Introduction to Fine-Grained Control Overview of fine-grained control and manipulation	Overview of meta learning applied to generative AI Meta-learning for optimization and adaptation of generative models	SARSA, and policy Gradients
	SLO-2	Compare ChatGPT ,Search engine and Analytics	Application of Contrastive Learning	Significance across different domains such as robotics, computer vision, and natural language processing	Model-agnostic meta-learning (MAML) for generative models	Introduction to reinforcement learning applied to generative models.

S-2	**SLO-1**	The structure and constituents of ChatGPT.	Introduction to Multi-Modal Generative Models Overview of multi-modal data	Basic principles and concepts of fine grained concepts	Meta-learning with recurrent neural networks	Policy gradient methods for training generative models
	SLO-2	Overview of major Open AI models	Understanding the Challenges and opportunities multi-modal data	Types of fine grained concepts	Metric-based meta-learning for generative tasks	Exploration-exploitation trade-offs in RL, Exploration strategies for generative models.
S-3	**SLO-1**	Architecture and key of each model	Overview of different types of multi-modal generative models	Low Level control Techniques – Overview	Transfer learning techniques for generative AI	Curiosity-driven exploration and intrinsic motivation
	SLO-2	Fine tuning open AI Models techniques	Traditional approaches vs. deep learning-based approaches	Optimization-based control techniques	Few-shot learning with meta-learning approaches	Designing reward functions for generative models.
S-4 & S-5	**SLO-1**	**Fine-tuning GPT for Text Generation.**	**Application of multi-modal GANs**	**Implement conditional generation**	**Adapt a generative model from MNIST to SVHN using meta-learning**	**Implement RL algorithm**
	SLO-2					
S-6	**SLO-1**	Data preparation	Variational Autoencoders (VAEs) for Multi-Modal Data,Basics of Variational Autoencoders (VAEs)	High Level Control Techniques - Overview	Meta-transfer learning and its applications in generative tasks	Intrinsic and extrinsic rewards in RL for generative models.
	SLO-2	Fine tuning preprocessing	Extending VAEs for multi-modal data ,Training and sampling from multi-modal VAEs	Stata space and reinforcement learning	Meta-learning approaches for model selection and architecture search	Reward shaping and temporal credit assignment
S-7	**SLO-1**	Evaluate the fine-tuned models	Generative Adversarial Networks (GANs) for Multi-Modal Data Multi-modal extensions of GANs	Planning and decision making algorithm	Hyperparameter optimization with meta-learning techniques.	Adversarial training methods for generative models
	SLO-2	Analysis the quality	Training and evaluating multi-modal GANs	Basic of Model-base control System identification Techniques	meta-reinforcement learning (meta-RL)	Adversarial attacks and defenses in R
S-8	**SLO-1**	Self-Supervised Learning Overview of self-supervised learning	Autoencoding Variational Bayes (AEVB) framework	Model Predictive control	Meta-RL for training adaptive and flexible generative models	Training generative models with adversarial objectives
	SLO-2	Historical context and development	Extensions for handling multi-modal data	Model-free control methods	Meta-RL algorithms and their applications in generative tasks	Training generative models with adversarial objectives
S-9 & S-10	**SLO-1**	**Implementing self-supervised with ChatGPT**	**Applications using Autoencoding variantional Bayes**	**Develop fine grained control in 3D Printing**	**Develop applications using RLalgorithm**	**Implement Adversarial training methods**
	SLO-2					
S-11	**SLO-1**	Basic principles and concepts	Overview of Conditional Generative Models	Control in NLP,Computer Vision	Meta-learning approaches for domain adaptation in generative tasks	Introduction to multi-agent RL and its applications in generative modeling. Multi-agent coordination and competition
	SLO-2	Types of self-supervised learning tasks	Multi-modal conditional generative models	Multimodal Systems	Unsupervised domain adaptation with meta-learning techniques	Hierarchical RL approaches for generative models
S-12	**SLO-1**	Learning useful representations without human annotations	Deep Generative Models for Multi-Modal Learning Overview	Overview of meta-learning concepts	Cross-domain transfer learning with meta-learning	Transfer learning and meta-learning in hierarchical RL
	SLO-2	Techniques for representation learning in self-supervised settings, Assessing the quality and effectiveness of acquired representations.	Combining deep learning with multi-modal generative models	Types of meta-learning: model-agnostic meta-learning (MAML),	Overview of reinforcement learning concepts and terminology.	Exploration strategies in latent space for generative models.

S-13	**SLO-1**	Principles and Methods of contrastive methods	Assess the performance of generative models	gradient-based meta-learning, and metric-based meta-learning	Markov Decision Processes (MDPs) and the RL framework	Improving sample efficiency in RL for generative models Meta-learning and few-shot learning techniques.
	SLO-2	Contrastive loss functions, contrastive methods	Challenges in evaluating multi-model generative models	Various domain applications	Basic RL algorithms: Q-learning,	Scaling up RL for large-scale generative modeling tasks
S-14 & S-15	**SLO-1**	**Implement image classification and retrieval using contrastive objectives with ChatGPT**	**Generate an application using conditional generative models**	**Generate an application using Meta learning**	**Fine-tune a pre-trained transformer model on a few-shot text classification problem using a meta-learning approach.**	**Develop RL based generative models using benchmark dataset**
	SLO-2					

Learning Resources	An Introduction to Variational Autoencoders, Diederik P. Kingma, Max Welling · 2019 Reinforcement Learning With Open AI, TensorFlow and Keras Using Python By Abhishek Nandy, Manisha Biswas · 2017 Getting Started with ChatGPT and AI Chatbots: An books.google.com › books, Mark Pesce	

Learning Assessment

	Bloom's Level of Thinking	**Continuous Learning Assessment (50% weightage)**								**Final Examination 50% Weightage**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	10%	15%	10%	15%	10%	15%	10%	15%	10%	15%
	Understand										
Level 2	Apply	10%	20%	10%	20%	10%	20%	10%	20%	10%	20%
	Analyze										
Level 3	Evaluate	20%	15%	20%	15%	20%	15%	20%	15%	20%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

#CLA–4canbefromanycombinationofthese:Assignments,Seminars,TechTalks,Mini-Projects,Case-Studies,Self-Study,MOOCs,Certifications,Conf.Paperetc.,

Course Designers

ExpertsfromIndustry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.S.Usha, Assistant Professor, SRMIST KTR

Course Code	PGI20AE2T	Course Name	Career Advancement – II	Course Category	AE	Ability Enhancement Course	L	T	P	C
							3	0	0	3

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	Demonstrate various principles involved in solving mathematical concepts	
CLR-2 :	Develop interest and awareness in students regarding profit/ loss, interest calculations and average	
CLR-3 :	Critically evaluate basic mathematical concepts related to mixtures and alligations, permutation and combination, time and work	
CLR-4 :	Provide students with skills necessary to generate and interpret data and concepts related to time, speed and distance and blood relation.	
CLR-5 :	Enable students to understand reasoning skills	
CLR-6 :	Create awareness in students regarding the various concepts in quantitative aptitude and reasoning skills and also its importance in various competitive exams	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3	Program Learning Outcomes (PLO)													
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	Understand, analyze and solve questions based on Profit and Loss, Discount, Simple Interest and Compound Interest.	3	80	70	H	H	M	H	L	M	-	H	-	H	-	H	M	-	H
CLO-2 :	Create, solve, interpret and apply basic mathematical models which are applicable in our day to day life	3	80	75	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-3 :	Understand the concepts of time and work, Time, Speed Distance Pipes & Cistern and to approach questions in a simpler and innovative method	3	85	70	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-4 :	Understand the concept in Clock, Calendar, and Data in different forms and interpretations.	3	85	80	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-5 :	Ability to solve the problems on logical reasoning	3	85	75	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-6 :	Able to face different competitive exams	3	80	70	M	H	M	H	-	M	-	H	H	M	-	H	M	-	H

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Percentage-Introduction	Time, Speed and Distance-Introduction	Problems on Trains	Clocks-Concepts Discussion	Logical Reasoning : Puzzles-Concepts
	SLO-2	Percentage - Basic Problems	Time, Speed and Distance-Basic problems	Problems on Trains	Clocks-Problems	Puzzles-Problems
S-2	SLO-1	Percentage - Problems	Time, Speed and Distance- Problems	Races & Games of Skill	Calendars-Introduction of basic concept	Puzzles-Problems

	SLO-2	Percentage - Tricky Problems	Time, Speed and Distance- Tricky problems	Races – Problems	Calendars-Problems	Puzzles- Tricky Problems
S-3	**SLO-1**	Discount – Basics	Time, Speed and Distance- Tricky problems	Area – Basics	Clock – Tricky Problems	Alphanumeric series - Introduction
	SLO-2	Discount – Problems	Time, Speed and Distance Advanced Problems	Area – Problems	Calendars – Tricky Problems	Alphanumeric series -Different types
S-4	**SLO-1**	Simple Interest-Introduction & Formulas	Height and distance - Introduction	Volume and Surface Area	Data sufficiency-Introduction and Basics	Alphanumeric series - Problems
	SLO-2	Simple Interest- Problems	Height and distance - Problems	Problems on Volume	Data sufficiency-Problems	Alphanumeric series - Tricky Problems
S-5	**SLO-1**	Simple Interest- Problems	Height and distance - Problems	Problems on Surface Area	Data sufficiency-Tricky Problems	Cube - Basics
	SLO-2	Simple Interest- Tricky Problems	Height and distance – Tricky Problems	Tricky problems on Area, Volume and Surface Area.	Data sufficiency-Advanced Problems	Cube - Problems
S-6	**SLO-1**	Compound Interest- Introduction & Formulas	Stocks and shares - Introduction	Geometry-Basics	Data Interpretation – Table	Cube –Tricky Problems
	SLO-2	Compound Interest- Problems	Stocks and shares -Basic problems	Geometry- Formulas	Data Interpretation – Table - Problems	Series – Odd one out- Introduction
S-7	**SLO-1**	Compound Interest- Problems	Stocks and shares - Problems	Geometry-Problems	Data Interpretation – Bar chart	Series – Odd one out - Problems
	SLO-2	Compound Interest-Tricky Problems	Stocks and shares - Tricky problems	Geometry – Tricky Problems	Data Interpretation – Bar chart - Problems	Series – Odd one out – Tricky Problems
S-8	**SLO-1**	Partnership – Fact and Formula	Stocks and shares - Tricky problems	Mensuration-Basics	Data Interpretation – Pie chart	Seating Arrangements - Linear
	SLO-2	Partnership – Problems	Problems based on ages - Introduction	Mensuration –Formulas	Data Interpretation – Pie chart - Problems	Seating Arrangements - Linear – Problems
S-9	**SLO-1**	Partnership – Problems	Problems based on ages - Basics	Mensuration – Problems	Data Interpretation – Line graph	Seating Arrangements – Circular
	SLO-2	Partnership – Tricky Problems	Problems based on ages – Tricky Problems	Mensuration - Tricky Problems	Data Interpretation – Line graph - Problems	Seating Arrangements – Circular – Problems

Learning Resources	Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Tata McGraw Hill, 5th Edition Dr. Agarwal.R.S, Quantitative Aptitude for Competitive Examinations, S. Chand and Company Limited, 2018 Edition Archana Ram, PlaceMentor: Tests of Aptitude for Placement Readiness, Oxford University Press, Oxford, 2018	Edgar Thrope, Test Of Reasoning for Competitive Examinations, Tata McGraw Hill, 6th Edition Dinesh Khattar, The Pearson Guide to Quantitative Aptitude for competitive examinations, Pearson, 3rd Edition P A Anand, Quantitative Aptitude for competitive examinations, Wiley publications, e book, 2019

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)			
		CLA-1 (20%)	CLA-2 (20%)	CLA-3 (30%)	CLA-4 (30%) ##
		Theory	Theory	Theory	Theory
Level 1	Remember	10%	10%	30%	15%
	Understand				
Level 2	Apply	50%	50%	40%	50%
	Analyze				
Level 3	Evaluate	40%	40%	30%	35%
	Create				
	Total	100 %	100 %	100 %	100 %

CLA-1, CLA-2 and CLA-3 can be from any combination of these: Online Aptitude Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, Mini Talks, Group Discussions, Mock interviews, etc.

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. P. Chockalingam, Senior Lead Software Engineer, Virtusa Consulting Services Private Ltd, DLF IT Park SEZ, Chennai - 600089	Dr. G. Saravana Prabu, Asst. Professor, Department of English, Amrita Vishwa Vidhyapeetham, Coimbatore - 641112	Dr. Sathish K, HOD, Department of Career Guidance Cell, FSH, SRMIST
		Dr. Aarthi S, Assistant Professor, Department of Career Guidance Cell, FSH, SRMIST

SEMESTER III

Course Code	PGI20C07J	Course Name	Object Oriented Analysis and Design	Course Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,
CLR-1 :	To understand the fundamentals of object modeling
CLR-2 :	To understand and differentiate Unified Process from other approaches.
CLR-3 :	To design with static UML diagrams.
CLR-4 :	To design with the UML dynamic and implementation diagrams
CLR-5 :	To improve the software design with design patterns

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning: Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Express software design with UML diagrams.	3	80	70
CLO-2 :	Design software applications using OO concepts.	3	85	75
CLO-3 :	Identify various scenarios based on software requirements.	3	75	70
CLO-4 :	Transform UML based software design into pattern based design using design patterns	3	85	80
CLO-5 :	Understand the various testing methodologies for OO software	3	75	70

Program Learning Outcomes (PLO)	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	L	H	H	H	H	M	-	H	M	H	-	H	-	-	-
CLO-2 :	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-3 :	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-4 :	M	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-5 :	L	H	H	H	H	-	-	M	M	L	-	M	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to OOAD with OO Basics	Class Diagram	Dynamic Diagrams	GRASP: Designing objects with responsibilities	Object Oriented Methodologies
S-2	SLO-1	Unified Process	Elaboration – Domain Model	UML interaction diagrams	Creator – Information expert	Software Quality Assurance
S-3	SLO-1	UML diagrams-Basics	Finding conceptual classes	System sequence diagram- Basics	Low Coupling	Impact of object orientation on Testing

	SLO-2	UML diagrams	Finding description classes.	System sequence diagram	High Cohesion	Impact of object orientation on Testing - Feedback
S-4-S-5	**SLO-1**	**Lab 1:Case study – the Next Gen POS system**	**Lab 4: Identify use cases**	**Lab7: Using the identified scenarios, find the interaction between objects and represent them using UML**	**Lab 10: Implement the system as per the detailed design.**	**Lab 13:Improve the reusability and maintainability of the software system**
S-6	**SLO-1**	Use Case	Associations – Attributes	Collaboration diagram – When to use Communication Diagrams	Controller ,Design Patterns	Develop Test Cases and Test Plans
S-7	**SLO-1**	Inception -Use case Modelling	Domain model refinement	State machine diagram and Modelling –When to use State Diagrams	creational – factory method	APPLICATIONS-Satellite Based Navigation
S-8	**SLO-1**	Relating Use cases	Finding conceptual class Hierarchies	Activity diagram – When to use activity diagrams	Adapter – behavioural	Traffic Management
S-9-S10	**SLO-1**	**Lab 2 :Identify a software system that needs to be developed.**	**Lab 5: Develop the Use Case model**	**Lab 8:Sequence and Collaboration Diagrams.**	**Lab 11: package diagrams - Component and Deployment Diagrams.**	**Lab 14 By applying appropriate design patterns.**
S-11	**SLO-1**	include, extend and generalization.	Aggregation and Composition	Implementation Diagrams - UML package diagram	Strategy – observer	Crypt Analysis
S-12	**SLO-1**	When to use Use-cases	- Relationship between sequence diagrams and use cases	When to use package diagrams - Component and Deployment Diagrams	Applying GoF design patterns	Weather Monitoring Station,
S-13	**SLO-1**	UML modeling tool	When to use Class Diagrams	When to use Component and Deployment diagrams	Mapping design to code	Vacation Tracking System.
S-14-15	**SLO-1**	**Lab 3: Document the Software Requirements Specification (SRS) for the identified system.**	**Lab 6: Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.**	**Lab 9: Draw relevant State Chart and Activity Diagrams for the same system**	**Lab 12: Test the software system for all the scenarios identified as per the use case diagram.**	**Lab 15: Implement the modified system and test it for various scenarios.** **SUGGESTED DOMAINS FOR MINI-PROJECT:** **1.Passport automation system.** **2. Book bank** **3. Exam registration** **4. Stock maintenance system.** **5.Online course reservation system**

Learning Resources	1. Craig Larman, ―Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development‖, Third Edition, Pearson Education, 2005. 2. Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition – 1999.	1. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, ―Design patterns: Elements of Reusable Object-Oriented Software‖, Addison-Wesley, 1995. 2. Martin Fowler, ―UML Distilled: A Brief Guide to the Standard Object Modeling Language‖, Third edition, Addison Wesley, 2003.

Learning Assessment											
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%) #**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	20%	20%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	10%	10%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA-1, CLA-2 and CLA-3 can be from any combination of these: Online Aptitude Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, Mini Talks, Group Discussions, Mock interviews, etc.

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Mr.D.B.Shanmugam, SRMIST, RMP

Course Code	PGI20D13J	Course Name	Adaptive AI in Data Analytics and Predictive Modeling	Course Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	Learn the fundamentals of Adaptive AI and Predictive Analysis	1
CLR-2 :	Familiarize about the differences between Generative AI and Adaptive AI	2
CLR-3 :	To study statistical methods for hypotheses testing and solving inference problems.	3
CLR-4 :	To interpret the results in a way that draws evidence-based and well-informed decisions from data.	
CLR-5 :	To derive conclusions from data and analyze its implications	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Understand the notion of a parametric model, point estimation of the parameters and properties of a good estimator.	2	85	80
CLO-2 :	Conquer the concept of interval estimation and confidence intervals.	3	85	80
CLO-3 :	Analyze and perform large-sample tests of hypotheses..	3	85	80
CLO-4 :	Discuss nonparametric tests of hypotheses.	3	85	80
CLO-5 :	Translate and correlate the statistical analysis into Statistical inference	3	85	80

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
L	-	-	-	-	-	-	-	M	-	-	-	-	-	-
M	H	H	-	-	-	-	-	M	-	-	-	-	-	-
-	H	H	H	H	-	-	M	M	-	-	-	-	-	-
-	-	H	H	M	-	-	M	M	-	-	-	-	-	-
-	-	H	H	H	-	-	-	M	H	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to Adaptive AI	Introduction to predictive analytics	Propensity models,	Classification Trees and RuleBased Models	Methods for time series analyses – Analysis: Motivation
	SLO-2			cluster models,	Model Evaluation Techniques.	
S-2	SLO-1	Overview of Data	Business analytics: types, applications-	collaborative filtering,	The Effect of Class	Exploratory analysis
	SLO-2	Analytics and Predictive Modeling		applications and fundamental	**Imbalance - Model Tuning**	

S-3	**SLO-1**	Importance of Adaptive AI in Model Improvement	Models: predictive models – descriptive models	limitations. Statistical Modeling-	Alternate Cutoffs	Prediction and forecasting
	SLO-2	Practical Applications of Adaptive AI				
S-4-5	**SLO-1**	**Lab :1 Develop a Personalized Content Delivery System**	**Lab 4: Implement Fraud Detection IN Banking and finance**	**Lab 7: Understanding Predictive Models** **Identify and discuss examples of predictive, descriptive, and decision models.**	**Lab 10: Dealing with Missing Values** **Practice techniques for handling missing data such as imputation or removal.**	**Lab 13: Measuring Performance in Regression Models** **Evaluate performance metrics for various regression models using a dataset.**
	SLO-2					
S-6	**SLO-1**	Ethical Considerations in AI and Data Analytics	decision models - applications	Formal Definition, Model Comparison	Adjusting Prior Probabilities	Classification
	SLO-2			Classification.		
S-7	**SLO-1**	Introduction to Supervised Learning Introduction to Unsupervised Learning	analytical techniques.	Measuring Performance in Regression Models	Unequal Case Weights	Regression analysis
	SLO-2			Linear Regression and Its Cousins		
S-8	**SLO-1**	Introduction to Reinforcement Learning Exploring Neural Networks	Data transformations: Individual predictors, Multiple predictors,	NonLinear Regression Models	Sampling Methods	Signal estimation
	SLO-2					
S-9-10	**SLO-1**	**Lab 2: Develop Intelligent Tutoring Systems.**	**Lab 5: Implement adaptive AI algorithms that can analyze student performance data, such as test scores and homework assignments**	**Lab 8: Analytical Techniques Overview** **Create a comparative analysis chart highlighting different analytical techniques and their applications.**	**Lab 11: Model Tuning and Data Splitting** **Split datasets into training and testing sets, perform model tuning, and evaluate performance.**	**Lab 14: Implementing Linear Regression** **Implement linear regression and its variants (e.g., ridge, lasso) using Python**
	SLO-2					
S 11	**SLO-1**	Introduction to Data Preprocessing Data Cleaning Techniques	Dealing with missing values, Removing. Adding, Binning Predictors,	Regression Trees and Rule-Based	Cost-Sensitive Training.	Segmentation. Models
	SLO-2					
S-12	**SLO-1**	Feature Selection Methods Feature Extraction Techniques	Computing, Model Tuning	Models Case Study: Compressive Strength of Concrete Mixtures.	Measuring Predictor Importance	Autoregressive model
	SLO-2					
S-13	**SLO-1**	Handling Missing Data	Data Splitting,			Partial autocorrelation function

	SLO-2	Handling Outliers	Resampling.	Classification Models - Discriminant Analysis and Other Linear - Non-Linear	Factors that can affect Model Performance.	
S-14-15	**SLO-1**	**Lab 3: Develop Dynamic Learning Pathways**	**Lab 6: Implement adaptive AI algorithms that can analyze traffic patterns and adjust traffic lights in real-time to optimize traffic flow.**	**Lab 9: Data Transformation Techniques**	**Lab 12: Cluster Model Implementation**	**Lab 15: Regression Trees and Rule-Based Models**
	SLO-2			**Implement data transformations for individual and multiple predictors using Python**	**Utilize clustering algorithms to create cluster models and explore their applications.**	**Build regression trees and rule-based models for a given dataset and compare their performance.**

Learning Resources	1. Kuhn, Max, and Kjell Johnson. Applied Predictive Modeling, 3rd Edition, Springer, 2019. 2. Jeffrey Strickland, Predictive analytics using R, Simulation educators, Colorado Springs, 2015. 3. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlowby Aurélien Géron 4. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville	1. Anasse Bari, Mohamed Chaouchi, Tommy Jung, Predictive Analytics for dummies, 2nd edition Wiley, 2016. 2. Daniel T.Larose and Chantal D.Larose, Data Mining and Predictive Analytics, 2nd edition Wiley, 2015.

Learning Assessment

Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Mr D Siva Assistant Professor, SRMIST, RMP

Course Code	PGI20D14J	Course Name	Artificial Intelligence and Machine Learning for Robotics	Course Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning

		1	2	3
CLR-1:	Introduce the fundamentals of AI	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2:	Understand the applications of artificial intelligence			
CLR-3:	Understand the basic concepts of machine learning.			
CLR-4:	Generate knowledge about Robotics			
CLR-5:	Understand the Robot operating system fundamentals			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3	Program Learning Outcomes (PLO)													
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1:	Apply the basic principles of AI in solutions that require Problem Solving	2	85	80	L	-	-	-	-	-	-	-	M	-	-	-	-	-	-
CLO-2:	Recall the basics of NLP for Automation	3	85	80	M	H	H	-	-	-	-	-	M	-	-	-	-	-	-
CLO-3:	Construct the basics of Machine Learning	3	85	80	-	H	H	H	H	-	-	M	M	-	-	-	-	-	-
CLO-4:	Assess and Apply suitable Machine Learning Techniques to different applications	3	85	80	-	-	H	H	M	-	-	M	M	-	-	-	-	-	-
CLO-5:	Understand the fundamental of Robotics programming and development.	3	85	80	-	-	H	H	H	-	-	-	M	H	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Problem solving and Scope of AI	Knowledge Representation	Introduction to Machine Learning	Supervised learning	Introduction to Robotics
	SLO-2		Knowledge Representation issues		Regression: Linear regression	Fundamentals of Robotics
S-2	SLO-1	Introduction to Artificial Intelligence	first order predicate calculus	Data and Features	logistic regression	Robot Kinematics
	SLO-2	Applications- Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems	Horn Clauses	Machine Learning Pipeline Data Preprocessing: Standardization	Classification: K-Nearest Neighbor	
S-3	SLO-1	AI techniques- search knowledge, abstraction	Resolution	Normalization, Missing data problem	Naïve Bayes, Decision Tree	Position Analysis
	SLO-2	Problem Solving State space search	Semantic Nets,Frames	Data imbalance problem		
S-4-5	SLO-1	**Lab :1. BFS using Python**	**Lab 4: program to implement A* Algorithm.**	**Lab 7: python program to import and export data using Pandas library functions**	**Lab 10: Implement Simple and Multiple Linear Regression Models.**	**Lab 13: Simulation using Adams View**
	SLO-2					
S-6	SLO-1	Production systems, search space control: depth-first, breadth-first search	Partitioned Nets	Data visualization - Setting up training, development and test sets	Random Forest, Support Vector Machine, Perceptron, Error analysis	Dynamic Analysis and Forces
	SLO-2		Procedural Vs Declarative knowledge			
S-7	SLO-1	Heuristic search	Forward Vs Backward Reasoning	Cross validation – Problem of Overfitting	Unsupervised learning – Clustering: K-means, Hierarchical	Robot Programming languages & systems
	SLO-2		Understanding Natural Languages Introduction to NLP			
S-8	SLO-1	Hill climbing, best-first search, branch and bound	Basics of Syntactic Processing	Bias Vs Variance - Evaluation measures	Spectral, subspace clustering, Gaussian Mixture Model	Introduction, the three levels of robot programming
	SLO-2		Basics of Semantic Analysis			
S-9-10	SLO-1	**Lab 2: DFS using Python**	**Lab 5: Implementation of NLP to develop spellchecker application using python**	**Lab 8: To develop face emotion recognition using python**	**Lab 11: Develop Logistic Regression Model for a given dataset.**	**Lab 14: Simulation using Post Processor**
	SLO-2					
S 11	SLO-1	Problem Reduction, Constraint Satisfaction End	Basics of Parsing techniques	Different types of machine learning	Hidden Markov Model, Parameter Estimation	requirements of a robot programming language
	SLO-2		Context free and transformational grammars, Transition nets			
S-12	SLO-1		Augmented transition nets			

	SLO-2	Means-End Analysis. LA* Algorithm	Shanks Conceptual Dependency	Supervised learning, Unsupervised learning	MLE and Bayesian Estimate, Expectation Maximization	problems peculiar to robot programming languages.
S-13	**SLO-1**	. L(AO*) Algorithm.	. Scripts, Basics of grammar free analyzers	Reinforcement learning	Dimensionality Reduction Techniques, Principal component analysis	Analysis of Robot Programming Language.
	SLO-2		Basics of sentence generation, and Basics of translation	Generative Learning and adversarial learning	Linear Discriminant Analysis - Introduction to Neural Networks, Reinforcement learning and generative learning	
S-14-15	**SLO-1**	**Lab 3: Tower of Hanoi Using Python**	**Lab 6: To Generate random sentence using python**	**Lab 9: Obstacle avoiding robot.**	**Lab 12: Implement Naïve Bayes Classification in Python**	**Lab 15: To develop pick and place robot using arduino**
	SLO-2					

Learning Resources	1. 1.E. Rich and K. Knight, "Artificial Intelligence", TMH, 3rd edition, 2017, ISBN: 9780070087705. 2. 2. Kevin P. Murphey. Machine Learning, a probabilistic perspective. The MIT Press Cambridge 3. Tsuneo Yoshikawa, "Foundations of Robotics", PHI Publication.	1. N.J. Nilsson, "Principles of AI", Narosa Publ. House, 1990. 2. Massachusetts, 2012. Christopher M Bishop. Pattern Recognition and Machine Learning. Springer 2010. 3. John J. Craig, "Introduction to Robotics",Addison Wesley publication.

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
Level 2	Apply Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Evaluate Create	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.V.Saravanan. Vice Principal(Academic), FSH, SRMIST, RMP Mr.A.Vignesh.,Asst Professor-Computer Science and Applications, FSH, SRMIST, RMP

Course Code	PGI20D15J	Course Name	Full Stack Development	Course Category	D	Discipline Elective Courses	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning

		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Learn fundamental Javascript concepts that power AngularJS.			
CLR-2 :	Write quicker, better AngularJS code by discovering how AngularJS itself is built.			
CLR-3 :	Realize the power of dependency injection, and how AngularJS accomplishes it			
CLR-4 :	Identify and acquire knowledge in various security attacks, Services and Mechanism			
CLR-5 :	Design custom directives and save time and energy with easily reusable components. Understand what a Single Page Application (SPA) is, and how they work.			
CLR-6 :	Build a Single Page Application (SPA) in AngularJS. Be the coder that explains AngularJS to everyone else, because you understand it better than anyone else.			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Understand the design of single-page applications and how AngularJS facilitates their development	2	85	80
CLO-2 :	Properly separate the model, view, and controller layers of your application and implement them using AngularJS	3	85	80
CLO-3 :	Master AngularJS expressions, filters, and scopes	3	85	80
CLO-4 :	Build Angular forms	3	85	80
CLO-5 :	Elegantly implement Ajax in your AngularJS applications	3	85	80
CLO-6:	Write AngularJS directives, Unit test and end-to-end test your AngularJS application			

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
L	H	H	L	H	-	-	-	-	H	-	-	-	-	-
M	L	H	L	M	-	-	-	-	H	-	-	-	-	-
M	M	H	L	L	-	-	-	M	H	-	-	-	-	-
M	M	H	H	M	-	-	-	M	H	-	-	-	-	-
H	M	H	L	M	-	-	-	M	H	-	-	-	-	-
L	-	H	L	L				L	L					

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Understanding the Basic Web Development Framework	JavaScript Fundamentals	Understanding the basics of Node.js	Overview of NoSQL databases and MongoDB	Building a single-page application with Angular: Foundations
	SLO-2			Setting up Node.js environment	Installation and setup of MongoDB	Angular CLI.

S-2	**SLO-1**	Why learn the full stack?	Introduction to Document and Window Object	Installing Node.js and npm	CRUD operations: Create, Read, Update, Delete	Creating an Angular Project
	SLO-2	User – Browser – Webserver	Objects - Generators	Creating and running a simple Node.js application	Data types in MongoDB	Components. Components Interaction. Dynamic Component
S-3	**SLO-1**	MVC Architecture	Advanced iteration- Modules	Exploring core modules such as fs, http, path, util, etc.	MongoDB Query Language	Angular Elements
	SLO-2	Single Page Application	DOM tree	Handling file system operations		Angular Forms.
S-4-5	**SLO-1**	**Lab :1 Write a program to create a simple webpage using HTML. Hello World Web Page**	**Lab 4. Write a simple Node.js script that outputs "Hello, World!" to the console.**	**Lab 7: Create different routes for handling HTTP GET requests using Express.**	**Lab 10: CRUD Operations:**	**Lab 13: Create a Simple Login form using R**
	SLO-2					
S-6	**SLO-1**	. Understanding the different stacks	Node properties	Building a basic HTTP server using the http module	Data Modeling in MongoDB	Template Driven Forms
	SLO-2	Introducing Node.js: The web server/platform	Browser events	Understanding the need for Express.js	Understanding document-oriented data modeling	Property, Style, Class and Event Binding. Two-way Bindings
S-7	**SLO-1**	Introducing Express: The framework	Event delegation	Installing Express.js	Designing schemas and collections	Reactive Forms. Form Group. Form Controls. About Angular Router
	SLO-2	Introducing MongoDB: The database	UI Events	Creating a basic Express application		Router Configuration.
S-8	**SLO-1**	Introducing AngularJS: The front-end framework	Forms, controls	Routing in Express	Embedded vs. referenced documents	Router State
	SLO-2	Designing a MEAN stack architecture				
S-9-10	**SLO-1**	**Lab 2: . Write a program to create a website using HTML CSS and JavaScript**	**Lab 5: To-Do-Liat Application**	**Lab 8: Write middleware functions to log requests, handle errors, and parse request bodies..**	**Lab 11 Query Language:**	**Lab 14: .Making HTTP requests from Angular to an API**
	SLO-2					
S 11	**SLO-1**	.A Common MEAN stack architecture	Document and resource loading	Middleware concept and implementation	Relationships and denormalization	Navigation Pages. Router Link
	SLO-2	Designing a flexible MEAN architecture				
S-12	**SLO-1**	. Introducing AngularJS: The front-end framework	Mutation observer - Event loop	Exploring built-in middleware in Express	Integration with Node.js	Query Parameters. URL matching
	SLO-2			Implementing custom middleware	Connecting MongoDB with Node.js applications	Matching Strategies-Services Dependency Injection
S-13	**SLO-1**	. How the MEAN stack components	.	Introduction to template engines (e.g., EJS, Pug)	Performing CRUD operations using the MongoDB Node.js driver	

	SLO-2	work together	microtasks and macrotasks	Integrating template engines with Express	The rules of a REST API	Http Client. Read Data from the Server. Http Header Operations. Intercepting requests and responses
S-14-15	**SLO-1**	**Lab 3:.Write a program to build a Chat module using HTML CSS and JavaScript.**	**Lab 6:.Write a program to create a voting application using Angular JS**	**Lab 9: Write middleware functions to log requests, handle errors, and parse request bodies.**	**Lab 12: Writing a REST API" Exposing theMongoDB database to theapplication**	**Lab 15: More complex views and routing parameters**
	SLO-2					

Learning Resources	1.Resources Text Book: Getting MEAN with Mongo, Express Angular and Node, Simon Holmes 2.Practical Node JS: Building a Real-World Scale Web Apps, Basarat Syed, A Press, 2014. 3.Learning Angular JS: A Guide to Angular JS Development, Ken Williamson, O'	**Reference Book:** **1. MEAN Web Development, AMOS Q. HAVIV** **2. AngularJS: https://angular.io/docs** **3. MongoDB: https://docs.mongodb.com/manual/tutorial/getting-started/**

Learning Assessment

Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.V.Pavithra (AP/MCA)SRMIST RMP

Course Code	PGI20D16J	Course Name	IoT Devices with Computer Vision Technologies	Course Category	D	Discipline Elective Courses	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to	Learning

		1	2	3
CLR-1 :	To introduce Internet of Things (IoT) environment and its technologies for designing smart systems			
CLR-2 :	Explore the system management and domain for various applications of IoT Categorize the various protocols that are used for developing IoT applications.			
CLR-3 :	Inculcate the fundamentals of computer vision			
CLR-4 :	To teach the functions of a Computer vision techniques involved in training the Computer vision models on different problems			
CLR-5 :	Build intelligent and automated real-world Computer vision applications			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bl)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Investigate various challenges and explore open-source hardware prototyping platforms for designing IoT devices	2	85	80
CLO-2 :	Understand basic circuits, sensors and interfacing, data conversion process and shield libraries to interface with the real world	3	85	80
CLO-3 :	Understanding the fundamental concepts of Computer vision	3	85	80
CLO-4 :	Gain hands-on solid skills, knowledge and expertise of real-world situations	3	85	80
CLO-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	3	85	80

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
L	M	L	M	M	-	H	-	M	-	-	-	-	-	-
M	H	H	-	H	-	H	-	M	-	-	-	-	-	-
M	H	H	H	H	-	-	M	M	-	-	-	-	-	-
H	-	H	H	M	-	M	M	M	-	-	-	-	-	-
M	-	H	H	H	-	M	-	M	H	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to IoT	Communication Models in IoT	Computer Vision -Introduction	Computer Vision Workflow Steps	Computer Vision Techniques an Overview
	SLO-2	Definition& Characteristics of IoT	Device to Device Model	Computer Vision Overview	Business Problem Identification	Image Processing
S-2	SLO-1	Physical design of IoT , Things in IoT	Device to Cloud Model Device to Gateway Model	Computer Vision defined from academic perspective	Success Criteria Definition	Image Processing Techniques

	SLO-2	IoT protocols	M2M,Differences between IoT and M2M	Computer Vision defined from Industry perspective	Right Computer Vision Techniques	Image Restoration, Linear Filtering , Independent Component Analysis , Pixelation
S-3	**SLO-1**	logical Design of IoT	Architecture of M2M	Signal Processing for Computer Vision	Collect Training Data	Challenges and opportunities in integrating IoT with computer vision
	SLO-2	IoT Functional Blocks	SoftwareDefinedNetworking (SDN) SDN, Architecture of SDN	Pattern recognition of Computer Vision	Label Train and Test Datasets	Overview of edge computing and its role in IoT
S-4-5	**SLO-1**	**Lab :1 Explain working of Raspberry Pi.**	**Lab 4: Describe gateway as a service deployment in Iot toolkit**	**Lab 7: Install OpenCV Displaying images OpenCV**	**Lab 10: Text in Images**	**Lab 13: Image Edge Detection OpenCV**
	SLO-2					
S-6	**SLO-1**	IoT Levels and Deployment Templates	Network Function Virtualization (NFV), Architecture of NFV	Challenges of Computer Vision	Train the computer vision model	Median Filter
	SLO-2	Levels 0, Levels 1	NFV for IOT, YANG - NETCONF	Computer Vision Data Requirements	Evaluate the computer vision model	Feature detection and matching
S-7	**SLO-1**	Levels 2, Levels 3	IoT System Management.Advantages and Disadvantages of IoT system management	How much data is needed	Test the model	Security challenges in IoT deployments
	SLO-2	Level 4, Level 5	NETCONF ,YANG and NETOPEER	Is your data good enough?	Deploy the model	Secure communication protocols and encryption techniques
S-8	**SLO-1**	IoT Deployment Challenges	IoT Systems and Device Management with NETCONF-YANG	Data Structure	Iterate the steps process	Problems that Computer Vision can Solve
	SLO-2	Domain Specific IoT	Purpose & Requirements, process model specification, domain model specification	Data Format	Computer vision architecture	Text Classification

S-9-10	**SLO-1**	**Lab 2: Controlling LED with Raspberry Pi**	**Lab 5: Weather Monitoring System**	**Lab 8: Reading &Writing images OpenCV**	**Lab 11: Color Space OpenCV Thresholding OpenCV**	**Lab 14: Image Scaling & Rotation using OpenCV**
	SLO-2					
S-11	**SLO-1**	Home, Cities	Information model specifications, service specifications, Iot level specifications	Data Type	Data Ingestion	Privacy concerns in computer vision applications
	SLO-2	Environment, Energy systems	Functional view specifications, operational view specifications	Training Data	Data Pre-processing	Implementing secure communication for IoT devices
S-12	**SLO-1**	Industry	Device & component Integration, Application development	Validation Data	Multiprocessing	Introduction to edge devices: Raspberry Pi, Arduino, NVIDIA Jetson Nano
	SLO-2	Agriculture	IoT System for Agricultur	Test Data	Transfer Learning/Model Processing	Hands-on exercises: Implementing secure communication for IoT devices
S-13	**SLO-1**	Health and Lifestyle	Functional view specifications, operational view specifications	Image Processing Techniques	Data Transformation	Hands-on exercises: Setting up an edge device, installing OpenCV
	SLO-2	IoT components	IoT Security and Interoperability, Risks and Attacks&Tools for Security	Filtering Techniques in Image Processing Linsear Filter, Non-Linear Filter	Popular Computer Vision frameworks: OpenCV, TensorFlow, Matlab	Hands-on exercises: Implementing object detection on IoT devices
S-14-15	**SLO-1**	**Lab 3: Interfacing Light Sensor with Raspberry pi**	**Lab 6: IoT based Soil Moisture Monitoring Device**	**Lab 9: Draw a Rectangle Draw a Circle**	**Lab 12: Finding Contours**	**Lab 15: Image Translation OpenCV Image Filtering OpenCV**
	SLO-2					

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. 7. CunoPfister, “Getting Started with the Internet of Things”, O’Reilly, 2011.

Learning Assessment													
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**										**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**					
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**			**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%			15%	15%
	Understand												
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%			20%	20%
	Analyze												
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%			15%	15%
	Create												
	Total	100 %		100 %		100 %		100 %				100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.N.Vijayalakshmi , Asst.Prof(Sr.G), SRMIST, RMP Dr J Dhilipan, Professor & Head, SRMIST, RMP Mrs.S.Sindhu, Asst.Prof(OG), SRMIST, RMP

Course Code	PGI20D17J	Course Name	Computer Vision in Smart Robotics	Course Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	To understand the basic principles of computer vision and its applications in robotics.	
CLR-2 :	To learn about different techniques for image processing and feature extraction.	
CLR-3 :	To study methods for object recognition and visual tracking in robotics.	
CLR-4 :	Explain the basic principles of computer vision and its role in robotics.	
CLR-5 :	Apply image processing techniques to enhance images for robotic perception.	
CLR-6 :	Implement feature extraction algorithms for object detection and recognition.	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	Demonstrate an understanding of the principles of computer vision and its role in robotics.	3	80	70	H	H	H	H	H	M	-	H	M	M	-	H	H	-	H
CLO-2 :	Apply image processing techniques such as filtering, segmentation, and feature extraction to process images for robotic perception.	3	85	75	M	M	H	H	H	-	-	M	M	M	-	H	M	-	L
CLO-3 :	Implement machine learning algorithms for tasks such as object detection and recognition in robotics.	3	75	70	M	M	H	H	H	-	-	M	M	L	-	H	M	-	H
CLO-4 :	Design and develop computer vision algorithms using libraries such as OpenCV for robotic applications.	3	85	80	H	H	H	H	H	M	-	M	L	H	M	H	M	-	-
CLO-5 :	Integrate computer vision systems with robotic platforms and demonstrate their functionality in real-world scenarios.	3	75	70	H	H	H	H	H	L	-	M	H	L	L	H	-	L	-
CLO-6 :	Design and implement visual tracking algorithms for robotic systems.	3	85	80	L	H	H	H	H	M	-	M	M	L	H	H	-	L	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Computer Vision - Introduction	Introduction on Image Acquisition	Techniques for object detection in images and videos	Introduction to Scene Understanding and Tracking in Robotics	Scene Understanding and Contextual Reasoning: Understanding scenes in a broader context for more informed decision-making.
	SLO-2	Computer Vision Overview	Image Acquisition Techniques in robotics	Object recognition and classification techniques	Sensor Fusion for Scene Understanding and Tracking	Vision-based Human-Robot Interaction: Techniques for robots to understand and interact with humans using vision
S-2	SLO-1	Computer Vision defined from academic perspective	Image preprocessing Techniques	Feature Extraction Techniques for Object Detection	Deep Learning Approaches for Scene Understanding	Visual Servoing: Using visual feedback to control the robot's motion or manipulation tasks.

	SLO-2	Computer Vision defined from Industry perspective	Need of Image preprocessing techniques in computer vision	Convolutional Neural Networks (CNNs) for Object Detection	Semantic Segmentation for Scene Understanding	Robust Vision Systems for Dynamic Environments: Dealing with challenges like lighting changes, moving objects, etc.
S-3	**SLO-1**	Challenges of Computer Vision	Noise reduction, image enhancement, and filtering methods	Region-Based CNNs for Object Detection	Object Tracking Techniques in Robotics Multi-Object Tracking in Dynamic Environments	Multi-Modal Sensor Fusion: Integrating vision with other sensor modalities for better perception.
	SLO-2	Computer Vision Data Requirements	Basics of image processing and computer vision algorithms	You Only Look Once (YOLO) Algorithm for Object Detection	Visual SLAM (Simultaneous Localization and Mapping) for Scene Understanding	Learning-based Visual Navigation: Using machine learning to improve robot navigation based on visual inputs.
S-4to S-5	**SLO-1** **SLO-2**	**Lab 1-Install OpenCV** **Displaying images OpenCV**	**Lab 4:Morphological Operations Opening OpenCV Morphological Operations Closing OpenCV**	**Lab 7:**Object 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.**	**Lab 10:**Motion Estimation **Implement a basic optical flow algorithm to estimate the motion of objects in a video stream.**	**Lab 13:Moving Object Detection and Tracking:** **Develop a vision-based system to detect and track moving objects in a dynamic environment.**
S-6	**SLO-1**	Computer Vision Development Hardware and Software Requirements	Deep Learning for Computer Vision and Machine learning for Computer vision	Single Shot Multibox Detector (SSD) for Object Detection	3D Scene Understanding for Robotics Contextual Understanding in Scene Analysis	Vision-based Object Manipulation: Techniques for robots to manipulate objects based on visual cues.
S-7	**SLO-1**	Building a Computer Vision Hardware system	Introduction to robotics, robot kinematics, and dynamics.	Mask R-CNN for Object Detection and Instance Segmentation	Scene Understanding for Human-Rbot Interaction	Visual SLAM in Dynamic Environments: Handling moving objects and changing scenes in SLAM. 1.
	SLO-2	Choosing the software components	Overview of computer vision in robotics	Transfer Learning for Object Detection in Robotics	Real-Time Scene Understanding and Tracking	Vision-based Localization in GPS-denied Environments: Localizing robots using vision when GPS is unavailable.
S-8	**SLO-1**	Image Processing Techniques, Image Restoration, Linear Filtering,Independent Component Analysis, Pixelation, Template Matching, Image Generation Technique (GAN)	Importance of computer vision in smart robotics	Data Augmentation Techniques for Object Detection	Scene Understanding for Autonomous Navigation	Vision-based Obstacle Avoidance: Using vision to detect and avoid obstacles in the robot's path.
	SLO-2	Computer Vision Workflow Steps	Integration of Computer Vision and Robotics: Applications of computer vision in robotic systems, such as navigation, manipulation, and perception.	Real-Time Object Detection in Robotics	Environmental Modeling for Scene Understanding	Deep Reinforcement Learning for Vision-based Robotics: Using deep RL to train robots for various vision tasks.
	SLO-1					

S-9 to S-10	**SLO-2**	**Lab 2: Reading & Writing Images Open CV**	**Lab 5: Image Acquisition and Display: Write a program to capture images from a camera and display them on a screen using OpenCV or a similar library.**	**Lab 8:Object Tracking-Implement a basic object tracking algorithm (e.g., KLT tracker) to track a moving object in a video stream.**	**Lab 11:Scene Classification-Given a dataset of images representing different scenes (e.g., indoor, outdoor, kitchen, bedroom), build a classifier to classify the scenes into their respective categories using machine learning techniques.**	**Lab 14:Event Detection in Surveillance Videos: Develop a system to detect events of interest in surveillance videos.**
S-11	**SLO-1**	What is a Computer vision framework? Features of a computer vison framework	Calibration of cameras and sensors for robotic applications	Multi-Object Tracking in Robotics	Machine Learning for Adaptive Scene Understanding Probabilistic Models for Scene Understanding and Tracking	Event-based Vision for Robotics: Utilizing event-based cameras for high-speed, low-latency vision tasks.
	SLO-2	Introduction to popular libraries and frameworks (e.g., OpenCV, TensorFlow, PyTorch)	Image filtering and enhancement techniques	Object Detection in Challenging Environments (e.g., low light, occlusions)	Scene Understanding in Challenging Conditions (e.g., adverse weather, low light)	Robotic Vision in Extreme Environments: Applying vision in challenging conditions like underwater or space robotics.
S-12	**SLO-1**	Basics of image processing	Feature extraction methods (e.g., corners, edges, keypoints)	Object Detection on Unmanned Aerial Vehicles (UAVs) Object Detection for Autonomous Vehicles	Cognitive Approaches to Scene Understanding in Robotics	Future Trends in Computer Vision for Robotics: Discussing emerging technologies and their potential impact on smart robotics.
	SLO-2	Basics of computer vision algorithms	Introduction to image segmentation	Semantic Segmentation for Object Detection in Robotics	Benchmark Datasets and Evaluation Metrics for Scene Understanding	Challenges and Limitations of Vision-based Robotics: Examining current limitations and areas for improvement in vision-based systems.
S-13	**SLO-1**	What is a Computer vision model?	Traditional methods for object detection (e.g., Haar cascades, HOG)	Fusion of Object Detection with Other Sensors (e.g., LiDAR, Radar)	Future Trends in Scene Understanding and Tracking in Robotics	Integration of Computer Vision with Other Technologies: Exploring how vision can be combined with AI, IoT, and other technologies to enhance robotics.
	SLO-2	Train &Evaluate the computer Vision model	Introduction to deep learning for object detection	Ethical Considerations in Object Detection for Robotics	Ethical Considerations in Scene Understanding and Tracking	Ethical Considerations in Vision-based Robotics: Addressing ethical issues related to privacy, bias, and decision-making in autonomous systems.
S-14 to S-15	**SLO-1** **SLO-2**	**Lab 3:Color Space OpenCV, Thresholding OpenCV**	**Lab 6:Color Detection: Implement a simple color detection algorithm to detect and track objects of a specific color in a video stream.**	**Lab 9:Camera Calibration: Calibrate a camera using a chessboard pattern to correct for distortion and obtain the camera's intrinsic parameters.**	**Lab 12:Semantic Segmentation 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.**	**Lab 15:Underwater Object Detection: Develop a vision-based system to detect objects underwater.**

Learning Resources	1."Robot Vision" by Berthold Klaus Paul Horn . 2.'Computer Vision: Models, Learning, and Inference" by Simon J.D. Prince

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.S.Meenakshi, Assistant Professor,SRM IST, Ramapuram, Chennai

Course Code	PGI20D18J	Course Name	Building Conversational AI for Human Resources	Course Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,
CLR-1 :	Discover Conversational Artificial Intelligence technologies.
CLR-2 :	Study the basics of designing intelligent agents that can solve HR problems
CLR-3 :	Discover appropriate HR dialogue system using natural language processing
CLR-4 :	Perform conversational design process with different use cases of HR context
CLR-5 :	Formalize conversational AI linear and nonlinear dialogue

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning: 1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)
CLO-1 :	Demonstrate fundamental understanding of the Conversational Artificial Intelligence and its foundations	2	85	80
CLO-2 :	Apply basic principles conversational artificial intelligence in HR domain knowledge	3	85	80
CLO-3 :	Develop conversational AI models with understanding of HR policies and procedures.	3	85	80
CLO-4 :	Ability to understand Natural Language Processing fundamentals	3	85	80
CLO-5 :	Ability to learn conversational agents and develop dialogue systems.	3	85	80

Program Learning Outcomes (PLO)	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	L	-	M	L	M	-	-	M	M	M	H	-	H	M	-
CLO-2 :	L	M	M	L	M	-	-	M	M	M	H	-	H	M	-
CLO-3 :	L	-	M	L	M	-	-	M	M	M	H	-	H	M	-
CLO-4 :	L	M	M	L	M	-	-	M	M	M	H	-	H	M	-
CLO-5 :	L	-	M	L	M	-	-	M	M	M	H	-	H	M	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to Conversational AI for HR	HR Domain Knowledge	Building Conversational AI Models	Ethical and Legal Considerations	Project Development and Presentation
	SLO-2	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
S-2	SLO-1	Applications and benefits of conversational AI in HR	Employee lifecycle management	Pre-trained language models for conversational AI	Data protection regulations	Project Proposal
	SLO-2	Challenges and limitations of conversational AI in HR contexts	Recruitment, on-boarding, performance management, off-boarding	Fine-tuning models on HR-specific datasets	Bias and fairness in conversational AI systems	Develop a project proposal outlining the problem statement
S-3	SLO-1	Conversational Design Process	HR compliance and legal considerations	Model evaluation	Transparency and accountability in AI decision-making	Objectives, methodology

	SLO-2	Use cases of HR context	Employee benefits, compensation, and payroll administration	Performance metrics	Ethical use of Conversational AI in HR interactions	Expected outcomes
S4to S5	**SLO-1**	**Lab 1 : Implement a tokenization function to split input text into tokens.**	**Lab 4 :Construct dialogue trees representing various conversation paths based on user inputs and system responses.**	**Lab 7: Access HR-related data sources (e.g., employee database, leave management system) using APIs or database queries.**	**Lab 10: Implement strategies to mitigate biases and ensure fairness and inclusivity in conversational AI systems.**	**Lab 13 : Project integrating concepts learned throughout the course**
S-6	**SLO-1**	Natural Language Processing (NLP) Fundamentals	User-centered design principles for conversational interfaces	Linear and Non-linear dialogue	Fulfilment using webhook	Project Implementation
	SLO-2	Basics of text processing and tokenization	Personal development and conversational tone	Actions & Parameters	Basic setup of webhook code	Implement the proposed conversational AI system, ,
S-7	**SLO-1**	Part-of-speech tagging	Prompt design	Understanding slot filling context	Extracting parameter values and structuring responses	Incorporating NLP
	SLO-2	Syntactic parsing	Error handling	Extended Lead Generation	Fulfillment using cloud function	Dialogue management
S-8	**SLO-1**	Named entity recognition and entity linking	Multimodal interactions	Linear dialogue	SAP Conversational AI	Integration with HR systems.
	SLO-2	Sentiment analysis and emotion detection	Accessibility considerations	Nonlinear Dialogue	Connect Chatbot to HR systems	Ethical considerations
S9to10	**SLO-1**	**Lab 2: Use an NLP library to perform part-of-speech tagging on sample sentences**	**Lab 5: Implement error handling strategies to handle user misunderstandings or unexpected inputs**	**Lab 8 :Preprocess retrieved data to extract relevant information and prepare it for use in conversational interactions**	**Lab 11: Build a Web hook for a Chatbot and connect with HR Systems.**	**Lab 14: Demonstrating the functionality and effectiveness of the conversational AI system.**
S-11	**SLO-1**	Dialogue Systems and Conversational Agents	Building blocks of Interaction models	Accessing HR databases	Assess the performance of conversational AI systems using appropriate metrics.	Deployment: Introduction to Heroku
	SLO-2	Introduction to dialogue systems architecture	Agents, types of Intents	APIs, and third-party services	User Testing	Deploying to Heroku
S-12	**SLO-1**	Intent recognition and dialogue state tracking	creating Intents, training phrases	Integrating conversational AI with HR management software	Conduct user testing sessions with human participants	Deploying on Alexa,
	SLO-2	Dialogue management strategies (rule-based, statistical, reinforcement learning)	Entities, configuring rich responses	Applicant tracking systems	Evaluate the usability and effectiveness of the conversational AI system	Re-training ,Validation& Testing
S-13	**SLO-1**	Handling multi-turn conversations.	Small talk and salutations	Data privacy	Analyze common errors and misunderstandings encountered during user interactions	Building a AI application on Heruku

	SLO-2	Context preservation.	Configuring and testing Intents on Google Assistant	Security, and compliance considerations.	Identify areas for improvement.	Demonstrating with HR systems
S14 to S15	**SLO-1**	**Lab 3: Designing Conversational Flows: Define common HR scenarios (e.g., employee onboarding, leave request) and outline the conversation flow for each scenario.**	**Lab 6: Design and train a simple intent recognition model using a rule-based or machine learning approach.**	**Lab 9: Test the integration between the conversational AI system and HR systems to ensure data accuracy and consistency.**	**Lab 12 : Conduct user testing sessions with human participants to evaluate the usability and effectiveness of the conversational AI system**	**Lab 15: Deploying a chatbot on Heruku.**

Learning Resources	**1. Hands-on chatbot with Google Dialogflow, Loonycorn, O'Reilly, Packt publishing** **2. Hands-on chatbots and conversational UI development, Srini Janarthanam, Packt publishing**

Learning Assessment

Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	1. Dr. Agusthiyar R, Professor, Computer Applications, SRM IST Ramapuram. 2. Mrs.S.Suriya, Asst. Professor, Computer Applications, SRM IST Ramapuram.

Course Code	PGI20P01L	Course Name	Internship	Course Category	P	Project Work, Internship In Industry / Higher Technical Institutions	L	T	P	C
							-	-	-	2

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning	Program Learning Outcomes (PLO)

		1	2	3
CLR-1 :	Demonstrate skills learnt in the real time environment.			
CLR-2 :	Explore the different industries that are using IT			
CLR-3 :	Enhance the skills in the system aspects			
CLR-4 :	Understanding the professional connections with the knowledge learnt			
CLR-5 :	Applying the skills in problem solving			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	To get an insight of an industry and organization/company	3	80	70	L	H	-	H	L	-	-	-	L	L	-	H	-	H	H
CLO-2 :	To gain valuable skills and knowledge	3	85	75	M	H	L	M	L	-	-	-	M	L	-	H	-	H	H
CLO-3 :	To make professional connections and enhance networking	3	75	70	M	H	M	H	L	-	-	-	M	L	-	H	-	H	H
CLO-4 :	To get experience in a field to allow the student to make a career transition	3	85	80	M	H	M	H	L	-	-	-	M	L	-	H	-	H	H
CLO-5 :	To get an inside view of an industry and organization/company	3	85	75	H	H	M	H	L	-	-	-	M	L	-	H	-	H	H

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

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

Course Code	PGI20P02L	Course Name	Mini Project Work	Course Category	P	Project Work, Internship In Industry / Higher Technical Institutions	L	T	P	C
							0	0	12	6

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

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

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)
CLO-1 :	To get an inside view of an industry and organization/company	3	80	70
CLO-2 :	To gain valuable skills and knowledge	3	85	75
CLO-3 :	To make professional connections and enhance networking	3	75	70
CLO-4 :	To get experience in a field to allow the student to make a career transition	3	85	80
CLO-5 :	To get an inside view of an industry and organization/company	3	85	75

Program Learning Outcomes (PLO)	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	L	H	-	H	L	-	-	-	L	L	-	H	-	-	-
CLO-2 :	M	H	L	M	L	-	-	-	M	L	-	H	-	-	-
CLO-3 :	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-4 :	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-5 :	H	H	M	H	L	-	-	-	M	L	-	H	-	-	-

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

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

Course Code	PGI20G01J	Course Name	Blockchain Technology	Course Category	G	Generic Elective Course	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning

CLR-1 :	Demystify fundamental components of Cryptography
CLR-2 :	Explain the basics of the blockchain.
CLR-3 :	Explain the components of decentralization in block chain
CLR-4 :	Identify and acquire knowledge in Bit coins
CLR-5 :	Ability to identify bit coin wallets

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)
CLO-1 :	Acquire the basics of Cryptography and how it works behind – the scene	2	85	80
CLO-2 :	Be aware block chains and their technology	3	85	80
CLO-3 :	Understand the decentralization process.	3	85	80
CLO-4 :	Establish deep understanding of the Bit coins	3	85	80
CLO-5 :	Apply knowledge in creation of bit coin wallet	3	85	80

Program Learning Outcomes (PLO)	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	L	-	-	-	-	-	-	-	M	-	-	-	-	-	-
CLO-2 :	M	H	H	-	-	-	-	-	M	-	-	-	-	-	-
CLO-3 :	-	H	H	H	H	-	-	M	M	-	-	-	-	-	-
CLO-4 :	-	-	H	H	M	-	-	M	M	-	-	-	-	-	-
CLO-5 :	-	-	H	H	H	-	-	-	M	H	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to Cryptography:	Blockchain basics	Permissioned ledger	Introducing Bitcoin	Bitcoin Network and Payments
	SLO-2	Cryptographic Hash Functions	The growth of blockchain technology	Shared ledger	Bitcoin	The Bitcoin network
S-2	SLO-1	Properties of Hash functions	Distributed systems	Fully private and proprietary blockchains	Bitcoin definition	Wallets
	SLO-2	SHA-256.	Electronic cash	Tokenized blockchains	Bitcoin – a bird's-eye view	Non-deterministic wallets- Deterministic wallets
S-3	SLO-1	Hash Pointers and Data Structures	Blockchain defined	Tokenless blockchains	Sending a payment to someone	Hierarchical Deterministic wallets

	SLO-2	Merkle trees	Generic elements of a blockchain	Consensus	Digital keys and addresses	Brain wallets-Hardware wallets
S-4-5	**SLO-1**	**Lab :1 Demonstrating secret key cryptography techniques**	**Lab :4 Implement a digital signature algorithm in c**	**Lab 7: Study assignment on blockchain-based applications/projects.**	**Lab 10: Creating bit coins**	**Lab 13: Creating a Crypto-currency Wallet using Java**
	SLO-2	**Proof of membership**				
S-6	**SLO-1**	Proof of non-membership	Generic elements of a blockchain	Consensus in blockchain	Private keys in Bitcoin	Online wallets
	SLO-2	Digital Signatures	How blockchain works	CAP theorem and blockchain	Public keys in Bitcoin	Mobile wallets
S-7	**SLO-1**	Properties	How blockchain accumulates blocks	Decentralization	Addresses in Bitcoin	Bitcoin payments
	SLO-2	Practical Concerns	Benefits and limitations of blockchain	Decentralization using blockchain	Base58Check encoding	Innovation in Bitcoin
S-8	**SLO-1**	ECDSA	Tiers of blockchain technology	Methods of decentralization	Vanity addresses-Multisignature addresses	Bitcoin Improvement Proposals (BIPs)
	SLO-2	Public Keys as Identities	Features of a blockchain	Disintermediation		Advanced protocols
S-9-10	**SLO-1**	**Lab 2: Demonstrating public key cryptography techniques**	**Lab 6: Demonstrate the working of the Merkle tree using any programming language**	**Lab 8: Write a program to study block chain using python**	**Lab 11: Case study for bitcoin generation mechanisms.**	**Lab 14: Code to implement peer-to-peer using block chain**
	SLO-2					
S11	**SLO-1**	Cryptocurrency	Types of blockchain	Contest-driven decentralization	Transactions-The transaction life cycle	Segregated Witness (SegWit)
	SLO-2	A Simple Cryptocurrency	Distributed ledgers-Distributed Ledger Technology	Routes to decentralization	Transaction fee	Bitcoin Cash
S-12	**SLO-1**	Coin	Public blockchains	How to decentralize	The transaction data structure	Bitcoin Gold- Bitcoin investment and buying and sellingbitcoins
	SLO-2	GoofyCoin	Private blockchains	The decentralization framework example	Metadata	Bitcoin Clients and APIs-Bitcoin installation-Types of Bitcoin Core clients
S-13	**SLO-1**	ScroogeCoin	Semiprivate blockchains	Blockchain and full ecosystemdecentralization	Inputs-Outputs	Setting up a Bitcoin node-Setting up the source code
	SLO-2	ScroogeCoin	Sidechains	Storage	Types of transactions- Coinbase transactions	Experimenting with Bitcoin-cli-Bitcoin programming and the command-line interface

S-14-15	**SLO-1**	**Lab 3: Demonstrating Hashing Techniques (SHA and MD5.**	**Lab 3: Demonstrating Hashing Techniques (SHA and MD5).**	**Lab 9: Case Study on Block chain decentralization**	**Lab 12: Building a Bitcoin Wallet Application Using any Programming Languages /Tools**	**Lab 15: Case Study on Applications of Bit coins**
	SLO-2					

Learning Resources	1. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Princeton Press, 2016. 2. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.	1. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands On Approach", 2017

Learning Assessment

Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.N.Krishnamoorthy . SRMIST, RMP

Course Code	PGI20G02J	Course Name	Cyber Security	Course Category	G	Generic Elective Courses	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning

CLR-1 :	To learn cybercrime and cyber law
CLR-2 :	To understand the cyber-attacks and tools for mitigating them
CLR-3 :	To understand information gathering
CLR-4 :	To learn how to detect a cyber-attack
CLR-5 :	To learn how to prevent a cyber-attack

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)
CLO-1 :	Explain the basics of cyber security, cyber crime and cyber law	2	85	80
CLO-2 :	Classify various types of attacks and learn the tools to launch the attacks	3	85	80
CLO-3 :	Apply various tools to perform information gathering	3	85	80
CLO-4 :	Apply intrusion techniques to detect intrusion	3	85	80
CLO-5 :	Apply intrusion prevention techniques to prevent intrusion	3	85	80

Program Learning Outcomes (PLO)

1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
L	L	L	L	-	L	-	-	-	-	-	-	M	M	M
L	H	L	H	M	L	-	-	-	-	-	-	M	M	M
M	L	M	L	-	L	-	-	-	-	L	-	M	M	M
H	H	L	M	M	L	-	-	-	-	-	-	M	M	M
H	M	L	L	L	L	-	L	-	-	L	-	M	M	M

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to Cyber Security	Attacks And Countermeasures: OSWAP	Reconnaissance: Harvester	Intrusion Detection:	Intrusion Prevention
	SLO-2			Whois- Netcraft – Host		
S-2	SLO-1	History of Internet	Malicious Attack Threats and Vulnerabilities	Extracting Information from DNS	Host -Based Intrusion Detection	Firewalls and Intrusion Prevention Systems
	SLO-2	Impact of Internet		Extracting Information from E-mail Servers		
S-3	SLO-1	CIA Triad	Scope of Cyber-Attacks	Social Engineering Reconnaissance	Network -Based Intrusion Detection	**Need for Firewalls**
	SLO-2	Reason for Cyber Crime		Scanning – Port Scanning		
	SLO-1					

S-4-5	**SLO-2**	**Lab :1 Install Kali Linux on Virtual box**	**Lab 4: Understand the nmap command d and scan a target using nmap**	**Lab 7: Write a program to calculate the message digest of a text using the SHA-1 algorithm.**	**Lab 10: Explore and install Snort intrusion detection tool.**	**Lab 13: Use Fail2banto scan log files and ban Ips that show the malicious signs**
S-6	**SLO-1**	Need for Cyber Security	Security Breach	Network Scanning	Distributed or Hybrid Intrusion Detection	**Firewall Characteristics**
	SLO-2			Vulnerability Scanning		
S-7	**SLO-1**	History of Cyber Crime	Types of Malicious Attacks	Scanning Methodology	Intrusion Detection Exchange Format	**Firewall &Access Policy**
	SLO-2			Ping Sweer Techniques		
S-8	**SLO-1**	Cybercriminals	Malicious Software	Nmap	Honeypots	Types of Firewalls
	SLO-2			Command Switches		
S-9-10	**SLO-1**	**Lab 2: Explore Kali Linux and bash scripting**	**Lab 5: Install metasploitable2 on the virtual box and search for unpatched vulnerabilities**	**Lab 8: Write a program to calculate the message digest of a text using the MD-5 algorithm**	**Lab 11: Install Linus server on the virtual box and install ssh**	**Lab 14: Launch brute-force attacks on the Linux server using Hydra.**
	SLO-2					
S 11	**SLO-1**	Classification of Cybercrimes	Common Attack Vectors	SYN – Stealth	Example System Snort	**Firewall Basing**
	SLO-2					
S-12	**SLO-1**	A Global Perspective on Cyber Crimes	Social engineering Attack	XMAS – NULL – IDLE – FIN Scans	Enabling new human experiences,	**Firewall Location and Configurations**
	SLO-2	Cyber Laws	Wireless Network Attack			**Intrusion Prevention Systems**
S-13	**SLO-1**	The Indian IT Act	Web Application Attack	Banner Grabbing and OS Finger printing Techniques.	Trust in online environment	**Example Unified Threat Management Products.**
	SLO-2	Cybercrime and Punishment	Attack Tools			
			Countermeasures			
S-14-15	**SLO-1**	**Lab 3: Perform open source intelligence gathering using Netcraft, Whois Lookups, DNS Reconnaissance, Harvester and Maltego**	**Lab 6: Use Metasploit to exploit an unpatched vulnerability**	**Lab 9: Write a program to implement digital signature standard**	**Lab 12: Study Email Tracking and EmailTracing and write a report on them**	**Lab 15: Perform real-time network traffic analysis and data pocket logging using Snort**
	SLO-2					

Learning Resources	1. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021 (Unit 1) 2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011 (Unit 1) 3. https://owasp.org/www-project-top-ten/	1. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones & Bartlett Learning Publishers, 2013 (Unit 2) 2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011 (Unit 3) 3. Kimberly Graves, "CEH Official Certified Ethical hacker Review Guide", Wiley Publishers, 2007 (Unit 3) 4. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015 (Units 4 and 5) 5. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", No Starch Press, 2014 (Lab)

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	**Dr.J.Dhilipan, Professor & Head,** SRMIST, RMP
		D.B.Shanmugam, Assistant Professor , SRMIST, RMP

Course Code	PGI20G03J	Course Name	Mobile Communication Network	Course Category	G	Generic Elective Course	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	Critical Understanding of Communication Infrastructure	
CLR-2 :	Preparation for Industry Relevance	
CLR-3 :	Empowering Innovation and Problem-Solving	
CLR-4 :	Global Connectivity and Societal Impact	
CLR-5 :	Foundation for Advanced Studies and Specializations	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1 Level of Thinking (Bl)	2 Expected Proficiency (%)	3 Expected Attainment (%)
CLO-1 :	Explain the basics of mobile telecommunication system	2	85	80
CLO-2 :	Illustrate the generations of telecommunication systems in wireless network	3	85	80
CLO-3 :	Understand the architecture of Wireless LAN technologies	3	85	80
CLO-4 :	Determine the functionality of network layer and Identify a routing protocol for a given Ad-hoc networks	3	85	80
CLO-5 :	Explain the functionality of Transport and Application layer	3	85	80

Program Learning Outcomes (PLO)														
1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
L	-	-	-	-	-	-	-	M	-	-	-	-	-	-
M	H	H	-	-	-	-	-	M	-	-	-	-	-	-
-	H	H	H	H	-	-	M	M	-	-	-	-	-	-
-	-	H	H	M	-	-	M	M	-	-	-	-	-	-
-	-	H	H	H	-	-	-	M	H	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to Mobile Communication Networks:	Wireless Propagation and Channel Modelling:	Multiple Access Techniques:	Cellular Concepts and System Design: Fundamental principles of cellular network design	Mobile Network Protocols: The protocols and protocols stacks
S-2	SLO-1	Evolution of Mobile Communication	Propagation Mechanisms	Frequency Division Multiple Access (FDMA)	Cellular Architecture	Communication between mobile devices and network infrastructure
	SLO-2	Introduce foundational concepts	Various propagation mechanisms	Process of FDMA divides the spectrum into frequency bands allocated to different users	Hierarchical structure of cellular networks	OSI Model and Protocol Stack
S-3	SLO-1	Spectrum allocation, modulation techniques, and network architecture	Reflection, diffraction and scattering	Time Division Multiple Access (TDMA)	Base stations, mobile stations, and switching centers	The physical, data link, network, transport, and application layers

	SLO-2	Wireless Propagation and Channel Characteristics	Impact on signal propagation.	TDMA's time-sharing approach - users transmit in allocated time slots	Cell Planning: The process of cell planning	Physical Layer Protocols: GSM, CDMA, and LTE
S-4-5	**SLO-1**	**Lab :1 Implement a simple mobile communication system simulator that demonstrates the basic concepts of frequency reuse, handover, and mobility management**	**Lab 4: Develop a simulator to compare and evaluate the performance of FDMA, TDMA, CDMA, and OFDMA in terms of spectral efficiency and interference management**	**Lab 7: Implement interference mitigation techniques such as power control, adaptive beam forming, or interference cancellation in a simulated wireless network environment**	**Lab 10: Implement a CDMA-based communication system simulator and analyze its performance in handling multiple users and mitigating interference**	**Lab 13: Design and implement QoS mechanisms to prioritize traffic, ensure bandwidth allocation, and manage latency in a simulated mobile network environment**
	SLO-2					
S-6	**SLO-1**	Overview of Data Communications	Path Loss Models	Code Division Multiple Access (CDMA)	Cell sizing, frequency reuse, and cell sectorization	Modulation schemes, frame structures, and channel coding techniques
S-7	**SLO-1**	Overview of Internet	Free space path loss, two-ray ground reflection model, and log-normal shadowing model	CDMA's spread spectrum technique-transmit using unique codes	Capacity and Coverage Planning	Data Link Layer Protocols: LAPD (Link Access Procedure for D channels)
S-8	**SLO-1**	Building Network and its types	Fading and Multipath Propagation: Understand fading phenomena	Simultaneous transmission	Techniques for optimizing network capacity and coverage	PPP (Point-to-Point Protocol) used for data encapsulation and framing
	SLO-2	Overview of Data and Signals	Rayleigh fading and Rician fading, and techniques to mitigate their effects	Orthogonal Frequency Division Multiple Access (OFDMA)	Cell splitting and sectorization	Network Layer Protocols: IP (Internet Protocol) and Mobile IP
S-9-10	**SLO-1**	**Lab 2: Analyze the performance differences between 1G, 2G, 3G, 4G, and 5G networks using network simulation tools like NS-3 or MATLAB. Wireless Propagation and Channel Modelling**	**Lab 5: Design and simulate a cellular network layout considering cell planning, frequency reuse, and interference management strategies using software like OpenCellular or Atoll**	**Lab 8: Implement a simplified version of the OSI protocol stack, including physical, data link, network, and transport layers, and demonstrate data transmission between mobile devices**	**Lab 11: Design and implement a Mobile IP protocol stack to support seamless mobility of devices across different IP networks, and evaluate its effectiveness in real-world scenarios**	**Lab 14: Develop location-based services (LBS) applications using GPS or cell tower triangulation techniques, and explore their use cases and practical implementations**
	SLO-2					
S 11	**SLO-1**	Explore how radio waves propagate in different environments	Channel Modelling: mathematical models for channel characterization	Introduce OFDMA - Divides the spectrum into subcarriers	Interference Management	Routing and mobility management in mobile networks
	SLO-2	Free space, urban, and indoor scenarios	Stochastic models and empirical models	Wireless Networks	Strategies for mitigating interference in cellular networks	Mobile Transport And Application Layer
S-12	**SLO-1**	Mobility Management: Techniques for managing mobility in mobile networks	Mobile telecommunication system GSM, Architecture, Protocols, Connection Establishment	Wireless LANs and PANs	Power control, adaptive modulation, and interference cancellation	Mobile TCP: WAP ,Architecture
	SLO-2	Procedures and location management	Frequency Allocation, Routing, Mobility Management	IEEE 802.11 Standard	MOBILE NETWORK LAYER: Mobile IP, DHCP ,AdHoc, Proactive and Reactive Routing Protocols	WDP , WTLS , WTP
S-13	**SLO-1**	MAC Protocols: SDMA, TDMA	Security ,GPRS	Architecture ,Services	Multicast Routing, Vehicular Ad Hoc networks (VANET)	WSP, WAE

	SLO-2	FDMA , CDMA	UMTS, Architecture	Blue Tooth- Wi-Fi ,WiMAX	MANET Vs VANET	WTA Architecture, WML
S-14 -15	**SLO-1**	**Lab 3: Simulate the effects of multipath propagation and fading using MATLAB or Python, and analyze the impact on signal quality and coverage**	**Lab 6: Develop an algorithm to optimize the allocation of resources (frequency channels, time slots) in a cellular network to maximize capacity and coverage while minimizing interference**	**Lab 9: Develop a GSM protocol stack simulator to handle functions such as call setup, SMS messaging, and handover between base stations. CDMA Protocol Implementation**	**Lab 12: Develop a security framework for mobile communication networks, including encryption algorithms, authentication protocols, and intrusion detection mechanisms**	**Lab 15: Experiment with emerging 5G technologies such as massive MIMO, beam forming, and network slicing by prototyping and testing various network configurations in a laboratory setting**
	SLO-2					

Learning Resources	1. Jochen Schiller, "Mobile Communications", PHI, Second Edition, 2003. 2. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt.Ltd, New Delhi – 2012 3. William.C.Y.Lee,"Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition,Tata Mc Graw Hill Edition ,2006.	1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005. 2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003. 3. C.K.Toh, "AdHoc Mobile Wireless Networksll, First Edition, Pearson Education, 2002.

Learning Assessment

Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember Understand	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
Level 2	Apply Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Evaluate Create	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.T.Papitha Christobel, SRMIST,RMP

Course Code	PGI20G04J	Course Name	Quantum Machine Learning	Course Category	G	GENERIC ELECTIVE COURSE	L	T	P	C
							3	0	2	4

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

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

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Acquire the basics of procedures for the Machine Learningalgorithms	2	85	80
CLO-2 :	Apply appropriate data sets to the Machine Learning algorithms	3	85	80
CLO-3 :	Use Machine Learning algorithms to solve real-world problems.	3	85	80
CLO-4 :	To gain knowledge of Outline predictions using machine learning algorithms.	3	85	80
CLO-5 :	Design Java/Python programs for various Machine Learning Algorithms.	3	85	80

Program Learning Outcomes (PLO)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLO-1 :	H	M	-	M	-	-	-	-	-	-	-	L	H	H	-
CLO-2 :	H	H	M	-	-	-	-	-	-	-	-	L	H	M	-
CLO-3 :	H	M	H	M	-	-	-	-	-	-	-	L	H	M	-
CLO-4 :	H	-	H	M	-	-	-	-	-	-	-	L	H	M	-
CLO-5 :	H	M	-	H	-	-	-	-	-	-	-	L	H	M	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to Quantum Computing	Diagonal Representation of an Operator	Grover's Algorithm	Quantum Linear Regression	Quantum Variational Optimization and Adiabatic Methods
	SLO-2	Quantum Bit	Normal Operators	Quantum Fourier Transform and Related Algorithms	Quantum Swap Test Subroutine	Variational Quantum Eigensolver
S-2	SLO-1	Multiple Qubits	Unitary Operators	Fourier Series	Swap Test Implementation	Expectation Computation
	SLO-2	Bell State	Commutator and Anti-commutator Operators	Fourier Transform	Quantum Euclidean Distance Calculation	Isling Model and Its Hamiltonian
S-3	SLO-1	Dirac Notation	Postulates of Quantum Mechanics	Discrete Fourier Transform	Quantum Euclidean Distance	Isling Model for a Quantum System

	SLO-2	Single-Qubit Gates	Hamiltonian Simulation and Trotterization	Kronecker Delta Function	Compute Routine Implementation	Implementation of the VQE Algorithm
S-4-5	**SLO-1**	**Lab :1 The probability that it is Friday and that a student is absent is 3 %. Since there are5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Bayesrule in python to get the result.**	**Lab 4: Implement linear regression using python**	**Lab 7: Implement the finite words classification system using Back-propagation algorithm**	**Lab 10: Program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample**	**Lab 13: Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set**
	SLO-2					
S-6	**SLO-1**	Multiple-Qubit Gates	Introduction to Quantum Algorithms	Motivating the Quantum Fourier Transform Using the Kronecker Delta Function	Quantum K-Means Clustering	Quantum Max-Cut Graph Clustering
	SLO-2	Measurements in Different Basis		Quantum Fourier Transform	Quantum K-Means Clustering Using Cosine Distance	Max-Cut Clustering Implementation Using VQE
S-7	**SLO-1**	Bell States with Quantum Gates	Cirq	QFT Implementation in Cirq	Quantum Principal Component Analysis	Quantum Adiabatic Theorem
	SLO-2	Quantum Teleportation	Simulation in Cirq with a Hadamard Gate	Hadamard Transform as a Fourier Transform	Quantum Support Vector Machines	Proof of the Adiabatic Theorem
S-8	**SLO-1**	Quantum Parallelism Algorithms	Qiskit	Quantum Phase Estimation	Quantum Least Square SVM	Quantum Approximate Optimization Algorithm
	SLO-2	Quantum Interference	Bell State Creation and Measurement	Quantum Phase Estimation Illustration in Cirq	SVM Implementation Using Qiskit	Implementation of QAOA
S-9-10	**SLO-1**	**Lab 2: Extract the data from database using python**	**Lab 5: Implement Naïve Bayes theorem to classify the English text**	**Lab 8: Find-S and Candidate Elimination Algorithm**	**Lab 11: Build an Artificial Neural Network by implementing the Backpropagationalgorithm and test the same using appropriate data sets.**	**Lab 14: program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.**
	SLO-2					
S 11	**SLO-1**	Introduction to Mathematical Foundations	Quantum Teleportation	Error Analysis in the Quantum Phase Estimation	Introduction to Quantum Deep Learning	Quantum Random Walk
	SLO-2	Postulates of Quantum Computing	Quantum Random Number Generator	Shor's Period Finding Algorithm and Factoring	Hybrid Quantum-Classical Neural Networks	Quantum Random Walk Implementation
S-12	**SLO-1**	Topics from Linear Algebra	Deutsch–Jozsa Algorithm Implementation	Hidden Subgroup Problem	Backpropagation in the Quantum Layer	Programming a quantum computer
	SLO-2	Basis Vectors	Bernstein–Vajirani Algorithm	Introduction to Quantum Machine Learning	MNIST Classification Using Hybrid Quantum-Classical Neural Network	The IBMQ

S-13	**SLO-1**	Orthonormal Basis	Bell's Inequality Test	HHL Algorithm	Quantum Neural Network for Classification on Near-Term Processors	Coding a quantum computer using simulator to carry basic quantum measurement
	SLO-2	Linear Operators	Simons Algorithm	HHL Algorithm Implementation Using Cirq	MNIST Classification Using TensorFlow Quantum	Coding a quantum computer using simulator to carry basic quantum state analysis
S-14-15	**SLO-1**	**Lab 3: Implement k-nearest neighbours classification using python**	**Lab 6:Implement an algorithm to demonstrate the significance of genetic algorithm**	**Lab 9: For a given set of training data examples stored in a .CSV file, implement anddemonstrate the Candidate-Elimination algorithm to output a description of the set of allhypotheses consistent with the training examples.**	**Lab 12: Program to implement the naïve Bayesian classifier for a sample training dataset stored as a .CSV file. Compute the accuracy of the classifier, considering few test datasets.**	**Lab 15:Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same dataset for clustering using k-Means algorithm. Compare the results of these twoalgorithms and comment on the quality of clustering. You can add Java/Python MLlibrary classes/API in the program**
	SLO-2					

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	1. Quantum Machine Learning with Python: Using Cirq from Google Research and IBM Qiskit, Santanu Pattanayak, 2021

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr.E.Srimathi. SRMIST, RMP

Course Code	PGI20G05J	Course Name	Cognitive Analytics Tools and Techniques	Course Category	G	GENERIC ELECTIVE COURSE	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	Learn the aspects related to Cognitive Psychology, Cognitive Systems and Cognitive Computing	
CLR-2 :	Familiarize the Cognitive Modelling and build the knowledge representation in cognitive modelling	
CLR-3 :	Conceive the concept of cognitive analytical tools and platforms.	
CLR-4 :	Identify and acquire knowledge in cognitive techniques, algorithms and ethical considerations	
CLR-5 :	Ability to identify the various applications of cognitive computing.	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bl.)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Acquire the basics of cognitive systems and its architecture	2	85	80
CLO-2 :	Implement of various cognitive models and its knowledge representation	3	85	80
CLO-3 :	Design and implement models using advanced cognitive tools and techniques	3	85	80
CLO-4 :	To gain knowledge in identifying the usage of cognitive technological	3	85	80
CLO-5 :	Apply cognitive analytics knowledge in various emerging application areas.	3	85	80

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
L	-	-	-	-	-	-	-	M	-	-	-	-	-	-
M	H	H	-	-	-	-	-	M	-	-	-	-	-	-
-	H	H	H	H	-	-	M	M	-	-	-	-	-	-
-	-	H	H	M	-	M	M	M	-	-	-	-	-	-
-	-	H	H	H	-	-	-	M	H	-	M	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Cognitive Psychology,	Overview of Cognitive Component Analysis	Overview of Cognitive analytics Tools with advanced computational Techniques IBM Watson Analytics Microsoft Azure Cognitive Services: Google Cloud AI Platform	Enabling cognitive technologies in cognitive computing	Applications: Cognitive analytics
	SLO-2	The Architecture of the Mind, The Nature of Cognitive Psychology				
S-2	SLO-1	Definition of Cognitive Science and Cognitive Systems	Low Level Cognitive Component Analysis: Machine Learning	Natural Language Processing Tools	Cognitive Analytics with Machine Learning Algorithms	Human-Computer Interaction (HCI)
	SLO-2		High Level Cognitive Component Analysis			
S-3	SLO-1	The Uses of Cognitive Systems	cognitive modelling: Symbolic Models	Machine Learning and Predictive Analytics Platforms	Artificial Intelligence as the foundation of cognitive Analytics	Education and Training
	SLO-2					

S-4-5	**SLO-1**	**Lab1: Customer Segmentation using Machine Learning in Python**	**Lab4: Implementation of Decision tree and K- Mean algorithm-A Low Level cognitive approach**	**Lab 7:Implement model using speech analytics techniques**	**Lab 10Text Detection and Extraction using OpenCV and OCR**	**Lab13: Build a cognitive assistant for Visually Impaired**
	SLO-2					
S-6	**SLO-1**	Understanding cognition Design Principles for Cognitive Systems	Connectionist Models	Cognitive Search and Knowledge Discovery Tools	Cognitive Computing with NLP	Psychology and Neuroscience
	SLO-2					
S-7	**SLO-1**	Components of a Cognitive system	Bayesian Models: Hybrid Models	Open AI'S GPT Model	Cognitive Computing and Reinforcement Learning	Artificial Intelligence (AI): human-like reasoning, perception, and decision-making
	SLO-2					
S-8	**SLO-1**	Human Centred Cognitive Cycle	Machines and Cognition	Visual analytics and Data Visualization Tools	Cognitive Computing and Deep Learning	chatbots, and virtual assistants.
	SLO-2					
S-9-10	**SLO-1**	**Lab 2: Implementation of Simple Machine AI real time problem**	**Lab5:Build a Bayesian Model for Anomaly=y Detection**	**Lab8:Implement Data Visualization using your own dataset**	**Lab 11: Age predictor and Gender classifier project using OpenCV**	**Lab 14: Build and train a self-learning Chatbot**
	SLO-2					
S 11	**SLO-1**	Evolution of Cognitive computing	Knowledge Based systems	Cognitive computing Platforms-Cloud AI Platform	Ethical considerations in cognitive analytics	Healthcare: medical diagnosis, treatment planning, and patient monitoring
	SLO-2					
S-12	**SLO-1**	Cognitive Computing Architecture	Logical Representation and Reasoning	Simulation software Tools: Agent based Modelling	Bias and fairness in data and algorithms	simulating clinical reasoning processes and analysing patient data
	SLO-2		Learning			
S-13	**SLO-1**	Cognitive computing Technologies	Language	Cognitive Architecture Software ACT-R and Soar	Privacy concerns and regulatory frameworks	Cognitive Decision Making
	SLO-2	Cognitive Science of Information Processing	Vision			Future of cognitive Science
S-14-15	**SLO-1**	**Lab3: Build a model for Information Processing using Cognitive science**	**Lab 6: Implement Knowledgerepresentation using predicate logics**	**Lab9: Explore the roles that metadata play in decision making, memory retrievals, and learning.**	**Lab 12: Case Study on Ethical, Fairness and Privacy considerations in Cognitive Science**	**Lab15:Time Series Analysis in health care domain**
	SLO-2					

Learning Resources	1.Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein, "Cognitive Science: An Introduction", MITPress. 2. Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao,CognitiveComputing:Theory and Applications: (Handbook of Statistics 35),Elsevier publications, 2016	3. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences" ,TheMITPress, 1999. 4. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020.

Learning Assessment												
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**									**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**				
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**		**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%		15%	15%
	Understand											
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%		20%	20%
	Analyze											
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%		15%	15%
	Create											
	Total	100 %		100 %		100 %		100 %			100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr S Uma Shankari , Associate Professor, SRMIST, RMP

Course Code	PGI20G06J	Course Name	Building GPT Powered Business Applications	Course Category	G	GENERIC ELECTIVE COURSE	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	Learn the aspects related to ChatGPT, Capabilities, advancements and future of ChatGPT.	
CLR-2 :	Familiarize the Natural Language Processing functionalities, Part of Speech, NLP Tools and Techniques.	
CLR-3 :	Conceive the concept of Prompt Engineering, LLM and advanced techniques for text generation,	
CLR-4 :	Identify and acquire knowledge in AI Chatbot, Copilot and Role of AI in Image Generation	
CLR-5 :	Ability to build GPT Powered Applications like Blog Writing, Text Generation, Writing Style and User Interface	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)
CLO-1 :	Acquire the basics of ChatGPT, Capabilities, advancements and future of ChatGPT	2	85	80
CLO-2 :	Enhance knowledge in Natural Language Processing functionalities, its tools and techniques.	3	85	80
CLO-3 :	Design and implement techniques in Prompt Engineering	3	85	80
CLO-4 :	To gain knowledge in AI Chatbot, Copilot and AI in Image Generation	3	85	80
CLO-5 :	Apply knowledge in developing GPT Powered Applications	3	85	80

Program Learning Outcomes (PLO)														
1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
L	-	M	-	M	M	-	-	M	-	-	M	-	-	-
M	H	H	-	-	H	-	-	M	-	-	M	-	-	-
-	H	H	H	H	H	-	M	M	-	-	H	-	-	-
-	H	H	H	M	H	-	M	M	-	-	H	-	-	-
-	H	H	H	H	H	-	-	M	H	-	H	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	ChatGPT Definition, 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
	SLO-2	Understanding the capabilities of ChatGPT	Statistical Language Modeling	Introduction to Large Language Models for Text Generation	Tasks in NLP	AI Blog Writing
S-2	SLO-1	Using ChatGPT	N-grams language models	Standard Practices for Text Generation with ChatGPT	Types of AI Chatbots	Topic Research
	SLO-2	Advancements and future of GPT Models	Markov chains and Hidden Markov Models	Advanced Techniques for Text Generation with LangChain	Challenges ahead	
S-3	SLO-1	Introduction to OpenAI	Smoothing techniques for language models	Vector Databases with FAISS and Pinecone	Working of AI Chatbots	Expert Interview
	SLO-2	OpenAI Playground	Text Classification and Sentiment Analysis	Autonomous Agents with Memory and Tools	Role of AI Tools in programming	

S-4-5	**SLO-1**	**Lab 1: Case Study on NLP Tool**	**Lab 4: Word2Vec Exploration**	**Lab 7: Experimenting with Prompts**	**Lab 10: Simple Chatbot**	**Lab 13: Build a website using Gen AI Tools**
	SLO-2					
S-6	**SLO-1**	Large Language Models(LLM)	Supervised learning for text classification	Introduction to Diffusion Models for Image Generation	Copilot by Github	Generate Outline
	SLO-2	Introduction to Natural Language Processing (NLP) - Overview of NLP	Naive Bayes	Challenges ahead	Working of copilot	
S-7	**SLO-1**	History, and Applications	Decision Trees	Limitations of Prompt Engineering	Copilot Compatibility	Text Generation
	SLO-2	Advantages and Disadvantages	Support Vector Machines (SVMs),	Future Directions and Emerging	Merits and Demerits of Copilot	
S-8	**SLO-1**	Challenges in NLP	Feature engineering for text data	Trends in Prompt Engineering	Converting comments to code using copilot	Writing Style
	SLO-2	Text preprocessing techniques	Evaluation metrics for text classification	Best Practices	Auto filling repetitive code	
S-9-10	**SLO-1**	**Lab 2:. Case Study on GPT**	**Lab 5: Applying Tokenization Techniques on text samples**	**Lab 8:.Working Functionality of GPT-3**	**Lab 11: Simple rule-based Chatbot**	**Lab 14: Gen AI with Custom Dataset**
	SLO-2					
S 11	**SLO-1**	Word Representations -	Types of sentiment analysis	Define GPT in academic perspective	Running tests using copilot	Title Optimization
	SLO-2	Lexical Analysis – Introduction	Lexicon-based and machine learning approaches	Importance and Use Cases of GPT	Navigating unfamiliar territory with copilot	
S-12	**SLO-1**	Tokenization	Evaluation of sentiment analysis models	History of GPT	Creating an application with copilot	AI Blog Images
	SLO-2	stemming	Introduction to word embeddings (Word2Vec, GloVe)	Risks and Limitations of GPT	Comparison of ChatGPT, Bard, LLAMA, Claude	
S-13	**SLO-1**	lemmatization	Transformers and their applications in NLP	Working of GPT	Role of AI in Image Generation	User Interface
	SLO-2	Part-of-speech tagging	Language generation and chatbots Introduction to neural networks for NLP	Realtime Examples of GPT	AI Tools for Image Generation	
S-14-15	**SLO-1**	**Lab 3: Case Study on Prompt Engineering**	**Lab 6: Case Study on ChatGPT API**	**Lab 9: Experimenting Naïve Bayes**	**Lab 12: Working of GPT-4**	**Lab 15: Working of Conversational AI**
	SLO-2					

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.	1. Steven Bird, Ewan Klein and Edward Loper."Natural Language Processing with Python", O'REILLY Publication.

Learning Assessment												
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**									**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**				
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**		**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%		15%	15%
	Understand											
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%		20%	20%
	Analyze											
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%		15%	15%
	Create											
	Total	100 %		100 %		100 %		100 %			100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr SUBBAIAH, Associate Professor, SRMIST, RMP

Course Code	PGI20G07J	Course Name	Development of Health Care Generative AI (Lab: Google Generative AI Studio)	Course Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,
CLR-1 :	Introduce the fundamentals of Generative AI
CLR-2 :	Understand the applications of Generative AI
CLR-3 :	Understand the Policy Generations of Generative AI
CLR-4 :	Understand the Autonomous Generation of Generative AI
CLR-5 :	Understand the Health care Policies of Generative AI

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning: 1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 ICT Skills	14 Professional Behavior	15 Life Long Learning
CLO-1 :	Recognize basics of Generative AI	2	85	80	L	-	-	-	-	-	-	-	M	-	-	-	-	-	-
CLO-2 :	Apply concepts in Generative AI	3	85	80	M	H	H	-	-	-	-	-	M	-	-	-	-	-	-
CLO-3 :	Identify the Policy Generations of Generative AI	3	85	80	-	H	H	H	H	-	-	M	M	-	-	-	-	-	-
CLO-4 :	Develop the Autonomous Generation of Generative AI	3	85	80	-	-	H	H	M	-	-	M	M	-	-	-	-	-	-
CLO-5 :	Employ techniques in Health care Policies of Generative AI	3	85	80	-	-	H	H	H	-	-	-	M	H	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Evolution of AI: From Rule-Based to Generative Models	Personalization and Adaptability in AI-Generated Content	best practices for using generative AI	Autonomous Generative AI	Contextual Awareness
	SLO-2					
S-2	SLO-1	Key Generative AI Models: RNNs, LSTMs, GPT, and More	Ensuring Quality and Reliability in AI-Generated Content	policy for generative AI	Generative AI-Augmented Apps and Services	Content Generation Role of Generative AI in Managing Administrative Process in Healthcare
	SLO-2					
S-3	SLO-1	Variational Autoencoders (VAEs)	Contextual AI and Memory Mechanism	Tech providers in the generative AI market	Generative AI in Schools and Education	Assistive Healthcare Interactive Chatbots
	SLO-2					

S-4-5	**SLO-1**	**Lab -Test models using prompt samples.**	**Lab - Google AI Studio quickstart**	**Lab - Code completion and generation**	**Lab - Build a product copy generator**	**Lab - Case Study I**
	SLO-2					
S-6	**SLO-1**	Generative Adversarial Networks (GANs)	The Convergence of Human and AI Creativity	Artificial general intelligence	Understanding Advanced Multimodal Generative AI	Medical Imaging
	SLO-2					
S-7	**SLO-1**	Transformers	The Role of Prompt Engineering in the AI-Driven Economy	Role of generative AI tools in various industries	Fusion Module	Drug Discovery and Development
	SLO-2					
S-8	**SLO-1**	Restricted Boltzmann Machines (RBMs	Benefits and applications of Generative AI	Generative AI tools and Platforms	Input Module, Output Module	Personalized Medicine
	SLO-2					
S-9-10	**SLO-1**	**LAb - Design and save our own prompts.**	**Lab - Writing scripts with Gemini AI**	**Lab - Generate and Customize Images**	**Lab - Build a custom chat application**	**Lab - Case Study II**
	SLO-2					
S 11	**SLO-1**	Popular Use Cases for Generative AI	The risks of generative AI	ChatGPT, Scribe	Multimodal Inputs,	Challenges of Generative AI in Healthcare Industry
	SLO-2					
S-12	**SLO-1**	Enhancing Creativity and Diversity in AI-Generated Content	Practical uses of generative AI	Alpha Code, GitHub Copilot	Cross-Modal Understanding	Ethical Considerations
	SLO-2					
S-13	**SLO-1**	.	Contribution of generative AI in Business	GPT-4	Single-Modal Vs Multi-Modal	Future of generative AI
	SLO-2	Addressing AI Ethics and Bias through Thoughtful Prompt Engineering				
S-14-15	**SLO-1**	**Lab - Convert text-to-speech and speech-to-text.**	**Lab -Creating text prompts with Google AI Studio and Gemini AI**	**Lab - Universal speech model**	**Lab - Experiment with model parameters**	**Lab - Case Study III**
	SLO-2					

Learning Resources	Impromptu: Amplifying Our Humanity Through AI,Reid Hoffman is a co-founder of LinkedIn, an investor at venture firm Greylock Partners, and a former board member of OpenAI.Publish Date: March 15, 2023 Rebooting AI: Building Artificial Intelligence We Can Trust.,Gary Marcus and Ernest Davis, both professors at New York University. Marcus is a professor emeritus of psychology and neural science, and Davis is a professor of computer science.Publish Date: September 10, 2019 Exploring the Advanced Multi-Modal Generative AI - Analytics Vidhya Generative AI in healthcare: Emerging use for care | McKinsey	

Learning Assessment												
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (50% weightage)**									**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**				
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**		**Theory**	**Practice**
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%		15%	15%
	Understand											
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%		20%	20%
	Analyze											
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%		15%	15%
	Create											
	Total	100 %		100 %		100 %		100 %			100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.JothiPeriasamy, Founder/Chief Data Scientist, DeepSphere.AI,2 Venture Drive, #13-26 Vision Exchange, Singapore, 608526	Dr.S. Gopinathan, Professor and Head, Department of Computer Science, University of Madras, Guindy Campus, Chennai – 600 025	Dr. V. Saravanan. SRMIST, RMP

Course Code	PGI20AE3T	Course Name	Career Advancement – III	Course Category	AE	Ability Enhancement Course	L	T	P	C
							3	0	0	3

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

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	To put in use the basic mechanics of Grammar.	
CLR-2 :	To learn to use grammar communicatively so that they become effective and efficient communicators	
CLR-3 :	To test the vocabulary power and skill to follow the logic of sentences	
CLR-4 :	To interpret and analyze texts	
CLR-5 :	To instill confidence in students and develop skills necessary to face the challenges of competitive exams and placements	
CLR-6 :	To help learners develop vocabulary of a general kind by developing their reading skills	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	To understand the different parts of speech and use them in sentences appropriately	3	80	70
CLO-2 :	To understand correct usage of grammar	3	80	75
CLO-3 :	To acquire satisfactory competency in use of Verbal Reasoning	3	85	70
CLO-4 :	To demonstrate his/her ability to write error free while making the best use of correct Vocabulary & Grammar.	3	85	80
CLO-5 :	To develop comprehension and interpretation skills	3	85	75
CLO-6 :	To help the students succeed in competitive exams and placements	3	80	70

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
H	H	M	H	L	M	-	H	-	H	-	H	M	-	H
M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
M	H	M	H	-	M	-	H	H	M	-	H	M	-	H

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Parts of Speech	Synonyms	Sentence improvement	Sentence completion (Vocabulary based)	Para Jumble/ Anagram
	SLO-2	Parts of speech -Practice	Synonyms Practice			Sentence Anagram
S-2	SLO-1	Modal verbs	Antonyms	Sentence improvement Practice	Sentence completion (Vocabulary based) - Practice	Anagrams - Practice
	SLO-2	Uses of Modal Verbs	Antonyms Practice			Cloze Passage
S-3	SLO-1	Types of Modal Verbs	Idioms	Sentence Correction	Sentence completion (Vocabulary based - Practice	Cloze Passage – Techniques to solve

	SLO-2	Modal Verbs- Assessment	Idioms – Practice			cloze passage-Practice
S-4	**SLO-1**	Spotting Errors	Idioms - Assessment	Sentence Correction-Practice	Odd word	Word analogy
	SLO-2	Error spotting based on Parts of Speech	Phrasal Verbs			Analogies – Types of Relationship
S-5	**SLO-1**	Errors how to avoid in Nouns & Pronouns	Phrasal verbs - Assessment	Sentence completion (Grammar based)	Odd word-Practice	Analogies – Types of Relationship
	SLO-2	Common Errors: Subject - verb Agreement		Sentence completion-Practice		Word analogy - Practice
S-6	**SLO-1**	Subject- verb Agreement - Practice	one word substitution	Sentence completion-Practice	Words often confused	Techniques of Effective Reading
	SLO-2	Usage of Articles (a, an, the)	One Word Substitution - Practice	Critical Reasoning and Verbal deduction		Kinds of Reading
S-7	**SLO-1**	Common mistakes with Prepositions	Homophones	Types of Critical Reasoning	Words often confused-Practice	Reading Comprehension – Unseen Passages
	SLO-2	Prepositional Errors - Practice	Homophones-Practice			
S-8	**SLO-1**	Change of Speech	Homonym	Critical Reasoning – Level 1	Words often misused	Reading comprehension - Practice
	SLO-2	Change of Speech - Practice	Homonym-Practice	Critical Reasoning – Intermediate Level		
S-9	**SLO-1**	Change of Voice	Homographs	Critical Reasoning – Advanced Level	Words often misused-Practice	Reading comprehension- Practice
	SLO-2	Change of voice - assessment	Homographs - Practice	Practice Session		

Learning Resources	Hari Mohan Prasad and Meenakshi Upadhyay, Objective English for Competitive Examinations, McGraw Hill Education. Norman Lewis, Word Power Made Easy New Revised and Expanded Edition, Goyal publication, 2011 Raymond Murphy, Intermediate English Grammar, Cambridge University Press, 2007	Bhatnagar R P, English for Competitive Examinations, Trinity Press, 2016. .S Aggawal, Objective General English,S.Chand Limited, 2018

Learning Assessment					
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (100% weightage)**			
		CLA-1 (20%)	**CLA-2 (20%)**	**CLA-3 (30%)**	**CLA-4 (30%) ##**
		Theory	**Theory**	**Theory**	**Theory**
Level 1	**Remember**	10%	10%	30%	15%
	Understand				
Level 2	**Apply**	50%	50%	40%	50%
	Analyze				
Level 3	**Evaluate**	40%	40%	30%	35%
	Create				
	Total	100 %	100 %	100 %	100 %

#CLA-1, CLA-2 and CLA-3 can be from any combination of these: Online Aptitude Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, MiniTalks, Group Discussions, Mock interviews, etc.

##CLA–4 can be from any combination of these: Assignments, Seminars, ShortTalks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf.Paperetc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr. P. Chockalingam, Senior Lead Software Engineer, Virtusa Consulting Services Private Ltd, DLF IT Park SEZ, Chennai - 600089	Dr. G. Saravana Prabu, Asst. Professor, Department of English, Amrita Vishwa Vidhyapeetham, Coimbatore - 641112	Mrs.Deepalakshmi, Assistant Professor, Department of Career Guidance Cell, FSH, SRMIST
		Dr. Muthu Deepa M, Assistant Professor, Department of Career Guidance Cell, FSH, SRMIST

SEMESTER IV

Course Code	PGI20P03L	Course Name	Project Work	Course Category	P	Project Work, Internship In Industry / Higher Technical Institutions	L	T	P	C
							0	0	24	12

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	To understand the basics of software development			
CLR-2 :	To know about life cycle of the software development			
CLR-3 :	To explore risk and people management for software development			
CLR-4 :	To learn about different software tools for software development.			
CLR-5 :	To know about different techniques related to software development.			
CLR-6 :	To Learn About documentation process for software development			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLO-1 :	To conceptualize a novel idea / technique into a product	3	80	70	H	H	M	H	L	M	-	H	-	H	-	H	M	-	H
CLO-2 :	To think in terms of multi-disciplinary environment	3	80	75	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-3 :	To understand the management techniques of implementing a project	3	85	70	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-4 :	To experience on the challenges of teamwork	3	85	80	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-5 :	To prepare a presentation in a professional manner	3	85	75	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-6 :	To prepare document all aspects of design work.	3	80	70	M	H	M	H	-	M	-	H	H	M	-	H	M	-	H

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 %