FACULTY OF SCIENCE AND HUMANITIES

ACADEMIC CURRICULA

POSTGRADUATE DEGREE PROGRAMME
(REGULATIONS - 2025)

MASTER OF SCIENCE
IN
APPLIED DATA SCIENCE

Two Years (Full-Time)

National Education Policy

Learning Outcomes based Curriculum Framework (LOCF)

National Credit Framework

Academic Year
2025 - 2026

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

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

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India

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

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

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

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

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

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

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

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

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

6. Programme Structure (Total Credits : 80 Credits)

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

Course Code	Course Title	Hours/ Week L	T	P	C
PAD25C01T	Statistical Foundations	4	0	0	4
PAD25C02J	Data Analysis Fundamentals	3	0	2	4
PAD25C03J	Data Structures and Algorithms	3	0	2	4
PAD25C04J	Natural Language Processing	3	0	2	4
PAD25C05J	Machine Learning	3	0	2	4
PAD25C06J	Social Media and Text Analytics	3	0	2	4
PAD25C07J	Computer Vision	3	0	2	4
PAD25C08T	Cloud Computing	4	0	0	4
PAD25C09J	Deep Learning	3	0	2	4
PAD25C10L	Capstone Project	0	0	8	4
Total Learning Credits					**40**

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

Course code	Course Title	Hours/ Week L	T	P	C
PAD25D01J	Artificial Intelligence	3	0	2	4
PAD25D02J	Big Data Analytics				
PAD25D03J	Data Engineering and Governance				
PAD25D04T	Reinforcement Learning for AI	4	0	0	4
PAD25D05T	Time Series Analysis				
PAD25D06T	Mathematics for Data Science				
PAD25D07J	Large Language Models	3	0	2	4
PAD25D08J	Exploratory Data Analysis				
PAD25D09J	Quantum Machine Learning				
Total Learning Credits					**12**

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

Course Code	Course Title	Hours/ Week L	T	P	C
PAD25G01T	Data Mining and Warehousing	2	0	0	2
PAD25G02T	Ethics in Data Science				
PAD25G03T	Digital Marketing Analytics	2	0	0	2
PCA25G04T	Blockchain Technology				
Total Learning Credits					4

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

Course Code	Course Title	Hours/ Week L	T	P	C
PAD25S01J	Data Visualization and Concepts	2	0	3	4
PAD25S02J	SQL and NoSQL for Data Science	2	0	3	4
Total Learning Credits					**8**

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

Course Code	Course Title	Hours/ Week L	T	P	C
PAD25P01L	Internship	0	0	0	2
PAD25P02L	Project Work	0	0	20	10
Total Learning Credits					**12**

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

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

7. Implementation Plan

Semester - I					
Code	Course Title	Hours/ Week			C
		L	T	P	
PAD25C01T	Statistical Foundations	4	0	0	4
PAD25C02J	Data Analysis Fundamentals	3	0	2	4
PAD25C03J	Data Structures and Algorithms	3	0	2	4
PAD25D01J	Artificial Intelligence	3	0	2	4
PAD25D02J	Big Data Analytics	3	0	2	
PAD25D03J	Data Engineering and Governance	3	0	2	
PAD25G01T	Data Mining and Warehousing	2	0	0	2
PAD25G02T	Ethics in Data Science				
PAD25S01J	Data Visualization and Concepts	2	0	3	4
PCD25AE1T	Comprehensive Skills in Quantitative and Logical Reasoning	2	0	0	2
Total		28			24

Semester - II					
Code	Course Title	Hours/ Week			C
		L	T	P	
PAD25C04J	Natural Language Processing	3	0	2	4
PAD25C05J	Machine Learning	3	0	2	4
PAD25C06J	Social Media and Text Analytics	3	0	2	4
PAD25C07J	Computer Vision	3	0	2	4
PAD25D04T	Reinforcement Learning for AI	4	0	0	4
PAD25D05T	Time Series Analysis	4	0	0	
PAD25D06T	Mathematics for Data Science	4	0	0	
PAD25S02J	SQL and NoSQL for Data Science	2	0	3	4
PCD25AE2T	Soft Skills and Verbal Mastery	2	0	0	2
Total		31			26

Semester - III					
Code	Course Title	Hours/ Week			C
		L	T	P	
PAD25C08T	Cloud Computing	4	0	0	4
PAD25C09J	Deep Learning	3	0	2	4
PAD25C10L	Capstone Project	0	0	8	4
PAD25D07J	Large Language Models	3	0	2	4
PAD25D08J	Exploratory Data Analysis	3	0	2	
PAD25D09J	Quantum Machine Learning	3	0	2	
PAD25G03T	Digital Marketing Analytics	2	0	0	2
PCA25G04T	Blockchain Technology				
PAD25P01L	Internship	0	0	0	2
Total		24			20

Semester - IV					
Code	Course Title	Hours/ Week			C
		L	T	P	
PAD25P02L	Project Work	0	0	20	10
Total		20			10

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

8. Program Articulation Matrix

Course Code	Course Title	Programme Learning Outcomes (PO)											
		Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
PAD25C01T	Statistical Foundations	3	3	2	3	3	3	3	3	3	3	-	3
PAD25C02J	Data Analysis Fundamentals	3	3	2	3	3	3	3	3	3	3	2	3
PAD25C03J	Data Structures and Algorithms	3	3	2	3	3	3	3	3	3	3	-	3
PAD25C04J	Natural Language Processing	3	3	2	3	3	3	3	3	3	3	-	3
PAD25C05J	Machine Learning	3	3	2	3	3	3	3	3	3	3	-	3
PAD25C06J	Social Media and Text Analytics	2	3	2	3	1	-	-	-	2	1	-	3
PAD25C07J	Computer Vision	3	3	2	3	3	3	3	3	3	3	-	3
PAD25C08T	Cloud Computing	3	3	2	3	3	3	3	3	3	3	-	3
PAD25C09J	Deep Learning	1	3	3	-	3	2	-	-	3	3	2	3
PAD25C10L	Capstone Project	3	3	2	3	3	3	3	3	3	3	-	3
PAD25D01J	Artificial Intelligence	3	3	2	3	3	3	3	3	3	3	2	2
PAD25D02J	Big Data Analytics	3	3	2	3	3	3	3	3	3	3	-	3
PAD25D03J	Data Engineering and Governance	3	3	2	2	2	2	2	-	-	3	-	3
PAD25D04T	Reinforcement Learning for AI	3	3	2	3	3	3	3	3	3	3	-	3
PAD25D05T	Time Series Analysis	3	3	2	3	3	3	3	3	3	3	-	3
PAD25D06T	Mathematics for Data Science	3	3	2	3	3	3	3	3	3	3	-	3
PAD25D07J	Large Language Models	3	3	2	3	3	3	3	3	3	3	-	3
PAD25D08J	Exploratory Data Analysis	3	3	2	3	3	3	3	3	3	3	-	3
PAD25D09J	Quantum Machine Learning	3	3	2	3	2	2	-	3	3	-	3	3
PAD25G01T	Data Mining and Warehousing	2	2	2	2	2	2	2	2	2	2	-	3
PAD25G02T	Ethics in Data Science	3	3	2	3	3	3	3	3	3	3	-	2
PAD25G03T	Digital Marketing Analytics	3	3	2	3	3	3	-	3	3	-	-	3
PCA25G04T	Blockchain Technology	3	3	2	3	3	3	3	3	3	3	-	3
PAD25S01J	Data Visualization and Concepts	3	3	3	3	3	3	-	2	3	3	3	3
PAD25S02J	SQL and NoSQL for Data Science	3	3	2	3	3	3	3	3	3	3	-	3
PCA25P01L	Internship	3	3	2	3	3	3	3	3	3	3	-	3
PCA25P02L	Project Work	3	3	2	3	3	3	3	3	3	3	2	3
PCD25AE1T	Comprehensive Skills in Quantitative and Logical Reasoning	-	3	1	3	1	-	-	-	2	-	-	-
PCD25AE2T	Soft Skills and Verbal Mastery	1	3	3	3	3	3	-	-	3	3	2	3
Program Average		3	3	2	3	3	3	3	3	3	3	2	3

SEMESTER - I

Code	PAD25C01T	Title	Statistical Foundations	Category	C	Professional Core Course	L	T	P	C
							4	0	0	4

Offering Department	Mathematics and Statistics	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Statistical Table

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To provide foundations in Data Collection, Classification and Presentation of Data., measures of central tendency, Dispersion
CR-2	To understand the concepts of Definition-Discrete Random Variable, Probability Mass Function, and Cumulative Distribution function
CR-3	To understand the concepts of Continuous Probability Distribution
CR-4	To acquire the knowledge of sampling and t, F chi square test concepts
CR-5	To learn and apply – non-parametric test concepts and its application

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	To acquire the knowledge of data, classification and presentation commonly used in Health and Medical Sciences	✓				*5*	*85*	*75*	*1*	-	-	*3*	-	*2*	-	*2*	*3*	*3*	-	*3*
CO-2	To calculate descriptive statistics Binomial distribution	✓	✓	✓		*4*	*85*	*75*	*3*	-	-	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-3	To calculate descriptive statistics - of continuous distribution		✓			*6*	*85*	*75*	*3*	-	-	*3*	-	-	-	-	*3*	*3*	-	*3*
CO-4	To acquire the skill of analysing the relationship between sampling techniques and its various types	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*2*	*3*	*3*	-	-	-	*3*	*3*	-	*3*
CO-5	To identify distribution form relating to the non-parametric test	✓	✓			*2*	*85*	*75*	*3*	*3*	*2*	*3*	-	*3*	*3*	*3*	*3*	*3*	-	*3*

Title & Session Outcomes	Measures of Central tendency	Binomial distribution	Normal distribution	Small sample tests	Non-parametric test
Duration (hour)	**12**	**12**	**12**	**12**	**12**
SO-1	Introduction -Statistics	Random experiment, types of events with examples	Definition– continuous random variables	Definition of sampling, types of sampling techniques	Definition– non-parametric test, application
SO-2	Measures of Central tendency – Mean	Definition of probability, addition and multiplication law	Expectation of continuous distribution	Definition of hypothesis testing, level of significance, Type–I error, type-II error	Sign test-procedure
SO-3	Measures of Central tendency – Median	Problems based on addition and multiplication law	Problems on continuous distribution	Small sample test: t-test with comparison of single sample mean	Problems on sign test
SO-4	Measures of Central tendency – Mode	Conditional Probability	Definition of Normal distribution	t-test with comparison of two sample means	Wald-Wolfowitz Procedure
SO-5	Calculation of median and node through graphs	Definition of Baye's theorem - Problems on Baye's theroem	Importance of Normal distribution	Paired t-test for dependent samples	Wald-Wolfowitz Procedure
SO-6	Empirical relationship between Mean, median, and mode	Definition-Discrete Random Variable, Probability Mass Function, and Cumulative Distribution function	Uses of Normal distribution	Problems based on t - test	Run test-One sample test-Problem
SO-7	Dispersion-Definition-	Discrete Probability Distribution	Properties of normal distribution	F-test: equality of two sample variances	Run test-One sample test-Problem
SO-8	Types of Dispersion	Problems based on Discrete Probability Distribution	Area properties of normal distribution	F-test: equality of two sample variances	Median test–procedure
SO-9	Quartile deviation Dispersion	Definition of Binomial distribution and its applications	Problems on normal distribution	Problems based on F test	Median test–procedure
SO-10	Standard deviation Dispersion	Problems based on Binomial distribution	Problems on normal distribution	Chi-square test: Goodness of fit	Kolmogorov Smirnov test – Procedure
SO-11	Measures of Skewness: Karl Pearson's method	Fitting of Binomial distribution	Large sample test – Z test using single sample mean	Chi-square test: independence of attributes	Problems on K-S test
SO-12	Measures of Skewness: By Bowley's method	Fitting of Binomial distribution	Large sample test –Z test using two sample mean	Chi-square test –independent of attributes and goodness of fit	Problems on K-S test

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

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

Resources			
1	Pratap Dangeti, Statistics for Machine Learning, Practical Statistics for Data Scientists, Second Edition, Andrew Bruceand Peter Gedeck, 2020. C.R.Kothari, Quantitative Techniques, Third Revised Edition, S.Chand Ltd, New Delhi, 2013.	2	Davis Freedman, Robert Pisani and Roger Purves, An Easy to Understand Guide to Statistics and Analytics, Third Edition, By David M. Levine and David F,Stephan, December 2014

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

Code	PAD25C02J	Title	Data Analysis Fundamentals	Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Learn essential Python programming concepts for data processing and analysis.
CR-2	Understand and apply NumPy for high-performance numerical computation.
CR-3	Master data manipulation and transformation techniques using Pandas.
CR-4	Visualize data trends and relationships using Matplotlib and Seaborn.
CR-5	Carry out end-to-end exploratory data analysis on real-world datasets.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Apply Python programming for data preprocessing and analysis	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Use NumPy for effective numerical computation and statistical processing	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Manipulate structured data using Pandas for real-world applications		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Develop insightful visualizations for data interpretation	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	2	3
CO-5	Conduct complete EDA and report actionable insights from data	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Python Basics for Data Analysis	Numerical Computation with NumPy	Data Manipulation with Pandas	Data Visualization	Exploratory Data Analysis (EDA)
Duration (hour)	15	15	15	15	15

SO-1	**Introduction to Python & Data Analysis** • Role of Python in data science • Data analysis pipeline • Setting up Python (Anaconda, Jupyter, Google Colab)	**NumPy Array Basics** • Creating arrays from lists • Attributes: shape, dtype • Initialization methods: zeros, ones, arange	**Series and DataFrame Structures** • Creating Series and DataFrames • Indexing and labels • Introspection of DataFrames	**Need for Data Visualization** • Why visualize? • Exploratory vs explanatory visualization • Types of plots and best practices	**What is EDA? Goals and Steps** • Descriptive statistics • EDA phases and tools • EDA vs data preprocessing
SO-2	**Python Data Types and Variables** • Numbers, strings, booleans • Type conversion • Variable naming and scope	**Indexing, Slicing, and Reshaping Arrays** • Accessing elements and slices • Multi-dimensional arrays • reshape(), flatten(), transpose()	**Reading and Writing Data** • read_csv(), read_excel() • Saving with to_csv(), to_excel() • Reading JSON and clipboard	**Matplotlib Basics** • Line plots, bar charts, histograms • Axes, titles, labels, legends	**Data Understanding and Summary Stats** • Shape, type, uniqueness • Central tendency, dispersion • Value counts and frequency distribution
SO-3	**Control Flow & Looping Constructs** • if, elif, else • for, while loops • Loop control: break, continue, pass	**Vectorized and Element-wise Operations** • Arithmetic operations • Comparisons and logical operations • Avoiding Python loops	**Data Selection and Filtering** • loc[], iloc[], conditional selection • Boolean masking • Column and row operations	**Advanced Plotting with Matplotlib** • Subplots and grid layouts • Plot customization • Annotations and style settings	**Detecting and Treating Outliers** • Boxplots, IQR method • Z-score and winsorization
SO 4-5	**Practice1: Implement a Python program to** Read and analyze data from CSV and JSON files	**Practice 4: Implement** Array creation and manipulation	**Practice 7:** Clean and filter real-world dataset	**Practice 10:** Visualize sales or student data using Seaborn	**Practice 13: Implement** Full EDA on Titanic or Iris dataset
SO-6	**Functions and Lambda Expressions** • Defining and calling functions • Parameters, return values • Anonymous functions (lambda)	**Aggregation and Broadcasting** • sum(), mean(), std(), axis parameter • Concept of broadcasting and examples	**Handling Missing and Duplicate Data** • isnull(), dropna(), fillna() • Removing or flagging duplicates	**Introduction to Seaborn** • Relationship with Matplotlib • Themes and color palettes • Simplified high-level plotting	**Data Cleaning and Feature Engineering** • Handling missing, noisy data • Creating new features • Scaling and encoding

SO-7	**Lists, Tuples, Dictionaries, and Sets** • Operations and methods on each type • Use-cases for data storage • Nesting and comprehension	**Mathematical and Statistical Functions** • np.min, np.max, np.percentile • Cumulative operations: cumsum, cumprod	**Data Cleaning and Transformation** • apply(), map(), replace() • Type conversions • Renaming and modifying columns	**Distribution Plots** • distplot, histplot, kdeplot • Analyzing univariate distributions	**Correlation and Covariance** • corr(), heatmaps • Pearson vs Spearman correlation
SO-8	**String Manipulation & Regular Expressions** • String formatting and slicing • re module basics: search, match, findall • Pattern matching	**Boolean Indexing and Filtering** • Condition-based selection • Modifying arrays using conditions • Practical use-cases	**Aggregation and Grouping** • groupby(), aggregation functions • Grouping by multiple columns • Multi-level index operations	**Categorical Plots** • boxplot, violinplot, stripplot, swarmplot • Visualizing group comparisons	**Univariate and Bivariate Analysis** • Histograms, bar plots • Cross-tabulations • Scatter plots and trend lines
SO 9-10	**Practice 2: Implement a Python program to** Process text and list data	**Practice 5: Implement** Statistical analysis using NumPy	**Practice 8: Perform** GroupBy operations on CSV data	**Practice 11:** Generate comparison plots and annotate	**Practice 14: Perform** Team-based dataset selection and cleaning
SO-11	**File Handling: Text, CSV, JSON** • Open, read, write files • Reading structured formats • Context managers and file objects	**Random Number Generation** • np.random.rand(), randint() • Simulations: coin flips, dice rolls • Seeding and reproducibility	**Merging and Joining DataFrames** • merge(), join(), concat() • Inner, outer, left, right joins	**Heatmaps and Pairplots** • Correlation heatmaps • Multivariate analysis using pairplot()	**Visual EDA with Seaborn and Pandas** • Summary plots: pairplot, jointplot • Plotting from DataFrame directly • Conditional visualizations
SO-12	**Error Handling and Debugging** • try, except, finally • Common exceptions in data processing • Debugging tools in Jupyter	**Handling Missing Values** • Representing NaN • Detecting and replacing nulls • Masking missing data	**Sorting and Ranking** • Sorting by values or index • rank() and custom sorting logic	**Plot Aesthetics and Export** • Style options: seaborn-darkgrid, ggplot, etc. • Saving images using savefig() • Image formats and sizes	**Case Study: Titanic / Iris Dataset** • Load dataset and describe • Analyze key features • Identify patterns

SO-13	**Jupyter & Google Colab Environment** • Cells, markdown, magic commands • Working with notebooks • Version control tips with notebooks	**Saving and Loading Arrays** • .npy and .npz formats • save(), load() • Saving to and loading from text/CSV	**Time Series Basics** • DateTime indexing • Resampling and time-based operations	**Time Series Visualization & Dashboards** • Plotting time-series data • Intro to Streamlit/Plotly Dashboards • Dashboard storytelling	**EDA Report Writing** • Structuring a data report • Visual storytelling • Summary, findings, recommendations
SO 14-15	**Practice3:** Build a Python script to extract structured info from JSON	**Practice 6:** Simulate dice throws and visualize distribution	**Practice 9:** Merge multiple data files and analyze	**Practice 12:** Build a basic dashboard in Colab or Streamlit	**Practice 15:** Present a visual EDA report (mini project)

Assessment

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

Strategies

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

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

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

Code	PAD25C03J	Title	Data Structures and Algorithms	Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

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

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

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

Title & Session Outcomes	Introduction	Stack, Queue and Tree	Categories of Tree	Graph and Sorting	Searching
Duration (hour)	15	15	15	15	15
SO-1	Overview and importance of algorithms Algorithm specification, Performance analysis	Introduction to stack, Representation of Stacks	Threaded Binary Tree, Application of Tree	Overview of Graph, Graph Terminology, Representation of Graph, Types of Graph, Operation of Graph	Introduction of Search, Types of Search
SO-2	Asymptotic Notation, The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding	Stack as ADT ,Stack Operations,	Introduction to Binary Search Tree(BST), Binary Search Tree: Construction,	Graph Traversal – BFS,DFS	Linear Search and Binary Search

SO-3	Introduction to Data structures, Abstract Data type, Data representation, Data structures Complexity of Algorithms,	Applications of Stacks – Recursion, Towers of Hanoi, Arithmetic Expressions, Polish notations,	Operation of Binary Search tree	Overview of Shortest Path Algorithm, Topological Sorting	Define Hashing, Hash functions
SO 4 - 5	**Practice 1: Simple Program**	**Practice 4: Implementation of Stacks**	**Practice 7: Implementation of Binary Search**	**Practice 10 : Implementation of Graph**	**Practice 13 : Implementation of Searching**
SO-6	Operations, Types of Data structures – Linear and Non Linear	Queue, Linked Representation of Queues	Introduction to AVL Tree, Operation of AVL	Spanning Trees , Dijkstra Algorithm	Hashing: Collision avoidance
SO-7	Arrays, Representation of Arrays, Types of Arrays	Queue as ADT, Operations on Queue	AVL Tree Rotations, Applications of AVL tree	Warshalls's algorithm, Prims and Kruskals Algorithms	Hashing: Separate chaining
SO-8	Arrays operations, Application of Arrays	Types of Queue ; Priority Queue, Circular Queue, Double ended Queue	Introduction to Heap, Types of Heap, Application of Heap,	Sorting, Types of Sorting: Internal and External Sort	Open addressing, Advantages of Hashing, Extensible Hashing
SO 9 -10	**Practice 2 : Implementation of Array**	**Practice 5: Implementation of Queue**	**Practice 8: Implementation of AVL Tree and Heap**	**Practice 11 Implementation of Shortest Path Algorithm**	**Practice 14 : Implementation of Hashing**
SO 11	Introduction to lists, Representation of Linked list , Operations	Tree terminologies, Implementation of Tree, Function of Tree	B-Tree, Properties of B-Tree, Operation of B-Tree	Bubble Sort, Insertion Sort	Divide and Conquer: Min- Max Problem
SO 12	Header Linked Lists, Circularly Linked Lists	Binary Tree, Representation of Binary Tree, Properties of Binary tree	Application of B-Tree, Introduction to B+ Tree, Properties of B+ Tree	Radix sort, Merge Sort	Greedy Algorithm: Knapsack Problem, Dynamic Programming: Multistage Graph
SO13	Doubly Linked Lists	Tree Traversals–In order, Preorder Post order.	Operation of B+Tree	Quick Sort Heap Sort	Backtracking: Sum of Subset Problem, Branch and Bound: Travelling Salesman Problem.
SO14 - 15	**Practice 3:- Implementation of Linked list**	**Practice 6:Implementation of binary tree**	**Practice 9: Implementation of Heap Tree**	**Practice 12: Implementation of Sorting**	**Practice 15: Implementation of Algorithm**

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

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

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

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

Code	PAD25D01J	Title	Artificial Intelligence	Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Understand foundational concepts and paradigms of Artificial Intelligence.
CR-2	Apply knowledge representation and reasoning techniques for intelligent behavior.
CR-3	Process and analyze natural language using rule-based and knowledge-driven approaches.
CR-4	Design intelligent agents that make decisions and coordinate in multi-agent environments.
CR-5	Evaluate and apply ethical principles, explainability, and governance in AI systems.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency	Expected Attainment	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design,	Modern Tool Usage	Society & Culture	Environment &	Ethical Practices &	Individual & Team	Communication	Project Management &	Life Long Learning
CO-1	Explain the foundational principles and problem-solving strategies of AI.	✓				2	85	75	3	2	-	2	-	-	-	-	-	1	-	2
CO-2	Implement knowledge-based systems using logic and probabilistic reasoning.	✓	✓	✓		3	85	75	3	3	2	3	2	-	-	-	2	-	-	2
CO-3	Analyze and develop rule-based NLP applications for intelligent language understanding.		✓	✓	✓	4	85	75	3	2	2	3	3	2	2	-	-	2	-	2
CO-4	Design multi-agent systems and decision-making strategies for real-world simulations.	✓	✓	✓	✓	6	85	75	3	3	3	3	3	-	-	-	3	2	2	2
CO-5	Evaluate AI systems with respect to ethical standards, transparency, and social responsibility.	✓	✓	✓	✓	5	85	75	2	-	-	2	-	3	3	3	-	3	-	3

Title & Session Outcomes	Foundations of Artificial Intelligence	Knowledge Representation and Reasoning	Natural Language Processing	Decision Making and Multi-Agent Systems	Responsible AI, Explainability and Emerging Trends
Duration (hour)	15	15	15	15	15
SO-1	Introduction to AI – History, Applications, Scope	KR Basics – Syntax and Semantics, Declarative vs Procedural KR	Overview of NLP – Text Data Characteristics, Applications	Intelligent Decision Making – Utility, Rational Choice Theory	Responsible and Trustworthy AI – Human-Centric AI, Value Alignment
SO-2	AI Paradigms – Symbolic vs Sub-symbolic, Reactive and Deliberative Agents	Propositional Logic – Syntax, Semantics, Truth Tables	Text Preprocessing – Tokenization, Stemming, Lemmatization	Markov Decision Processes (MDP) – Transitions, Rewards, Policies	AI Fairness and Bias – Definitions, Causes, Mitigation
SO-3	Intelligent Agents – PEAS framework, Rationality, Types of Agents	First Order Logic (FOL) – Quantifiers, Unification, Inference	Part-of-Speech Tagging – Rule-based, Statistical Methods	Game Theory – Payoffs, Nash Equilibrium, Strategy	Explainable AI (XAI) – SHAP, LIME, Rule-based Interpretability

SO 4-5	**Lab:** **Implementation of BFS and DFS in Python.** **A* Search: Maze Navigation.**	**Lab:** **Prolog-style inference simulation in Python.** **Rule-based system using forward chaining.**	**Lab:** **Preprocessing with NLTK and spaCy** **POS tagging and NER exercises**	**Lab:** **Gridworld MDP simulation** **Multi-agent simulation using custom Python agents**	**Lab:** **Bias detection using open datasets** **Explainability with SHAP/LIME**
SO-6	Problem Solving – Problem formulation, State space search	Inference Mechanisms – Forward and Backward Chaining	Named Entity Recognition – Use Cases, Challenges	Multi-Agent Systems – Agent Types, Environments	Conversational AI – Dialog Flow, Rasa Architecture
SO-7	Uninformed Search – Breadth-first, Depth-first, Uniform-cost	Rule-Based Systems – Production Rules, Conflict Resolution	Regular Expressions – Pattern Matching in Text	Agent Communication – Protocols, Ontologies (KQML)	AI Governance and Regulation – EU AI Act, Indian Frameworks
SO-8	Informed Search – Greedy, A* Algorithm, Heuristics	Semantic Networks and Frames – Concept Hierarchies, Inheritance	Vectorization – BoW, TF-IDF	Coordination and Cooperation – Auctions, Negotiation	Privacy and Surveillance – Federated Learning, Differential Privacy
SO 9-10	**Lab:** **Minimax Algorithm: Tic-Tac-Toe AI** **Designing a PEAS-based agent**	**Lab:** **Fuzzy logic controller using scikit-fuzzy.** **Bayesian network modeling with pgmpy.**	**Lab:** **Information extraction using regex** **TF-IDF analysis using scikit-learn**	**Lab:** **Swarm behavior using Boids model in Pygame** **Planning with STRIPS-style simulation**	**Lab:** **Ethics case study walkthrough** **Chatbot design using DialogFlow or Rasa**
SO-11	Adversarial Search – Minimax, Alpha-beta pruning	Scripts and Ontologies – Structured KR, Event Representation	Rule-based Text Classification – Sentiment, Intent	Swarm Intelligence – Boids Model, Self-Organization	Green and Sustainable AI – Energy Efficiency, Carbon Footprint
SO-12	Constraint Satisfaction Problems – Variables, Domains, Constraints, Backtracking	Uncertainty in Reasoning – Fuzzy Logic, Probabilistic Reasoning	Chatbots – Rule-based and Retrieval-based Architectures	AI Planning – STRIPS, Partial Order Planning	Prompt Engineering and Human-AI Collaboration
SO-13	Applications of Classical AI – Robotics, Game Playing, Planning	Bayesian Networks and Expert Systems – Structure, Inference, MYCIN Example	Ethics in NLP – Bias, Misinformation, Content Moderation	Applications in IoT and Smart Cities – Traffic, Energy, Delivery	Careers and Research Trends in AI – Neuro-symbolic AI, Multimodal Systems
SO 14-15	**Lab:** **Sudoku Solver using Backtracking (CSP).** **Mini Project: Search-based Agent Simulation.**	**Lab:** **Frames and scripts implementation in Python** **Mini Project: Expert System Design**	**Lab:** **Rule-based chatbot with NLTK or Rasa** **Mini Project: Text Classifier or Domain-specific Bot**	**Lab:** **Smart traffic or warehouse coordination** **Mini Project: Multi-agent environment with coordination**	**Lab:** **Roleplay-based simulation of AI policy** **Mini Project: Responsible AI prototype with explainability**

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

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

Resources

1	Russell, S., & Norvig, P. (2021). *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson.	2	Poole, D., & Mackworth, A. (2017). *Artificial intelligence: Foundations of computational agents* (2nd ed.). Cambridge University Press.
3	Brachman, R. J., & Levesque, H. J. (2004). *Knowledge representation and reasoning*. Morgan Kaufmann.	4	Nilsson, N. J. (1998). *Artificial intelligence: A new synthesis*. Morgan Kaufmann.
5	Bird, S., Klein, E., & Loper, E. (2009). *Natural language processing with Python: Analyzing text with the natural language toolkit*. O'Reilly Media.	6	Jurafsky, D., & Martin, J. H. (2023). *Speech and language processing* (3rd ed., draft). Stanford University.
7	Wooldridge, M. (2009). *An introduction to multiagent systems* (2nd ed.). Wiley.	8	Kaelbling, L. P., & Littman, M. L. (1996). *Reinforcement learning: A survey*. Journal of Artificial Intelligence Research, 4, 237–285.
9	Mittelstadt, B. D., & Floridi, L. (2016). *The ethics of algorithms: Mapping the debate*. Big Data & Society, 3(2), 1–21.	10	Danks, D., & London, A. J. (2017). *Algorithmic bias in autonomous systems*. Proceedings of the 26th International Joint Conference on Artificial Intelligence, 4691–4697.

Designers

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

Code	PAD25D02J	Title	Big Data Analytics	Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To learn how to Data architects help companies manage, store and secure their data.
CR-2	To learn about SQL and NoSQL databases
CR-3	To get a clear understanding about Hadoop
CR-4	To get in-depth knowledge of data management and ETL
CR-5	To analyze large data sets to find trends and correlations

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	To gather extensive knowledge in Big Data and its architecture	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	To improve and understand ETL process and relevant ETL tools	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	To differentiate between a batch layer for large volumes of data and a speed layer for real time processing of data streams		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	To understand Distributed systems, data management and ETL	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	To understand Data modelling techniques	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Principles	Big Data	Overview	ETL	Data Lake
Duration (hour)	15	15	15	15	15
SO-1	Introduction to Data and Data lifecycle principles	Introduction to Big data and Hadoop	Four V's in Big Data	Distributed computing and ETL	Data lake and data warehouse
SO-2	Data and data lifecycle	Introduction to Big data	Big Data - reading data from CSV	Data Driven Organizations	Data lakes
SO-3	Databases	Characteristics of Big Data	Overview of the Four Vs	Decision Making	Characteristics of data lakes

SO 4-5	**Practice 1: Implement 2D and 3D transformations using Open CV**	**Practice 4: Implement image compression techniques**	**Practice 7: Implement epipolar lines**	**Practice 10: Write a code to find active contours**	**Practice 13: Implement K- Nearest neighbor classifier**
SO-6	SQL	Building systems to scale with data	The Importance of Variety - The Importance of Velocity	Batch vs in-memory processing	Data warehouse
SO-7	NoSQL	A quick overview of Hadoop	The Relationship	Tools for data management	Characteristics of Data Warehouse
SO-8	Creating ERD (Entity relationship diagram)	MapReduce overview	Between the Four V's	Understanding ETL	Data warehouse Architecture
SO 9-10	**Practice 2: Implement camera calibration**	**Practice 5: Implement geometric transformations**	**Practice 8: Write a code to find pixel level disparity**	**Practice 11: Implement watershed segmentation**	**Practice 14: Implement KNN for health care dataset**
SO-11	Implementing SQL with AWS	Map	Variety and Data Structure	ETL with Talend open studio	Data lakes Vs Data Streams
SO-12	Implementing NoSQL with AWS	Phases of MapReduce	Validity and Volatility	ETL pipeline in python	Data streams
SO-13	NoSQL DB with python	Reduce phase	Use Cases	Data modelling	Data lakes on AWS
SO 14-15	Create SQL DB with python	Data Silos	Extracting Value from the Four V's	Data partitioning/engineering/ reporting	Working with data lakes on AWS

Assessment

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

Strategies

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

Resources			
1	Big Data Fundamentals: Concepts, Drivers & Techniques, By Wajid Khattak, Paul Buhler and Thomas Erl, January 2016	2	Practical Enterprise Data Lake Insights: Handle Data-Driven Challenges in an Enterprise Big Data Lake, Saurabh Gupta and Venkata Giri, June 2018
3	The Enterprise Big Data Lake, Alex Gorelik, March 2019		

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

Code	PAD25D03J	Title	Data Engineering and Governance	Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Covers data storage, ETL, and orchestration.
CR-2	Focuses on big data processing.
CR-3	Ensures data security and compliance.
CR-4	Explores advanced data workflows.
CR-5	Applies concepts in a real-world project.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Understand ETL pipelines and workflow automation.	✓				5	85	75	3	2	2	-	2	2	-	-	-	-	-	-
CO-2	Apply Hadoop, Kafka, and Flink for data processing.	✓	✓	✓		4	85	75	3	3	-	2	-	2	2	-	-	-	-	1
CO-3	Implement security, governance, and compliance frameworks.	✓	✓	✓		6	85	75	3	3	-	2	-	2	2	-	2	-	-	1
CO-4	Optimize queries and automate pipelines.	✓	✓	✓		3	85	75	3	3	2	2	-	2	2	-	2	-	-	2
CO-5	Develop and deploy a complete data pipeline.	✓	✓	✓	✓	2	85	75	3	3	2	2	1	2	3	-	2	-	2	2

Title & Session Outcomes	Foundations of Data Engineering	Big Data and Technologies	Data Governance & Security	Advanced Data Engineering	Capstone Project & Case Studies
Duration (hour)	15	15	15	15	15
SO-1	Introduction to Data Engineering	Introduction to Big Data & Its Characteristics	Introduction to Data Governance & Data Quality	Introduction to Advanced Data Engineering	Introduction to Capstone Projects
SO-2	Data Engineering vs. Data Science	Big Data Ecosystem (Hadoop, Spark, Kafka, Flink)	Metadata Management & Data Lineage	Data Partitioning Strategies	Case Study: Real-time Fraud Detection System (Kafka + Flink)
SO-3	Tools Overview (Spark, Hadoop, Kafka)	HDFS (Concepts & Architecture)	Implement Data Lineage with Apache Atlas	Data Modeling and Schema Design	Case Study: Large-scale ETL Pipeline for E-commerce (Spark, Delta Lake)

SO 4-5	**Practice 1: Set up Data Engineering Environment (Docker, Spark)** **Lab: Basic Data Pipeline (Python, SQLite)**	**Practice 4: Process Large Datasets with HDFS**	**Practice 7:Implement RBAC in Data Pipelines**	**Practice 10:Query Optimization Techniques**	**Practice 13: Build a Real-time Data Stream with Kafka & Flink** **Eg. Process & Store E-commerce Data with Spark & Delta Lake**
SO-6	SQL vs. NoSQL (Concepts & Use Cases)	MapReduce (Concepts & When to Use)	Data Privacy Regulations (GDPR)	Introduction to Data Lakehouse	Capstone Project Proposal & Planning
SO-7	Data Warehousing vs. Data Lakes	YARN (Resource Management)	Data Masking & Encryption Techniques	Build a Simple Data Lakehouse	Data Collection & Storage Strategies
SO-8	Cloud-Based Storage (MinIO, AWS S3 AP)	Apache Spark Overview & Key Concepts	Data Encryption & Masking	Basics of Workflow Automation	Data Ingestion & Storage (MinIO, Delta Lake)
SO 9-10	**Practice 2: Work with SQL & NoSQL (PostgreSQL, MongoDB)**	**Practice 5: Process Big Data with Spark (Batch)**	**Practice 8: Audit Data Pipelines with Logging & Monitoring**	**Practice 11: Automate Workflows with Apache Airflow**	**Practice 14:Implement Access Control & Data Governance**
SO-11	ETL vs. ELT (Concepts & Use Cases)	Apache Kafka (Architecture & Use Cases)	Schema Evolution & Data Versioning (Delta Lake)	Introduction to Real-time Data Processing	Scaling Data Engineering Solutions
SO-12	Batch vs. Stream Processing (Comparison & Examples)	Apache Flink (Real-time Stream Processing)	Data Cataloging & Discovery (AWS Glue, Google Data Catalog)	Real-time Processing with Apache Flink	Final Integration & Deployment of Capstone Project
SO-13	Data Orchestration (Apache Airflow - DAGs & Workflow)	Kafka-Flink Integration	Auditing & Compliance in Data Governance	Basics of CI/CD for Data Pipelines	Industry Best Practices & Future Trends
SO 14-15	**Practice 3: Build ETL Pipeline (Python, SQLite)**	**Practice 6:** **Case Study: Real-time Data Processing System**	**Practice 9: Case Study: Data Governance in Financial Services**	**Practice 12: Hands-on: Deploy Data Pipelines with Docker & Kubernetes**	**Practice 15: Capstone Project Presentations & Evaluation**

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

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

Resources			
1	Joe Reis & Matt Housley (2022). Fundamentals of Data Engineering: Plan and Build Robust Data Systems. 1st Edition. O'Reilly Media.	2	Martin Kleppmann (2017). Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems. 1st Edition. O'Reilly Media.
3	Evren Eryurek (2021). Data Governance: The Definitive Guide: People, Processes, and Tools to Operationalize Data Trustworthiness. 1st Edition. O'Reilly Media.	4	Tom White (2015). Hadoop: The Definitive Guide. 4th Edition. O'Reilly Media.

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

Code	PAD25G01T	Title	Data Mining and Warehousing	Category	G	Generic Elective Course	L	T	P	C
							2	0	0	2

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Gain knowledge about Data mining and Knowledge Discovery Process
CR-2	Practice the Data mining Tools to apply Data mining algorithms
CR-3	Understand and Apply Association rule mining techniques Understand and Apply various Classification algorithms
CR-4	Gain knowledge on the concepts of Cluster and Outlier Analysis
CR-5	Gain knowledge about Data Warehouse manager, Query manager and DW Schema

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Understand the Data mining concepts and KDD process	✓				5	85	75	1	-	-	2	-	2	-	2	1	2	-	2
CO-2	Understand and Apply Association rule mining and classification techniques in real world Scenario	✓	✓	✓		4	85	75	2	-	-	2	1	-	-	-	2	2	-	2
CO-3	Gain knowledge about Cluster & Outlier Analysis		✓			6	85	75	2	-	-	2	-	-	-	-	2	2	-	2
CO-4	Understand the importance of applying Data mining concepts in different domains	✓	✓	✓	✓	3	85	75	2	1	2	2	2	-	-	-	2		-	2
CO-5	Gain knowledge on Data warehouse and different types of Schema concepts	✓	✓			2	85	75	2	2	2	2	-	2	2	2	2	2	-	2

Title & Session Outcomes	Introduction to Datamining	Neural Network	Data Warehouse	Partitioning	Data Marts
Duration (hour)	6	6	6	6	6
SO-1	Introduction to Data Mining, Understanding Data, Information, and Knowledge	Visualization Techniques & Data Understanding , Measures of Likelihood & Distance Metrics	Introduction to Data Warehouse Architecture, Process Architecture	Introduction to Data Warehouse Partitioning, Types of Partitioning	Introduction to Data Marts, Estimation of Design Cost
SO-2	Data Types and Techniques, Data Mining Tools & Applications	Introduction to Neural Networks, Decision Tree Technique	Query Manager and Data Warehouse Objects, Fact Table & Dimension Table	Understanding Partitioning Techniques Hardware & Software Partitioning	Meta Data and its Role in Data Marts

SO-3	Knowledge Discovery in Databases (KDD), Data Mining Architecture	ID3 Algorithm, Genetic Algorithms	Data Warehouse Users	Fact Table Design	Understanding Meta Data through Role Play, Backup Strategies in Data Warehousing
SO-4	Data Mining Operations and Issues,	Crossover & Mutation Techniques	OLTP vs. OLAP	Star Schema Design – One Fact vs. Multiple Facts	Types of Backup
SO-5	Data Mining Tasks	Clustering & Applications,	Data Warehouse Schema - Star Schema, Snowflake Schema	Fact Table Components	Online Backup Solutions (SureWest Online Backup Example)
SO-6	Learning and Types	Association Rule Mining & Apriori Algorithm	Fact Constellation Schema	Designing Summary Tables & Drill Across Techniques	Disaster Recovery Procedures & Recovery Models, Backup & Recovery Best Practices

Assessment

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

Strategies

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

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

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

Code	PAD25G02T	Title	Ethics in Data Science	Category	G	Generic Elective Course	L	T	P	C
							2	0	0	2

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To Understand the foundational ethical principles and frameworks within data science.
CR-2	To explore ethical concerns surrounding data privacy, data protection laws, and the responsibilities of data scientists.
CR-3	To discuss the ethical challenges related to algorithmic bias, fairness, and accountability in data-driven systems.
CR-4	To address the need for transparency and explainability in data-driven models.
CR-5	To explore the ethical issues arising from the latest technologies and applications in data science.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Gain an understanding of the basic principles of ethics and their relevance in the data science field.	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Understand the ethical importance of safeguarding personal data and adhering to privacy laws.	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Understand the importance of fairness and the need to mitigate bias in data science models and decisions.		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Know the importance of transparency and ability in building trustworthy data-driven systems.	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Students will be equipped to critically analyze the ethical issues.	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Introduction to Ethics in Data Science	Data Privacy and Protection	Bias, Fairness, and Accountability in Data Science	Transparency, Explainability, and Trust in Data Science	Ethical Implications of Emerging Technologies and Data Science Applications
Duration (hour)	6	6	6	6	6
SO-1	Definition of Ethics	Principles of Data Privacy (Confidentiality, Consent, Data Minimization)	Sources of Bias in Data (Sampling Bias, Label Bias, Prejudice in Data)	Transparency in Data Collection and Analysis Processes	The Ethical Implications of Artificial Intelligence and Automation
SO-2	Morality in the Context of Data Science	Data Protection Regulations (GDPR, CCPA, HIPAA)	Identifying and Mitigating Bias in Machine Learning Models	Explainability vs. Interpretability in Machine Learning Models	Ethical Concerns in Big Data and Predictive Analytics
SO-3	Importance of Ethical Considerations in Data Collection, Analysis, and Usage	Informed Consent and Anonymization of Data	Fairness in Algorithmic Decision-Making	Trustworthy AI: Building Reliable and Transparent Systems	The Role of Data Science in Social Good vs. Social Harm

SO-4	Ethical Frameworks (Utilitarianism, Deontological Ethics, Virtue Ethics)	Risk Assessment and Impact on Individuals' Privacy	Accountability in Automated Systems and Artificial Intelligence	Ethical Implications of "Black-box" Models	Ethical Considerations in Autonomous Systems and Robotics
SO-5	The Role of Data Science in Society	Case Studies of Data Breaches	Legal and Ethical Implications of Biased Models	The Role of Data Scientists in Ensuring Transparency	Data Science in Healthcare, Finance, and Criminal Justice: Ethical Boundaries
SO-6	Ethical Challenges and the Impact of Unethical Data Practices	Case Studies on Ethical Dilemmas	Case Studies of Unfair Data Practices (e.g., biased hiring algorithms, facial recognition)	Ethical Approaches to Model Explanation and Auditing	Ethical Issues in Predictive Policing, Surveillance, and Social Media Algorithms

Assessment

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

Strategies

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

Resources

1	Lee, K. M. M., & Li, S. S.**,** *Ethics of Artificial Intelligence and Big Data*, 1st Edition, Springer, 2018.	2.	Davis, K., *Data Ethics: The New Competitive Advantage*, 1st Edition, O'Reilly Media, 2018.
3.	O'Neil, C., *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy*, 1st Edition, Crown Publishing Group, 2016.	4.	Mason, H., & Patil, D. J.**,** *Ethics for Data Science*, O'Reilly Media, 2019.
5	Mitchell, M.**,** *Artificial Intelligence: A Guide for Thinking Humans*, 1st Edition, Farrar, Straus and Giroux, 2019.	6.	Kearns, M., & Roth, A.**,** *The Ethical Algorithm: The Science of Socially Aware Algorithm Design*, 1st Edition, Oxford University Press, 2019.

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

Code	PAD25S01J	Title	Data Visualization and Concepts	Category	S	Skill Enhancement Course	L	T	P	C
							2	0	3	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To get acquainted with Tableau's user-friendly interface.
CR-2	To explore the basic features and functionalities of Tableau.
CR-3	To understand technological advancements of data visualization.
CR-4	To understand various data visualization techniques.
CR-5	To understand the methodologies used to visualize large data sets.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Exploration and manipulation of dimensions and measures in Tableau.	✓				5	85	75	1	3	3	3	2	-	1	2	3	1	-	3
CO-2	Design and process data for visualization.	✓	✓	✓		4	85	75	2	3	3	2	2	-	2	1	3	3	-	3
CO-3	Explore filtering options in Tableau for dynamic and interactive visualizations.		✓			6	85	75	2	3	3	3	3	-	2	1	3	2	-	3
CO-4	Apply visualization techniques for research projects with Seaborn.	✓	✓	✓	✓	3	85	75	3	3	2	3	3	-	3	1	3	3	3	3
CO-5	Analyze appropriate data visualization techniques using Matplotlib.	✓	✓			2	85	75	3	3	2	3	3	-	2	3	3	3	-	3

Title & Session Outcomes	Data Visualization Concepts in Tableau	Core Concepts of Tableau to Create Visualizations	Power BI Desktop Interface	Data Visualization with Seaborn	Plotting Data using Matplotlib
Duration (hour)	15	15	15	15	15
SO-1	Introduction to Tableau Interface & Installation, Need and Significance of Tableau, Storytelling and Building first Visualization	Filtering, Filtering on a Dimension Filtering on a Measure	Introduction to Power BI, Core Blocks of Power BI, Menus and Options, Power BI Components	Introduction to Seaborn, Installing Seaborn, Importing Libraries and Dataset, Seaborn Functionalities	An Introduction to Matplotlib, Open-Source Data Visualization with Matplotlib
SO-2	Creating a New View in Tableau, Using Multiple Data Sources, Connecting to a Server Data Source, Editing and Saving a Data Source	Creating Date Filters, Quick Filters	Data Connection, Types of Data Connection, Connecting to Data Sources, Creating Tables in Power BI, Data Loading, Data Transformation Strategies	Seaborn Figure Aesthetic, Figure Styles, Removing Axes Spines, Overriding the Elements, Scaling Plot Elements	Setting Up Matplotlib, Essential Role of Pyplot in Matplotlib

SO 3-5	**Practice 1: Create a Stacked Bar Chart with a Separate Bar for each Dimension and Measure**	**Practice 4: Create a Product Analysis project focusing on the effective use of filters**	**Practice 7: Create and publish a Sales Dashboard in Power BI**	**Practice 10: Explore Various Color Palettes in Seaborn**	**Practice 13: Creating different types of Plots using Matplotlib**
SO-6	Data Aggregation and Statistical Functions in Tableau	Groups, Create Group from Data Pane, Create Group Using Visual Grouping	Data Modeling and Building Relationships, Data Model Performance, Data Analysis Expressions (DAX), DAX Functions for Power BI	Seaborn Color Palette, Building Color Palette, Qualitative Color Palette, Sequential Color Palette, Diverging Color Palette	Visualizing data, 3D Plots in Matplotlib
SO-7	Clutter and Clutter Elimination, Gestalt principles, Decluttering: Enhancing Storytelling with data	Hierarchies, Building Hierarchy using Drag and Drop, Building Hierarchy using Right-Click menu	Visualizing Data with Charts in Power BI, Line Chart, Stacked Column Chart, Donut Chart, Bar Chart, Treemap, Scatter Chart, Waterfall Chart, Pie Chart, Gauge Chart, Map Chart	Seaborn Histogram, Kernel Density Estimates, Visualizing Pairwise Relationship	Correlation, Covariance, Z-score, Libraries for data visualization in Python
SO 8-10	**Practice 2: Create a Bar Chart with Multiple Measures on a Single Axis**	**Practice 5: Create a story with Tableau, Design and implement interactive dashboards**	**Practice 8: Explore various charts in Power BI**	**Practice 11: Plotting Univariate Distribution, Bivariate Distribution, Scatter Plot, Hexbin Plot**	**Practice 14: Plot a frequency polygon for the Min/Max Temperature Series data using Histogram.**
SO-11	Visualization for storytelling Scenarios: Bar Charts, Types of Bar Charts	Sets, Creating a Constant Set, Dynamic Set, Combined Set, Sort data in a visualization	Power BI Service and Cloud Integration, Power BI Performance Optimization: Advanced Techniques	Plotting Categorical data using Seaborn, Distribution of Observations: Box Plots, Violin Plots	Apply Matplotlib to build histograms using Rectangles and PolyCollections
SO-12	Heat Map, Creating and Customizing Heat Map	Dates in Tableau, Discrete vs Continuous Dates, Defining a Fiscal Year, Custom Dates	Designing Mobile Layouts, Creating Mobile Optimized Reports	Seaborn Linear Relationships, Fitting Different kinds of Models, Facet Grid, Pair Grid	Using bar charts, scatter plots, Quartiles and box plots
SO 13-15	**Practice 3: Analyze customer data through various chart types**	**Practice 6: Building a Sales Growth Dashboard using Tableau**	**Practice 9: Create Mobile View in Power BI**	**Practice 12: Statistical Estimation using Seaborn**	**Practice 15: Assess the performance of students of a class in the annual examination. Plot the data using boxplot and perform a comparative analysis of performance in each subject.**

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

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

Resources			
1	*Claus O. Wilke, Fundamentals of Data Visualization, O'Reilly, April 2019*	2	*Alexander Loth, Visual Analytics with Tableau, Wiley, May 2019*
3	*Daniel G. Murray, Tableau Your Data! Fast and Easy Visual Analysis with Tableau Software, Wiley, January 2016*	4	*Devin Knight, Mitchell Pearson, Bradley Schacht, Erin Ostrowsky, Microsoft Power BI Quick Start Guide, Packt Publishing Ltd, October 2020*
5	*.Karan Singh Bisht, Seaborn Basic to Advanced For Machine Learning, Kindle, March 2022*	6	*Dr. Pooja, Data Visualization with Python: Exploring Matplotlib, Seaborn, and Bokeh for Interactive Visualizations, BPB Publications, July 2023*

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

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

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

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

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethicalpractices& Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Apply numerical methods to solve problems involving number classification, divisibility tests, progressions, HCF & LCM, simplification techniques, and vinculum-based calculations.	✓	✓	✓	✓	1	85	75	-	3	1	3	1	-	-	-	2	-	-	-
CO-2	Calculate interest, analyze profit and loss, and solve problems related to percentages, discounts, permutations, combinations, and probability, enhancing their quantitative reasoning skills.	✓	✓	✓	✓	3	85	75	-	3	1	3	1	-	-	-	2	-	-	-
CO-3	Solve problems related to time and work, speed and distance, boats and streams, mixtures and alligations, height and distance, and age-based calculations with accuracy and efficiency.	✓	✓	✓	✓	4	85	75	-	3	1	3	1	-	-	-	2	-	-	-
CO-4	Solve problems related to clocks, calendars, directions, blood relations, and interpret data from various graphical representations, including tables, bar charts, pie charts, and line graphs, with accuracy and clarity.	✓	✓	✓	✓	4	85	75	-	3	1	3	1	-	-	-	2	-	-	-
CO-5	Solve number puzzles, logical puzzles, sequential output tracing, and reasoning problems, as well as alphanumeric series and coding/decoding problems, with precision and speed.	✓	✓	✓	✓	5	85	75	-	3	1	3	1	-	-	-	2	-	-	-

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

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

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

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

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

SEMESTER- II

Code	PAD25C04J	Title	Natural Language Processing	Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Provides the foundational techniques for preprocessing text data.
CR-2	Covers methods to transform raw text into numerical representations.
CR-3	Delves into advanced techniques like NER, text parsing, and topic modeling to extract structured information.
CR-4	Introduces deep learning methods, including RNNs, LSTMs, and transformers, that are crucial for state-of-the-art NLP applications.
CR-5	Explores practical applications of NLP in areas like chatbots, machine translation and ethical considerations.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management &	Life Long Learning
CO-1	Able to preprocess raw text data, implement tokenization, text normalization, lemmatization, stemming, and perform basic text operations like stop word removal.	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Implement text vectorization methods such as TF-IDF, BoW, and word embeddings, and understand feature extraction for text classification tasks.	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Able to implement advanced NLP techniques such as Named Entity Recognition, dependency parsing, and topic modeling using LDA.		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Apply deep learning models like RNNs, LSTMs, and fine-tune transformer models for text classification, generation, and sentiment analysis.	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Able to implement real-world NLP applications such as chatbots, machine translation systems, and question-answering models, while addressing ethical concerns in NLP.	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

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

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

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

Resources			
1.	Jurafsky, D., & Martin, J. H., Speech and Language Processing, 3rd Edition, Pearson, 2021.	2	Goldberg, Y., Neural Network Methods for Natural Language Processing, 1st Edition, Morgan & Claypool Publishers, 2017.
3	Manning, C. D., & Schütze, H., Foundations of Statistical Natural Language Processing, 1st Edition, MIT Press, 1999.	4	Chollet, F., Deep Learning with Python, 1st Edition, Manning Publications, 2017.
5	Bird, S., Klein, E., & Loper, E., Natural Language Processing with Python, 1st Edition, O'Reilly Media, 2009.	6	Van der Plas, L., & Cohn, T. Introduction to Natural Language Processing, 1st Edition, Springer, 2020.

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

Code	PAD25C05J	Title	Machine Learning	Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Gain knowledge about basic concepts of Machine Learning
CR-2	Identify machine learning techniques suitable for a given problem
CR-3	Solve the problems using various machine learning techniques
CR-4	Design application using machine learning techniques
CR-5	Interpret business models and scientific computing paradigms

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Gain knowledge about basic concepts of Machine Learning	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Identify machine learning techniques suitable for a given problem	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Solve the problems using various machine learning techniques		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Apply Dimensionality reduction techniques	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Design application using machine learning techniques	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Overview of Machine Learning	Discriminative and Generative Models	Unsupervised Learning	Learning Methods	Neural Network
Duration (hour)	15	15	15	15	15
SO-1	Introduction Machine Learning	Introduction-Discriminative and Generative Models	Introduction Unsupervised learning	Probabilistic methods for learning	Neural Networks
SO-2	Need –History – Definitions	Linear Regression	Clustering Algorithms -K – Means	Naïve Bayes Algorithm	Biological Motivation
SO-3	Applications	Least Squares	Hierarchical Clustering	Maximum Likelihood	Perceptron

SO 4-5	**Practice 1: Write a python program to import and export data using Pandas library functions.**	**Practice 4: Develop Logistic Regression Model for a given dataset.**	**Practice 7: Implement Dimensionality reduction using Principle Component Analysis (PCA) method.**	**Practice 10: Implement Naïve Bayes Classification in Python**	**Practice 13: Implement Simple and Multiple Linear Regression Models.**
SO-6	Advantages, Disadvantages & Challenges	Under-fitting / Overfitting	Cluster Validity	Maximum Apriori	Multi-layer Perceptron
SO-7	Types of Machine Learning Problems	Cross-Validation	Dimensionality Reduction	Bayesian Belief Networks	Feed Forward Network
SO-8	Mathematical Foundations	Lasso Regression- Classification	Principal Component Analysis	Probabilistic Modelling of Problems	Feed Forward Network
SO 9-10	**Practice 2: Show the various data pre-processing techniques for a given dataset:**	**Practice 5: Build KNN Classification model for a given dataset.**	**Practice 8: Write a python program to implement K-Means clustering Algorithm.**	**Practice 11: To implement probabilistic reasoning using Bayes' Theorem for a simple medical diagnosis problem.**	**Practice 14: Implement Feed Forward Network**
SO-11	Probability and Statistics	Logistic Regression, Gradient Linear Models	Recommendation Systems	Inference in Bayesian Belief Networks	Back Propagation-
SO-12	Bayesian Conditional Probability	Support Vector Machines –Kernel Methods	EM algorithm. Reinforcement Learning	Probability Density Estimation	Activation and Loss Functions
SO-13	Bayesian Conditional Probability	K-Nearest Neighbours – Tree based Methods –Decision Trees –ID3 – CART	Elements -Model based Learning	Sequence Models – Markov Models – Hidden Markov Models	Limitations of Machine Learning
SO 14-15	**Practice 3: To implement Bayesian Conditional Probability using Bayes' Theorem in a real-world context**	**Practice 6: Develop Decision Tree Classification model for a given dataset and use it to classify a new sample.**	**Practice 9: To implement Model-Based Learning using a Gaussian Naive Bayes classifier on a simple dataset (Iris dataset).**	**Practice 12: Demonstrates Markov Models and Hidden Markov Models (HMMs) using Python**	**Practice 15: Build Artificial Neural Network model with back propagation on a given dataset.**

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

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

Resources			
1.	Andreas C. Müller and Sarah Guido , Introduction to Machine Learning with Python October 2016	2.	Noah Gift, Essential Machine Learning and Pragmatic AI, December 2018

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

Code	PAD25C06J	Title	Social Media and Text Analytics	Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To leverage the power of the R eco-system to extract, process, analyze, visualize and model social media data
CR-2	Visualize and analyze data from social media platforms to understand and model complex relationships using various concepts and techniques
CR-3	Understand the fundamentals of text mining
CR-4	Utilize text for prediction techniques
CR-5	Understand the relevance between information retrieval and text mining

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Understand the basics of social media analytics and R language	✓				3	80	70	1	3	-	3	1	-	-	-	1	1	-	3
CO-2	Analyze data from major social media channels such as Twitter & Flickr	✓	✓	✓		4	85	75	2	3	1	2	1	-	-	-	2	1	-	3
CO-3	Acquire knowledge on fundamentals of text mining		✓			3	75	70	2	3	2	3	1	-	-	-	2	1	-	3
CO-4	Perform prediction from text and evaluate it	✓	✓	✓	✓	3	85	80	2	3	2	3	1	-	-	-	2	1	-	3
CO-5	Perform document matching	✓	✓			2	85	75	3	3	2	3	1	-	-	-	2	1	-	3

Title & Session Outcomes	Introduction	Data Analysis	Information Retrieval	Decision Tree	Hierarchical Clustering
Duration (hour)	15	15	15	15	15
SO-1	Getting Started with R and Social Media Analytics	Visualizing data, Managing packages	Overview of Text Mining, What's Special About Text Mining?	Using Text for Prediction, Recognizing that Documents Fit a Pattern,	Finding Structure in a Document Collection, Clustering Documents by Similarity, Similarity of Composite Documents

SO-2	Advantages and Significance of Social Media ,Disadvantages and Pitfalls of Social Media	Data analytics - Analytics workflow, Machine learning techniques-Supervised learning, Unsupervised learning	Structured or Unstructured Data, Is Text Different from Numbers?	Document Classification, Learning to Predict from Text, Similarity and Nearest-Neighbor Methods	k-Means Clustering, Hierarchical Clustering
SO-3	Social media analytics, A typical social media analytics workflow.	Text analytics, Understanding Twitter, APIs	What Types of Problems Can Be Solved?, Document Classification, Information Retrieval.	Document Similarity, Decision Rules	The EM Algorithm, What Do a Cluster's Labels Mean?, Applications, Evaluation of Performance.
SO 4-5	**Practice 1: Simple Text Analytics**	**Practice 4:Text Analytics**	**Practice 7:Working with Classification**	**Practice 10:Working with Document Classification**	**Practice 13: implementing clustering algorithm**
SO-6	Data access, Data processing and normalization, Data analysis and Insights, Opportunities and Challenges	Connecting to Twitter using R, Extracting sample Tweets	Clustering and Organizing Documents, Information Extraction, Prediction and Evaluation	Decision Trees, Scoring by Probabilities, Linear Scoring Methods	Case Study: Market Intelligence from the Web Case Study: Lightweight Document Matching for Digital Libraries
SO-7	Getting started with R, Environment setup	Trend analysis, Sentiment analysis, Key concepts of sentiment analysis –Subjectivity, Sentiment polarity Opinion summarization	From Textual Information to Numerical Vectors, Collecting Documents, Document Standardization	Evaluation of Performance - Estimating Current and Future Performance, Errors and Pitfalls in Big Data Evaluation	Mining Social Media
SO-8	Data types, Data structures-Vectors	Features	Tokenization, Lemmatization-Inflectional Stemming, Stemming to a Root.	Information Retrieval and Text Mining, Is Information Retrieval a Form of Text Mining?	E-mail Filtering
SO 9-10	**Practice 2:Working with Data structures**	**Practice 5:Working with Twitter data**	**Practice 8:Information Extraction**	**Practice 11:Decision Trees**	**Practice 14: EM Algorithm**
SO-11	Arrays, Lists, Data Frames	Sentiment analysis in R, Follower graph analysis	Vector Generation for Prediction, Multiword Features	Key Word Search, Nearest-Neighbor Methods	Emerging Directions
SO-12	Functions - Built-in functions, User-defined functions	Flickr Data Analysis, Accessing Flickr's data, Understanding Flickr data	Labels for the Right Answers, Feature Selection by Attribute Ranking, Sentence Boundary Determination	Measuring Similarity -Shared Word Count, Word Count and Bonus, Cosine Similarity, Web-Based Document Search - Link Analysis	Summarization, Active Learning
SO-13	Controlling code flow - Looping constructs, Conditional constructs, Advanced operations-apply, lapply, sapply,tapply, mapply.	Are your photos interesting? - Preparing the data -Building the classifier	Part-of-Speech Tagging, Word Sense Disambiguation, Phrase Recognition, Named Entity Recognition, Parsing, Feature Generation.	Document Matching, Inverted Lists, Evaluation of Performance	Learning with Unlabeled Data
SO 14-15	**Practice 3: Working with Looping and functions**	**Practice 6:Working with Flickr Data Analysis**	**Practice 9: Phrase Recognition**	**Practice 12: Nearest-Neighbor Methods**	**Practice 15: E-mail Filtering**

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

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

Resources			
1	Raghav Bali, Dipanjan Sarkar, Tushar Sharma, (2017), ”Learning Social Media Analytics with R”, Packt Publishing.	2	Sholom M. Weiss, Nitin Indurkhya, Tong Zhang, (2015), “Fundamentals of Predictive Text Mining”, Second Edition, Springer London.

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

Code	PAD25C07J	Title	Computer Vision	Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To understand core image processing techniques in computer vision
CR-2	To analyze shapes, regions, and motion in visual data.
CR-3	To gain insights into 3D vision and scene reconstruction.
CR-4	To explore classical and deep learning methods for object recognition.
CR-5	To apply vision algorithms in real-world applications using modern tools.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Apply image-based feature extraction techniques for vision tasks.	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Perform shape and region analysis for image interpretation.	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Implement 3D reconstruction and depth estimation methods.		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Design object detection and recognition pipelines.	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Use CNNs and RNNs for segmentation and video analysis.	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Image-Based Feature Extraction	Shapes And Regions	3D Vision And Depth Estimation	Object Detection and Recognition	Deep Learning for Computer Vision
Duration (hour)	15	15	15	15	15
SO-1	Understand image representation and challenges in computer vision	Understand binary shape and region representations	Understand camera calibration and pose estimation	Understand object detection and category classification	Understand CNN architecture and kernel visualization
SO-2	Apply adaptive and global thresholding techniques	Analyze boundary tracking and centroid profiles	Apply triangulation and structure-from-motion methods	Apply face detection and recognition methods	Implement CNN-based object detection (e.g., R-CNN)
SO-3	Detect edges and corners using gradient-based operators	Recognize lines and circles using Hough transform	Analyze stereo geometry and depth estimation	Use instance recognition with geometric alignment	Perform segmentation using FCN and U-Net

SO 4-5	**Practice 1a: Implement global and adaptive thresholding on sample images 1b: Apply Canny edge detection and visualize results**	**Practice 4a:: Perform skeletonization and thinning of shapes 4b: Detect lines and circles using OpenCV Hough methods**	**Practice 7a: Calibrate camera and estimate focal length 7b: Implement stereo correspondence and depth map creation**	**Practice 10a: Detect faces using Haar cascades and HOG. 10b: Recognize faces using Eigenfaces and PCA**	**Practice 13a: Build and train CNN on image classification dataset.13b: Perform semantic segmentation using U-Net**
SO-6	Use Laplacian, hysteresis, and level set for edge refinement	Apply foot-of-normal for line detection	Use bundle adjustment and factorization methods	Train part-based models for category recognition	Apply Faster R-CNN for real-time detection
SO-7	Perform graph cut and active contour segmentation	Extract and describe region-based features	Extract epipolar lines and disparity maps	Use Bag of Visual Words for object classification	Use Mask-RCNN for instance segmentation
SO-8	Identify texture patterns using local descriptors	Detect ellipses using shape-based methods	Apply multiview stereo reconstruction	Perform semantic scene analysis	Integrate CNN and RNN for spatiotemporal analysis
SO 9-10	**Practice 2a: Compare edge detection techniques using real-world datasets. 2b: Extract Harris corners and visualize interest points**	**Practice 5a: Shape descriptor extraction and comparison,5b: Iris localization using edge and shape features**	**Practice 8a: Visualize 3D point clouds from stereo images. 8b: Perform structure-from-motion using image sequences**	**Practice 11a: Build object recognition pipeline using BoVW. 11b: Detect pedestrians using pre-trained models**	**Practice 14a: Video-based activity recognition using CNN + LSTM. 14b: Mask-RCNN for segmenting multiple objects**
SO-11	Use local invariant feature descriptors (SIFT/SURF)	Perform contour extraction and morphological processing	Model 3D objects using point-based representations	Evaluate detection using precision-recall metrics	Apply LSTM models for video event detection
SO-12	Apply region growing and clustering for segmentation	Use image moments for shape analysis	Analyze surface models from active sensing	Use datasets for training detection models	Train end-to-end deep models on custom datasets
SO-13	Evaluate the robustness of feature descriptors	Segment and classify shapes in binary images	Use shape-from-X methods for 3D perception	Integrate contextual cues for scene understanding	Evaluate deep vision models with confusion matrix
SO 14-15	**Practice 3a: Feature extraction with SIFT and SURF 3b: Segment images using graph-based and region-based methods**	**Practice 6a: Compare segmentation of shapes with threshold and region growing. 6b: Develop shape classification using descriptors**	**Practice 9a: 3D reconstruction using shape-from-texture.9b: Surface visualization using point cloud libraries**	**Practice 12a: Apply geometric alignment for object matching. 12b: Multi-object detection using YOLO framework**	**Practice 15a: Compare R-CNN and YOLO for detection speed.15b: Deploy trained CNN model using TensorFlow/PyTorch**

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

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

Resources			
1.	*Davies, E. Roy,* Computer and Machine Vision: Theory, Algorithms, Practicalities, *1st edition, Academic Press, 2012.*	2.	Shanmugamani, Rajalingappaa, Deep Learning for Computer Vision: Expert Techniques to Train Advanced Neural Networks Using TensorFlow and Keras, 1st edition, Packt Publishing Ltd, 2018
3.	*Baggio, D. L., et al.*, Mastering OpenCV with Practical Computer Vision Projects, *1st edition, Packt Publishing, 2012.*	4.	Solem, Jan Erik, *Programming Computer Vision with Python: Tools and Algorithms for Analyzing Images*, 1st edition, O'Reilly Media, 2012
5.	*<Szeliski, Richard,* Computer Vision: Algorithms and Applications, *1st edition, Springer Science & Business Media, 2010.*	6.	Nixon, Mark, Aquado, Alberto S., *Feature Extraction and Image Processing for Computer Vision*, 3rd edition, Academic Press, 2012.

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

Code	PAD25D04T	Title	Reinforcement Learning for AI	Category	D	Discipline Elective Course	L	T	P	C
							4	0	0	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To understand the concept of algorithms helps approach problems with step by step solutions
CR-2	To apply creative thinking towards the problem which would help in having a solution-oriented mindset
CR-3	To develop the students, have familiarity with them and stays relevant to the future modern world
CR-4	To develop the abilities creates new opportunities in most business sectors and consumer applications.
CR-5	To develop the decision-making knowledge

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Learn how to define RL tasks and the core principals behind the RL, including policies, value functions	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Implement in code common algorithms following code standards and libraries used in RL	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Understand and work with Dynamic Programming for Reinforcement Learning		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Explore Deep reinforcement learning with algorithms	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Recognize current advanced techniques and applications in RL	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Introduction	Markov Process	Policy Algorithms	Deep Reinforcement Learning	Reinforce Algorithm
Duration (hour)	12	12	12	12	12
SO-1	Introduction to Reinforcement Learning	Markov Decision Process (MDP)	Dynamic Programming for RL Policy iteration, Value iteration	Temporal Difference (TD) Learning Basics of Temporal Difference, TD Prediction, TD Control , TD Algorithm and Eligibility Traces	Policy Gradient Methods, REINFORCE Algorithm, Actor-Critic Methods
SO-2	Applications and Uses of RL Reinforcement learning as MDF	Markov Process	Value iteration with Dynamic programming	Relationship between TD Learning and other RL methods	Advanced Policy based methods

SO-3	Learnable Functions in Reinforcement learning	Markov Reward Process	Bellman Expectation and Optimality Equations	Convergence and Stability of TD methods	PPO , A3C
SO-4	Taxonomy of RL Approaches	Markov Decision process	On-Policy and Off – Policy, Algorithm, On-Policy Learning Off-Policy Learning, Differences Between On-Policy and Off Policy	Deep Reinforcement Learning (DRL) Basics, Classic RL Algorithms, Model-Free RL, Model-Based RL	Multi-Agent RL, Competitive and cooperative Multi-Agent Systems Nash Equilibria in Multi-Agent RL
SO-5	Reinforcement learning flow	Bellman Equations	Examples of On-Policy Algorithms, SARSA, Actor-Critic	Deep Q Learning, Why Deep Q-Learning, DQN	Hierarchical RL, Framework, Long decision horizons, Sparse rewards
SO-6	Compare and contrast RL and ML State change and transition, process	Partial Observable MDPs	Examples of Off - Policy Algorithms Q-Learning, Deep Q Networks	Improvements in DQN, Double DQN, Dueling DQN	Hierarchy of Controllers, High-level policy, Low-level policy, ,Hierarchical RL Architectures
SO-7	Deep Learning for Reinforcement learning, Reinforcement learning and Supervised Learning	Policies and Value Functions, Discounted Rewards	Exploration vs. Exploitation in On-Policy vs. Off- Policy, Applications of On-Policy and Off-Policy Learning, Optimal Policies	Deep Q-Learning Variants, Double DQN, Dueling DQN, Noisy DQN Rainbow DQN	Model based RL, Planning with learned models
SO-8-10	**Model-based Algorithms** Dynamic Programming, Monte Carlo Tree Search, Model-Based Q-Learning, Dyna-Q	Predicting Rewards with the State-Value Function, Predicting Rewards with the Action-Value Function	Monte Carlo Methods, First -visit and Entry-Visit Monte Carlo, Off-Policy vs. On-Policy Learning	Hyper parameters in DQN, Learning rate, Discount factor, Batch size, Replay buffer size, Target network update frequency	Meta-RL,Transfer learning in RL
SO-11-12	**Model-free Algorithms** Q-Learning, SARSA, Deep Q-Network, Policy Optimization, A3C	Predicting Rewards with the Action-Value Function	Monte Carlo Policy Generation	Deep Q-Learning, Prioritized ,Experience Replay Example Applications -Atari Games ,Autonomous Driving, Robotics	Few-Shot RL

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

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

Resources			
1	Phil Winder, Reinforcement Learning Industrial Applications of Intelligent Agents, O'Reilly Media, Inc, 2020	2	Laura Graesser, Wah Loon Keng, Foundations of Deep Reinforcement Learning, Addison Wesley Data & Analytics Series, 2019

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

Code	PAD25D05T	Title	Time Series Analysis	Category	D	Discipline Elective Course	L	T	P	C
							4	0	0	4

Offering Department	Mathematics and Statistics		Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Statistical Table and Graph sheet

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To provide basic knowledge of times series Analysis
CR-2	To understand the Concepts of Autoregressive moving average and Auto regression
CR-3	To acquire the knowledge of Vector Error Correction model
CR-4	To learn the application of ARMA, ARIMA and VAR
CR-5	To understand the concept of forecasting of time series analysis

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment &	Ethical Practices & Social	Individual & Team Work	Communication	Project Management &	Life Long Learning
CO-1	To acquire the knowledge of basic characteristic of time series	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	To understand the concepts of ARMA, ARIMA model	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	To understand the Vector Autoregression model		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	To gain the knowledge of Cointegration, spurious regression and super consistency	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	To acquire the skill of constructing the VECM and VAR model	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Learning Unit / Module 1	Learning Unit / Module 2	Learning Unit / Module 3	Learning Unit / Module 4	Learning Unit / Module 5
Duration (hour)	12	12	12	12	12
SO-1	Concepts of Time series, Objective of time series analysis	Introduction to stationary process -Linear process– properties	Stochastic vs. deterministic trends, The random walk process	Introduction of VEC model, Construction of VEC model	Modeling the Break Process, Model Comparisons Under Different Numbers of Breaks
SO-2	Components of time series, Simple models of time series	Concepts of Auto regression, moving average models	Impulse-response functions and variance decomposition, Example for Impulse-response functions and variance decompositions	Cointegrated VAR Models, Cointegrated VAR structure	Uncertainty about Out-of-Sample Breaks,No new Break

SO-3	Zero mean model, Models with trends and seasonality	Problems on moving average, Introduction to ARMA	Impulse-response functions and variance decomposition	Estimation of Co-integrated VAR	Single out-of-sample Break, Multiple out-of-sample Breaks
SO-4	General approach to time series modeling, Stationary models and the auto regression function	Properties of Mean and auto correlation, ARMA(p, q) Processes The ACF and PACF of an ARMA(p, q) Process.	Unit root tests, Spurious regressions	Estimation of Co integrated VAR	Filtering – filter function, Filtering Sine and cosine - Concepts
SO-5	Sample auto correlation function, Model for the Lake Huron Data	Calculation of the ACVF, Calculation of the ACVF	Example for Spurious regressions, Definition co-integration	Example for estimation of co integrated VAR	Filtering Sine and cosine, Filtering general series
SO-6	Model for the Lake Huron Data, Models in trend and seasonality	Partial Autocorrelation Function, Spectral Densities – problems	Example for co integration	Testing of Co integrated VAR	Sequential filtering- concepts, Linesr model - Kalman filtering – concept, model construction
SO-7	Estimation and Elimination of Trend in the Absence of Seasonality, Estimation and elimination of trend	State space models – ARIMA, Estimation state-space models	Testing Bivariate Co-integrating Relationships	Testing Procedure for Co integrated VAR, Testing for Co integrated VAR - example	Mean and variance for kalman filtering, Examples for kalman filtering
SO-8	Estimation and elimination of trend, Estimation and elimination of seasonal variation	State space model with missing values, EM algorithm – problem	Dickey-Fuller test- Augmented Dickey-Fuller test	Forecasting (Johansen)- model	Forecasting using kalman filtering, Application of kalman filtering
SO-9	Estimation and elimination of seasonal variation, Estimation and elimination of seasonal variation	Forecasting ARMA Processes, ARMA(p, q) Processes	Test on white noise Procedure	Forecasting (Johansen)- procedure, Example Forecasting Johansen	Application of kalman filtering, Non-linear model – ARCH model
SO-10	Elimination of seasonal variation in trend, Elimination of both trend and seasonal components	Properties – causality, ACF and PACF of the ARMA model	Problems on test on white noise	Forecasting and Granger Causality in a VAR model	GARCH – definition, construction, Mean, variance, autocorrelation
SO-11	Eliminating the noise sequence,	ACF and PACF of the ARMA model – problems, ACF and PACF of the ARMA model – problems	Spurious Regression procedure	Granger Causality in a VAR procedure	GACH Model of Order p, q GARH(p,q):,interpretation of GACH
SO-12	Eliminating the noise sequence	Forecasting of ARMA model	Causes of spurious regression	Granger Causality in a VAR example	Application of GACH

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

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

Resources			
1	Time Series Analysis with Python Cookbook, by Tarek A. Atwan, 2022	2	Modern Time Series Forecasting with Python, by Manu Joseph, 2022

Designers					
Professional Experts		Higher Institution Experts		Internal Experts	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr.Venmani, Assistant Professor, Dept. of Mathematics & Statistics, SRMIST, KTR

Code	PAD25D06T	Title	Mathematics for Data Science	Category	D	Discipline Elective Course	L	T	P	C
							4	0	0	4

Offering Department	Mathematics & Statistics	Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	Data Book / Codes/Standards	Nil

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To apply the numerical techniques to solve the system of linear equations.
CR-2	To apply the basic concepts and theorems of Matrices.
CR-3	To learn the basic concepts of differential and integral calculus.
CR-4	To learn the basic concepts of vector spaces and its applications.
CR-5	To understand the basic concept of vector integration and its applications.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Understanding the numerical methods to solve the equations	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Gaining knowledge in basic concepts of matrix method and its applications	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Understanding the concepts of differentiation and integration		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Understanding the concept of vector spaces	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Getting the knowledge of vector integration and its real life application	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	System of linear Equations	Matrices	Calculus	Vector spaces	Vector calculus
Duration (hour)	12	12	12	12	12
SO-1	Introduction to system of linear equations	Definition and Types of Matrix with Examples	Differentiation: Basic problems	Introduction to Vector Space	Gradient, Divergence, and Curl
SO-2	Matrix form of System of Linear Equations	Characteristic Equation	Successive Differentiation	Definition and Examples	Problems based on Gradient

SO-3	Cramer's Rule	Eigen values and Eigen vectors of a Real Matrix	Leibnitz's Theorem and problems	Vector Space-Simple Properties	Problems based on Gradient
SO-4	The Gaussian Elimination Method	Properties of Eigen values and Eigenvectors	Problems on Euler's theorem	Vector Space - Problems	Directional Derivatives and problems based on directional derivative
SO-5	Gauss Jordan Method	Minimal Polynomial	Problems on Euler's theorem	Subspaces	Directional Derivatives and problems based on directional derivative
SO-6	Gauss Jordan Method	Cayley - Hamilton Theorem (Problems only)	Partial Differentiation	Subspaces: Definition and Examples	Divergence and Curl
SO-7	Gauss Jacobi Method	Cayley - Hamilton Theorem and Problems	Jacobians	Linear Combination and Span	Problems on Divergence and Curl
SO-8	Gauss Jacobi Method	Cayley - Hamilton Theorem and Problems	Integral calculus: Basic problems on integration	Linear Independence and Dependence	Problems on Divergence and Curl
SO-9	Gauss Seidel Method	Matrix Diagonal forms	Integration by Method of substitution	Linear Independence and Dependence-Properties & Problems	Problems on Divergence and Curl
SO-10	Gauss Seidel Method	Matrix Triangular forms & Triangular forms	Integration by Method of substitution	Linear Transformation	Vector integration
SO-11	Crout's method	Diagonalization of Matrices	Integration of rational algebraic function	Linear Transformation -- Basis and Dimension of a Vector Space	Vector integration problems on Line integrals
SO-12	Crout's method	Diagonalization of Matrices	Bernoulli's formula	Change of Basis	Vector integration problems on Line integrals

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

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

Resources			
1	B S Grewal, Higher Engineering Mathematics, 42nd edition, Khanna Publishers, 2012	2	A Singaravelu, Allied Mathematics, 7th edition, A.R.S. Publications, 2015.
3	Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2016.	4	nptel.ac.in/courses/127106019, Numerical methods for science and engineering.
5	T Veerarajan, Engineering Mathematics – I , 12th edition, Mc Graw Hill Education, 2018.	5	nptel.ac.in/courses/111105122, Vectors and integration
6	Srimanta Pal, Subodh C Bhunia, "Engineering Mathematics", 3rd edition, Oxford University Press, 2015	7	nptel.ac.in/courses/111105160, Advanced calculus for Data Scientists.

Designers					
Professional Experts		Higher Institution Experts		Internal Experts	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. L.Sivakami, SRMIST, sivakaml@srmist.edu.in
				2	Dr. S. Saravanakumar, SRMIST, saravans14@srmist.edu.in

Code	PAD25S02J	Title	SQL and NoSQL for Data Science	Category	S	Skill Enhancement Course	L	T	P	C
							2	0	3	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To understand the basic concepts and terminology related to DBMS and Relational Database Design
CR-2	To understand advanced DBMS techniques to construct tables and write effective queries, forms, and reports
CR-3	To understand Database Administration & Database Recovery
CR-4	Gain knowledge of NoSql Databases
CR-5	Understand NoSql Query Processing & Optimization

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Acquire the knowledge of providing a reliable, consistent, secure, and available corporate-wide data	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Acquire the skills of several database operation and maintenance issues	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Obtain the knowledge of enabling the learner to become a Data Base technology Expert		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Gain knowledge of NoSql Databases, Query Processing & Optimization	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Know-how of the file organization, Query Optimization, Transaction management, and database administration techniques	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Introduction to Database systems	SQL	Applications of SQL	NoSQL	Implementation of NoSQL
Duration (hour)	15	15	15	15	15

SO-1	File systems Vs DBMS- Advantages of DBMS- Database Design and ER Diagrams - Entities, Attributes, And Entity Sets	The Form of A Basic SQL Query- Examples of Basic SQL Queries- Nested Queries	An Introduction To JDBC- Architecture	Definition, advantages, challenges of SQL	Indexing in Distributed Databases – B-Trees, Hash-based indexing, LSM Trees
SO-2	Describing and storing data in a DBMS- Relationships And Relationship Sets	Triggers and Active Databases- Examples of Triggers in SQL	JDBC Classes And Interfaces	Architectures – Client-server, peer-to-peer, multi-tier models	Sharding and Partitioning Strategies – Range-based, Hash-based, Consistent Hashing
SO-3	Key Constraints -Participation Constraints, Weak Entities- Aggregation- Case Study: The Internet Shop- Introduction To The Relational Model	Constraints versus Triggers- Other Uses of Triggers	JDBC Driver Management - Connections	Data Distribution and Fragmentation – Horizontal, vertical, and hybrid	Data Replication Techniques – Synchronous vs Asynchronous replication
SO 4-5	**Practice 1: SQL queries for students database**	**Practice 4: Practice of triggers- SQL Trigger | Student Database**	**Practice 7: Case study for JDBC**	**Practice 10:MongoDB Installing and configuring in Windows**	Practice 13: MongoDB Insert, Delete document in a collection
SO-6	Creating And Modifying Relations Using SQL- Integrity Constraints Over Relations	Accessing Databases From Applications- Embedded SQL	SQLJ- Executing SQL Statements	Replication and Consistency- Distributed Database Design Principles	Performance Considerations – Latency, throughput, load balancing
SO-7	Key Constraints- Foreign Key Constraints- General Constraints	Declaring Variables and Exceptions	Writing SQLJ Code	CAP Theorem and BASE vs ACID	Distributed Query Processing Basics – Query decomposition and execution
SO-8	Simple examples Querying Relational Data	Embedding SQL Statements	SQLJ example	Trade-offs in distributed databases	Join Processing in Distributed Systems – Hash join, Nested-loop join
SO 9-10	**Practice 2: SQL queries for employee Database**	**Practice 5: - Practice Embedding SQL Statements**	**Practice 8: Creating a Student database**	**Practice 11: Demonstrate how create and drop a database in MongoDB**	Practice 14: MongoDB Update document
SO-11	Selection And Projection - Set Operations	Cursors- Basic Cursor Definition and Usage	How to Limit Query Results in SQL?	Distributed File Systems Concepts	Query Optimization Techniques – Cost-based and rule-based optimization
SO-12	Renaming- Joins	Properties of Cursors	Understanding the LIMIT Clause in SQL- Using LIMIT with WHERE Clause	Architecture, examples (HDFS, GFS)	Concurrency Control Mechanisms – Locking, Timestamp ordering, MVCC
SO-13	Condition Joins - Equijoin- Natural Join- Division	Dynamic SQL	How to Export Query Result in MySQL?	NoSQL Databases – Types: key-value, document, column-family-graph databases	Deadlocks and Resolution Strategies – Detection and Prevention techniques
SO 14-15	**Practice 3: Execution of join operations**	**Practice 6: Sample programs for cursors**	**Practice 9: Exporting query results from MySQL**	**Practice 12: creating a collection in MongoDB on the fly**	**Practice 15: MongoDB Indexing**

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

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

Resources

1.	R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2004	2.	A. Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2008.
3.	Kevin Loney (Fifth RePrint-2007), Oracle Database 10G: The Complete Reference, McGraw Hill, New Delhi.	4.	https://www.geeksforgeeks.org/sql-tutorial
5.	Abraham Silberschatz, Henry F. Korth, S. Sudarshan "Database System Concepts 7th Edition McGrawHill 2019	6.	M. Tamer Özsu, Patrick Valduriez, Principles of Distributed Database Systems4ht Edition Springer 2019
7.	Pramod J., NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence 1st Edition Addison-Wesley Professional 2012	8.	https://www.spiceworks.com/tech/artificial-intelligence/articles/what-is-nosql/

Designers

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

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

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

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

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical practices &Social Responsibility	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Gain a deeper understanding of self, including emotional intelligence and career aspirations	✓	✓	✓	✓	3	85	75	1	-	3	-	3	3	-	-	3	3	2	3
CO-2	Apply effective presentation skills for clear, engaging communication	✓	✓	✓	✓	6	85	75	1	3	3	-	3	2	-	-	3	3	2	3
CO-3	Participate confidently and effectively in group discussions and interviews	✓	✓	✓	✓	3	85	75	1	3	1	-	3	2	-	-	3	3	2	3
CO-4	Enhance their ability to understand and use language effectively in different contexts	✓	✓	✓	✓	2	85	75	1	-	-	-	1	-	-	-	-	3	2	2
CO-5	Improve language comprehension and accuracy	✓	✓	✓	✓	5	85	75	1	-	-	-	1	-	-	-	-	3	2	2

Title & Session Outcomes	Personal Development	Mastering Workspace Dynamics	Career Essentials	Verbal Ability	Verbal Reasoning and Comprehension
Duration (hour)	6	6	6	6	6
SO-1	Self-analysis through SWOT, The Johari Window	Personal, Professional and Social Etiquette	Resume Preparation and Activity	Synonyms and Antonyms	Statement and Assumption
SO-2	Goal Setting Importance, Goal Setting based on the Principle of SMART	Professional Communication - Presentation Skills	E-mail Drafting and Practice	One Word Substitution	Paragraph Summary

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

Assessment

Level of Thinking		**Continuous Learning Assessment (CLA)** (100 % weightage)							
		CLA – 1		**CLA – 2**		**CLA – 3**		**CLA – 4**	
		(20 %)		**(20 %)**		**(30 %)**		**(30%)**	
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
7	**Remember**	25%	-	20%	-	30%	-	50%	-
8	**Understand**								
9	**Apply**	50%	-	50%	-	40%	-	25%	-
10	**Analyze**								
11	**Evaluate**	25%	-	30%	-	30%	-	25%	-
12	**Create**								
	Total	100 %		100 %		100 %		100%	

Strategies

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

Resources

3	"The Johari Window: A Model for Self-awareness and Personal Growth" by Joseph Luft & Harrington Ingham	4	Campus Recruitment complete Reference , Praxis Groups
5	"The 7 Habits of Highly Effective People" by Stephen R. Covey	6	A Modern Approach to Verbal and Non Verbal Reasoning – Dr A S Agarwal
7	"SMART Goals: How to Set and Achieve Your Personal and Professional Goals" by S.J. Scott	8	Verbal Ability & Reading Comprehension for CAT - Arun Sharma

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

SEMESTER – III

Code	PAD25C08T	Title	Cloud Computing	Category	C	Professional Core Course	L	T	P	C
							4	0	0	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	An overview of Distributed Systems and its algorithm
CR-2	To understand the concepts of Cloud Computing and Learn about various public cloud services
CR-3	To explore about Web Services and Service Oriented Architecture.
CR-4	To learn about Cloud Management Products, Cloud Storage and Cloud Security
CR-5	To know about Google App Engine, AWS and Azure.

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Implement various Distributed algorithms	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Use Google collaboration tools and several public cloud services.	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Recognize and Implement the Levels of Virtualization.		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Use security tools, finding the vulnerabilities and also to Generate a detailed report.	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Install and configure Open Stack and launch VMs in AWS and Azure.	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Distributed Algorithms	Cloud Services	Virtualization	Security Tools	AWS and Azure
Duration (hour)	**12**	**12**	**12**	**12**	**12**
SO-1	Introduction to Distributed Systems	Introduction to Cloud Computing	Introduction to Web Service and Service Oriented Architecture	Resource Provisioning and Methods	HDFS MapReduce
SO-2	Distributed Systems Architecture	Evolution of Cloud Computing	SOAP – REST – Basics of Virtualization	Cloud Management Products	Google App Engine (GAE
SO-3	Characteristics	Cloud Characteristics- Elasticity in Cloud	Full and Para Virtualization	Cloud Storage	Programming Environment for GAE
SO 4-5	Issues in Distributed Systems	Challenges and benefits of Elasticity	Advantages of Full and Para Virtualization	Provisioning Cloud Storage	Programming Environment for GAE
SO-6	Distributed System Model	On-demand Provisioning	Implementation Levels of Virtualization	Managed and Unmanaged Cloud Storage	Architecture of GFS
SO-7	Request/Reply Protocols	NIST Cloud Computing Reference Architecture	Tools and Mechanisms	Cloud Security Overview	Case Studies: Openstack, Heroku and Docker Containers
SO-8	RMI, Key components of RMI	Architectural Design Challenges, Addressing Architectural Design Challenges	Virtualization of CPU, Types of Virtualization of CPU	Cloud Security Challenges, Cloud Security Challenges types	Amazon EC2, Instance management, pricing and cost optimization
SO-9	Logical Clocks and Casual Ordering of Events	Deployment Models: Public, Private and Hybrid Clouds	Memory – I/O Devices	Architecture Design – Virtual Machine Security	AWS
SO-10	RPC- Election Algorithm	Service Models: IaaS- PaaS – SaaS	Desktop Virtualization	Security – Application Security	Microsoft Azure
SO-11	Distributed Mutual Exclusion	Benefits of Cloud Computing	Server Virtualization	Data Security	Google Compute Engine
SO-12	Distributed Deadlock Detection Algorithms	Accessibility & Remote Work	Overview and benefits of Server Virtualization	key elements of Data Security	Key features of google compute engine and usecase of google compute engine

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

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

Resources			
1	1. Andrew S. Tanenbaum, Maarten Van Steen, “Distributed Systems - Principles and Paradigms”, Second Edition, Pearson, 2006.	2	Buyya R., Broberg J., Goscinski A., “Cloud Computing: Principles and Paradigm”, John Wiley& Sons, 2011.
3	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.	4	John W.Rittinghouse, James F.Ransome, "Cloud Computing: Implementation"Management, and Security", CRC Press, 2010.
5	Mukesh Singhal, "Advanced Concepts In Operating Systems", McGraw Hill Series in Computer Science, 1994.	6	https://cloud.google.com/compute/docs/instances/create-start-instance
7	https://learn.microsoft.com/en-us/training/azure/	8	https://aws.amazon.com/education/awseducate/

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

Code	PAD25C09J	Title	Deep Learning	Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	To understand neural network architecture.
CR-2	To learn various techniques for training neural networks
CR-3	To study CNNs architecture for image classification tasks
CR-4	To apply Recurrent Neural Networks (RNNs) for sequence prediction tasks
CR-5	To create generative models for generating new data

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	To design neural networks using deep learning frameworks.	✓				3	80	70	1	-	3	-	3	3	-	-	3	3	2	3
CO-2	To train an effective neural networks.	✓	✓	✓		3	85	75	1	3	3	-	3	2	-	-	3	3	2	3
CO-3	To implement Convolutional Neural Networks (CNNs) for classification tasks		✓			3	75	70	1	3	1	-	3	2	-	-	3	3	2	3
CO-4	To apply Recurrent Neural Networks (RNNs) for sequence prediction.	✓	✓	✓	✓	3	85	80	1	-	-	-	1	-	-	-	-	3	2	2
CO-5	To implement generative models for data generation.	✓	✓			3	75	70	1	-	-	-	1	-	-	-	-	3	2	2

Title & Session Outcomes	Introduction to Neural Network	Neural Network Learning	Convolutional Neural Network(CNNs)	Recurrent Neural Networks (RNNs)	Generative Models
Duration (hour)	15	15	15	15	15
SO-1	Introduction to Neural Network: BNN Vs ANN	Loss Function	Overview of CNN Architecture	Recurrent Neural Networks: Architecture	Introduction to Auto encoders
SO-2	ANN Architecture	Regularization	Convolution Operations: Convolutional layer, filters, and feature maps	Backpropagation Through Time (BPTT)	Architecture of Auto encoder
SO-3	Computational Models in NN	Delta Rule and Learning Rate	Padding, strides, and pooling layers	Applications of RNN, Limitations of RNN	Types of Auto encoder
SO 4-5	**Practice 1: Implementing Neural Networks Neural Networks Models**	**Practice 4: Implement and compare Loss function on classification tasks.**	**Practice 7: Build a CNN model to classify images from a popular dataset (MNIST, CIFAR-10, etc.)**	**Practice 10: Create a RNN program for stock price prediction**	**Practice 13: .Implement an Auto encoder in Tensor Flow.**

SO-6	Deep Learning Frameworks (TensorFlow, PyTorch, Keras)	Backpropagation: Stochastic and Minibatch Gradient	Layer Normalization, Dropout	GRU Architecture	Variational Auto encoders (VAE)
SO-7	Perceptron's: Single Layer Perceptron, Multi-Layer Perceptron	Test Sets, Validation Sets and Overfitting, Underfitting	Data Augmentation	Components of GRU	Latent Space Representation: Exploration of the properties of the latent space and its dimensionality.
SO-8	Activation Function	Optimization Algorithms	Evaluation Metrics for CNN Models	Applications of GRU	Loss Functions in VAEs: reconstruction loss and the KL divergence loss in VAEs.
SO 9-10	**Practice 2: Analyze and compare convergence when training MLP using Sigmoid vs Softmax**.	**Practice 5: Train model on the classification task and apply regularization techniques**	**Practice 8: Implement your own CNN model using TensorFlow/Keras, experiment with hyper parameters, and evaluate performance**	**Practice 11:Write a program to implement Time series prediction using GRU**	**Practice 14: implementing a variational autoencoder using TensorFlow or PyTorch.**
SO-11	Forward and Backpropagation	Hyper parameters	Architectures of CNNs: LeNet, AlexNet, VGG, ResNet, Inception	LSTM Architecture: Gates (Input, Forget, Output)	Generative Adversarial Networks
SO-12	Gradient Descent and Variants (SGD, Momentum, Adam, RMSProp)	Data Pre-processing for neural networks	Transfer Learning: Pretrained models, Fine-tuning for specific tasks	Bidirectional Long Short Term Memory (BLSTM)	Generator, Discriminator
SO-13	Training Neural Network	Feature Engineering	Applications of CNNs :Image classification, object detection, image segmentation	Applications of LSTM	Training GANs
SO 14-15	**Practice 3: Build a deep neural network with many layers using Tensor Flow**	**Practice 6: Build a simple neural network using Keras or TensorFlow. Use the pre-processed dataset and the engineered features.**	**Practice 9: Use transfer learning to fine-tune a pre-trained model on a specific task**	**Practice 12: Write a program implement LSTM architecture**	**Practice 15: Implement a GAN model**

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

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

Resources			
1.	Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.	2	Ian Goodfellow, YoshuaBengio and Aaron Courville, " Deep Learning", MIT Press, 2017.
3	Fundamentals of Deep Learning, Nikhil Buduma and Nicholas Locasio, O-Reilly, 2017		

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

Course Code	PAD25C10L	Course Name	Capstone Project	Course Category	C	Professional Core Course	L	T	P	C
							0	0	8	4

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

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

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

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

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

Code	PAD25D07J	Title	Large Language Models	Category	D	Discipline Specific Elective Course	L	T	P	C
							3	0	2	4

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

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

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Understand the basic concept of LLMs, NLP	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	To gain knowledge for developing LLM applications	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Implement and train a Neural Language Model		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	Explore techniques for fine Tuning pre-trained language models	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Understand how to apply LLMs to a variety of applications	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Define language models	Introduction to Transformer	Fine-tuning Methods	Applications of LLMs,	Ethics, Deployment, Security
Duration (hour)	15	15	15	15	15
SO-1	Introduction to Language Model-Evolution of LLM	Transformer Overview: Key Concepts and Architecture Motivation	Pretraining Objectives: Masked LM and Causal LM	Multilingual Fine-Tuning: Cross-lingual Transfer	Ethics, Deployment, and Optimization of LLM
SO-2	Overview of NLP Syntax, Semantics, Pragmatics	Introduction to Transformer Architecture	Transfer Learning in NLP	Evaluation of Fine-Tuned LLMs	Bias and Fairness in Language Models
SO-3	Corpus and Corpus Linguistics, Tokenization, Lemmatization, Stemming	Multi-Head Self-Attention, Scaled Dot-Product Attention	Fine-tuning Methods: Full, Layer-wise, Adapter-based	Applications of LLMs,Text Generation and Autocompletion	Hallucination, Misinformation, and Content Filtering

SO 4-5	**Practice 1:perform tokenization, stemming, and lemmatization on any text dataset**	**Practice 4:Implementing Self-Attention Mechanism in Python**	**Practice 7:Fine-tuning BERT for a custom text classification dataset and Using LoRA for memory-efficient fine-tuning**	**Practice 10:NER using spaCy and transformer-based models**	**Practice 13: Evaluating generated content for bias and hallucination**
SO-6	Classical Language Models Finite state Language Models	Positional Encoding, Feedforward Layers	Data Preparation and Tokenization Techniques	Text Summarization: Extractive , Abstractive	Energy Consumption, Carbon Footprint, and Green AI
SO-7	Normalized Finite state Language Models, Tightness of Finite-state Models	Encoder and Decoder Blocks	Instruction Tuning: Prompt-based and Prefix Tuning	Machine Translation using Transformer Models	Model Quantization, Pruning, and Distillation Techniques
SO-8	The n-gram Assumption and Sub regularity, Representation based n-gram Models	Layer Normalization, Residual Connections, Training Dynamics	LoRA, QLoRA, and other PEFT techniques	Question Answering Systems, Retrieval-Based Models	Tools for Model Acceleration: ONNX, DeepSpeed, TensorRT
SO 9-10	**Practice 2:Implement N-gram models and calculate perplexity on sample corpus**	**Practice 5:Building a basic Transformer block with PyTorch and Comparing outputs from different transformer models**	**Practice 8:Prompt tuning using T5 for summarization**	**Practice 11:Building a QA bot with context windowing**	**Practice 14: Creating a REST API for LLM services using FastAPI**
SO-11	Pushdown language models Context free Grammars	GPT Architecture, BERT Architecture: Pretraining,	RLHF, Quantization-Aware Fine-Tuning (QAT)	Retrieval-Augmented Generation (RAG): Concepts and Architecture	Deployment Architectures: Cloud, Edge, API, Serverless
SO-12	Weighted Context free Grammars	T5 and RoBERTa: Objectives	Transfer Learning Pipeline,PPO and Reward Models	LangChain: Tool Use, Agents & Pipelines, LLMs in Healthcare	Security and Privacy in LLM Applications, Safety Measures: Red Teaming
SO-13	Normalizing Weighted Context free Grammar, Push down automata, Pushdown Language Models Multi-stack Pushdown Automata	Transformer Variants, XLNet, ALBERT, DistilBERT	Prompt Engineering Techniques for Domain-Specific Tasks, Hyperparameter Tuning, Check pointing Strategies	Conversational AI, Virtual Assistants, Code Generation with LLMs (e.g., Codex, StarCoder)	Copyright, Licensing, and Data Provenance in LLMs,Adversarial Attacks and Defenses for LLMs
SO 14-15	**Practice 3: Write a python program to implement pushdown automata.**	**Practice 6:Using Hugging Face to load and use BERT and GPT and Sentence classification using fine-tuned BERT**	**Practice 9:Building custom prompts and evaluating responses**	**Practice 12:Creating a Lang Chain pipeline for document Q&A**	**Practice 15: Deploying an LLM-powered chatbot using Streamlit and Docker**

Assessment											
Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10%)		CLA – 2 (10 %)		CLA – 3 (20 %)		CLA – 4 (10 %)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember										
2	Understand	20%	20%	15%	15%	15%	15%	20%	20%	20%	20%
3	Apply										
4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
5	Evaluate										
6	Create	10%	10%	15%	15%	15%	15%	10%	10%	10%	10%
	Total	100 %		100 %		100 %		100 %		100 %	

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

Resources			
1.	Lewis Tunstall, Leandro von Werra, Thomas Wolf- Natural Language Processing with Transformers: Building Language Applications with Hugging Face ,1st Edition, 2022.	2.	Responsible AI in Practice Patrick Hall, Katie Shilton 1st Edition, 2024 Manning Publications
3.	Speech and Language Processing Daniel Jurafsky, James H. Martin 3rd Draft Edition, 2023 (online) Pearson (for 2nd ed.), Draft 3rd ed. available online.	4.	Mastering Transformers: Build state-of-the-art models from scratch with advanced natural language processing techniques Savas Yildirim 1st Edition, 2021Packt Publishing
5.	Transformers for Natural Language Processing Denis Rothman 2nd Edition, 2022 Packt Publishing	6.	Responsible AI in Practice Patrick Hall, Katie Shilton 1st Edition, 2024 Manning Publications
7.	Deep Learning for NLP Palash Goyal, Sumit Pandey, Karan Jain 1st Edition, 2018 Apress/Springer	8.	

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

Code	PAD25D08J	Title	Exploratory Data Analysis	Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	The essential exploratory techniques for summarizing data with R
CR-2	To develop more complex statistical models
CR-3	Eliminating or sharpening potential hypotheses about the world that can be addressed by the data
CR-4	The plotting systems in R
CR-5	The basic principles of constructing informative data graphics

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Making exploratory graphs	✓				5	85	75	1	-	-	3	-	2	-	2	3	3	-	3
CO-2	Principles of analytic graphics	✓	✓	✓		4	85	75	3	-	-	3	3	-	-	-	3	3	-	3
CO-3	Plotting systems and graphics devices in R		✓			6	85	75	3	-	-	3	-	-	-	-	3	3	-	3
CO-4	The base and ggplot2 plotting systems in R	✓	✓	✓	✓	3	85	75	3	1	2	3	3	-	-	-	3	3	-	3
CO-5	Clustering methods	✓	✓			2	85	75	3	3	2	3	-	3	3	3	3	3	-	3

Title & Session Outcomes	Introduction to EDA	Univariate Analysis	Bivariate Analysis	Multivariate Analysis	Feature Engineering & Transformation
Duration (hour)	15	15	15	15	15
SO-1	EDA fundamentals ,Understanding Data Science, Significance of EDA	Introduction to Univariate Analysis	Introduction to Bivariate Analysis	Introduction to Multivariate Analysis	Introduction to Feature Engineering

SO-2	Data transformation techniques-merging database, reshaping and pivoting,	Analysis Based on Variable Type-Numerical Variables-Descriptive Statistics- Mean, median, mode, Standard deviation, variance, Range, IQR, Skewness and kurtosis	Numerical Vs Numerical-Correlation Coefficients, Pearson, Spearman, Kendall	Definition and significance, Difference from univariate and bivariate analysis	Handling Categorical Variables
SO-3	Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.	Visualizations- Histogram, Box plot, Density plot / KDE plot, Violin plot	Visualizations-Scatter plots, Regression lines, Pair plots, Bubble plots	Multivariate Descriptive Statistics-Summary statistics across multiple variables, Grouped aggregates (e.g., multi-column groupby),Using pivot tables for multivariate summaries	Label Encoding, One-Hot Encoding, Ordinal Encoding, Binary Encoding ,Pros and cons of each method
SO 4-5	**Practice 1: Implementation of data transformation techniques using python**	**Practice 4: Implementation of Descriptive Statistics and Visualizations**	**Practice 7:Implementation of Scatter plots, Regression lines, Pair plots,Bubble plots**	**Practice 10:Summary statistics across multiple variables**	**Practice 13:Implementation of Handling Categorical Variables**
SO-6	Importing Matplotlib – Simple line plots – Simple scatter plots	Distribution Analysis- Symmetry vs skewness, Heavy-tailed vs light-tailed, Identifying normal vs non-normal distributions	Categorical vs Categorical-Cross-tabulations,Chi-square test of independence,Measures of association (e.g., Cramér's V – optional)	Visualizing Multivariate Relationships- Pair plots / scatterplot matrix (e.g., Seaborn pairplot), Heatmaps of correlation matrices, Facet plots (e.g., Seaborn FacetGrid)	Handling Numerical Variables-Binning/Bucketing **,**Log Transformation
SO-7	Visualizing errors – density and contour plots	Transformations for Skewed Data-Log transformation, Square root transformation, Reciprocal transformation, Box-Cox / Yeo-Johnson transformations	Visualizations- Grouped bar plots, Heatmaps of contingency tables	Colored scatter plots with hue (third variable),Bubble plots (fourth variable as size),3D scatter plots (e.g., Plotly, Matplotlib),Parallel coordinates plots (for high-dimensional visualization),Violin or box plots with multiple categories, Radar/spider charts	Date and Time Features- Extracting features: year, month, day, weekday, hour, etc.Time since event, duration features
SO-8	Histograms – legends – colors – subplots	Binning/Bucketing- Equal-width binning,Equal-frequency (quantile) binning	Categorical vs Numerical-**Group-wise summaries,**Using group by, p**ivot_table**	Correlation and Covariance Matrix-Interpreting a correlation matrix,Detecting clusters of correlated variablesVisual tools: heatmaps, cluster maps.	Text Data Features

SO 9-10	**Practice 2: Implementation of Plots ,Histograms - legends – colors – subplots**	**Practice 5:Implementation of Histograms,Box Plot,Density Plot,Distribution Analysis and Transformations for skewed data**	**Practice 8:Implementation of Grouped bar plots, Heatmaps of contingency tables**	**Practice 11:Implementation of Colored scatter plots with hue,3D scatter plots**	**Practice 14: Implementation of Handling Numerical Values,Date and Time features,Text data features.**
SO-11	Text and annotation – customization	Analysis Based on Variable Type-Categorical Variables-Frequency Counts, Value counts and proportions, Cardinality (number of unique categories)	Statistical Tests, T-test, ANOVA Mann-Whitney U, Kruskal-Wallis (non-parametric)	Categorical & Numerical Data Interactions, Using color, shape, or facetting to layer categories in plots, Exploring interactions (e.g., impact of one categorical variable on numerical relationships),Pivot tables across two categorical variables	Scaling and Normalization-Min-Max Scaling,Standardization (Z-score),Robust Scaling
SO-12	Three dimensional plotting	Visualizations- Bar plot, Pie chart, Count plot,	Visualizations- Box plots, violin plots, strip/swarm plots	Dimensionality Reduction (Overview), PCA (Principal Component Analysis), Concept and intuition, Scree plot and explained variance	Outlier Handling
SO-13	Geographic Data with Basemap	Outlier Detection- IQR method (Tukey's rule), Z-score method, Visual methods (box plot, histogram)	Bar plots with error bars	Feature Clustering and Pattern Discovery (Optional/Advanced), Clustering variables (not observations), Using dendrograms and hierarchical clustering for feature similarity, Applications in feature reduction and selection	Winsorizing, Clipping, Imputing or removing outliers,
SO 14-15	**Practice 3:Implementation of Three dimensional plotting**	**Practice 6:Implementation of Bar Plot,Pie Chart,Count Plotand Detecting Outliers**	**Practice 9:Implementation of Box plots, violin plots, strip/swarm plots**	**Practice 12:Implementation of PCA and Clustering**	**Practice 15:Handling outliers**

Assessment											
Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10 %)		CLA – 2 (10 %)		CLA – 3 (20 %)		CLA – 4 (10 %)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	15%	15%	15%	15%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	15%	15%	15%	15%	10%	10%	10%	10%
6	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Resources			
1	John W. Tukey, "Exploratory Data Analysis", Addison-Wesley PublishingCompany, 2022. (Reprint 12th Edition)	2	Andrew Gelman and Jennifer Hill, "Exploratory Data Analysis Using Regression and Multilevel/Hierarchical Models", Cambridge University Press,2017.
3	Wendy L. Martinez, Angel R. Martinez, Jeffrey Solka, "Exploratory Data Analysis with MATLAB", CRC Press, 2017		

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

Code	PAD25D09J	Title	Quantum Machine Learning	Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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

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

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethical Practices & Social	Individual & Team Work	Communication	Project Management & Finance	Life Long Learning
CO-1	Acquire the basics of procedures for the Machine Learning algorithms	✓				*5*	*85*	*75*	*1*	-	-	*2*	-	*2*	-	*2*	*3*	-	-	*2*
CO-2	Apply appropriate data sets to the Machine Learning algorithms	✓	✓	✓		*4*	*85*	*75*	*3*	-	*2*	*3*	*2*	-	-	*3*	*3*	-	*2*	*2*
CO-3	Use Machine Learning algorithms to solve real-world problems.		✓			*6*	*85*	*75*	*3*	*3*	-	*3*	*2*	*2*	-	*3*	*3*	-	-	*3*
CO-4	To gain knowledge of Outline predictions using machine learning algorithms.	✓	✓	✓	✓	*3*	*85*	*75*	*3*	*1*	*3*	*3*	*2*	-	-	*3*	*3*	-	*3*	*3*
CO-5	To gain knowledge quantum computing techniques.	✓	✓			*2*	*85*	*75*	*3*	*2*	*2*	*3*	*2*	*3*	-	*3*	*3*	-	*3*	*3*

Title & Session Outcomes	Fundamentals of Quantum Computing	Operators and Algorithms in Quantum Computing	Quantum Algorithms and Fourier Techniques	Quantum Machine Learning and Data Analysis	Quantum Optimization and Adiabatic Algorithms
Duration (hour)	**15**	**15**	**15**	**15**	**15**
SO-1	Introduction to Quantum Computing Quantum Uncertainty	Diagonal Representation of an Operator, Normal Operators	Grover's Algorithm, Quantum Fourier Transform and Related Algorithms	Quantum Linear Regression	Quantum Variational Optimization and Adiabatic Methods
SO-2	Superposition, Entanglement Quantum bits (Qubits),	Unitary Operator, Commutator and Anti-commutator Operators	Fourier Series, Fourier Transform	Swap Test Implementation Quantum Euclidean Distance Calculation	Isling Model and Its Hamiltonian

SO-3	Multiple Qubits Bell State	Postulates of Quantum Mechanics Hamiltonian Simulation and Trotterization	Kronecker Delta Function Quantum Fourier Transform	Quantum Euclidean Distance Quantum K-Means Clustering	VQE Algorithm Implementation of the VQE Algorithm
SO 4-5	**Practice 1: Introduction to Qiskit with some execises**	**Practice 4: Python basics and Project preparation phase 1 (Analysis of problem statement related to quantum computing**	**Practice 7: Implementation of QSVM and Project preparation phase 3(Implementation of quantum problem statement in Qiskit or Pennylane)**	**Practice 10: Implementation of Quantum K Nearest Neighbour**	**Practice 13: Implementation of Quantum Neural Networks**
SO-6	Dirac Notation, Single-Qubit Gates, Multiple-Qubit Gates	Overview of Qiskit / Cirq / PennyLane	Hadamard Transform as a Fourier Transform	Quantum Support Vector Machines	Quantum Max-Cut Graph Clustering Quantum Adiabatic Theorem
SO-8	Bell States with Quantum Gates	Simulation in Cirq with a Hadamard Gate	Introduction to Quantum Machine Learning	Quantum Principal Component Analysis	Quantum Approximate Optimization Algorithm
SO 9-10	**Practice 2: Develop circuit composer in Qiskit lab**	**Practice 5: Implement single and multiple qubit gates using python**	**Practice 8: Implementation of QML algorithm**	**Practice 11: Implementation of different QML models**	**Practice 14: Implementation of QCNN in healthcare applications**
SO-11	Quantum Teleportation	Quantum Random Number Generator	Advantages of Quantum Machine Learning	Introduction to Quantum Deep Learning,	Introduction to QAOA
SO-12	Quantum Interference	Bell's Inequality Test Simons Algorithm	HHL Algorithm	Merits and demerits of Quantum Deep Learning	Implementation of QAOA
SO-13	Qubits states	Bell's Inequality Test Simons Algorithm-example	HHL Algorithm-example	Hybrid Quantum-Classical Neural Networks	Quantum Random Walk
SO 14-15	**Practice 3: Demonstrate Quantum gates using Qiskit**	**Practice 6: Project preparation phase 2 (Design of the project based on problem statement using Qiskit or Pennylane)**	**Practice 9: Implementation of Quantum classifiers**	**Practice 12: Project presentation phase 4 demo (use case developed) and thesis preparation**	**Practice 15: Implementation of Micro project using QA**

Assessment											
Level of Thinking		Continuous Learning Assessment (CLA) (50 % weightage)								Final Exam (50% Weightage)	
		CLA – 1 (10 %)		CLA – 2 (10 %)		CLA – 3 (20 %)		CLA – 4 (10 %)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
1	Remember	20%	20%	15%	15%	15%	15%	20%	20%	20%	20%
2	Understand										
3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4	Analyze										
5	Evaluate	10%	10%	15%	15%	15%	15%	10%	10%	10%	10%
6	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Resources			
1.	Maria Schuld and Francesco Petruccione, Supervised Learning with Quantum Computers, 1st Edition, Springer, 2018.	2.	Peter Wittek, Quantum Machine Learning: What Quantum Computing Means to Data Mining, 1st Edition, Academic Press, 2014.
3.	Vedran Dunjko and Hans J. Briegel, Machine Learning & Artificial Intelligence in the Quantum Domain, 1st Edition, Springer, 2023.	4.	https://qiskit.org/learn/intro-qml/, Introduction to Quantum Machine Learning with Qiskit – official IBM Qiskit tutorial on QML concepts and implementations.
5.	Kristen L. Pudenz and Daniel Lidar, Quantum Machine Learning: An Applied Approach, 1st Edition, Springer, 2023.	6.	https://quantumai.google/cirq/experiments/qml/, Google's Cirq QML Experiments – examples and explanations of machine learning algorithms using Cirq.

Designers					
Professional Experts		Higher Institution Experts		Internal Experts	
1	Dr. Gangadharan G.R,Professor,National Institute of Technology, Tiruchirappalli- 620015	1	Mr. Harishankher Selvaraj, Talent Lead and Head of Placements,GUVI Geek Networks Pvt Ltd	1	Dr. M. John Britto, SRMIST, KTR
				2	Dr.E.Srimathi. SRMIST, RMP

Code	PAD25G03T	Title	Digital Marketing Analytics	Category	G	Generic Elective Course	L	T	P	C
							2	0	0	2

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

Rationale (CR)	*The purpose of learning this course is to:*
CR-1	Understand the digital marketing analytics on the data captured
CR-2	Learn tools for performing different digital analytics on the digital marketing data.
CR-3	Knowing the impact of digital influence and listening
CR-4	Conducting research on the digital marketing data
CR-5	Identifying strategies for Mobile analytics and Business Intelligence

Outcomes (CO)	*At the end of this course, learners will be able to:*	Depth				Attainment			Program Outcomes (PO)											
		1	2	3	4	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Conceive	Design	Implement	Operate	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Problem Solving	Design & development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment &	Ethical Practices & Social	Individual & Team Work	Communication	Project Management &	Life Long Learning
CO-1	Understand the digital media marketing and the need for analytics on the data captured	✓				2	85	80	3	2	2	-	2	2	-	-	-	-	-	-
CO-2	Choose the appropriate tools for performing different digital analytics on the digital marketing data.	✓	✓	✓		3	85	80	3	3	-	2	-	2	2	-	-	-	-	1
CO-3	Analyze and appraise the outcomes of digital influence and listening		✓			3	85	80	3	3	-	2	-	2	2	-	2	-	-	1
CO-4	Formulate a research plan and perform search analysis on the digital marketing data	✓	✓	✓	✓	3	85	80	3	3	2	2	-	2	2	-	2	-	-	2
CO-5	Summarize the strategies for Mobile analytics and Business Intelligence	✓	✓			3	85	80	3	3	2	2	1	2	3	-	2	-	-	2

Title & Session Outcomes	Introduction	Digital Analytics	Digital Influence	Research Life Cycle	Return on Investment (ROI)
Duration (hour)	12	12	12	12	12
SO-1	Digital media and analytics	Tools for digital analytics	Digital influence and listening	Research plan and Search Analysis	ROI, Mobile Analytics and Business Intelligence
SO-2	Digital media types	Social Media Listening Tools	Reality of Digital Influence	Launching new product	Return on Investment (ROI)
SO-3	Owned social metrics	Evolution of Social Media Listening Tools	Media List - Klout, PeerIndex Online Versus Offline Influence	Product life cycle	Return on Engagement, Influence, Experience, Tracking ROI
SO-4	Earned social metrics	Social analytics life cycle Social media monitoring software	Using the Influencer List Developing Social Media Listening Program	Introduction Phase Growth Phase	Understanding measurement fundamentals Measurement reporting cadence

SO-5	Paid searches	Sysomos Radian6 Visible Technologies, Zoho social and others	Using Listening Data for Program Planning Implementing Listening Program	Maturity Phase Formulating research plan	Mobile Analytics Mobile market landscape
SO-6	Organic Searches	Search Analytics Tools Basics of search	Conversation Audit Online Influencers	Developing source list Research methods	Mobile marketing measurement
SO-7	Aligning Digital and Traditional Analytics	Search analytics use cases Search data, Google trends YouTube trends	Conducting Social brand benchmarking Use of Online data for crisis anticipation	Constructing reports Delivering reports	Marketing activities Audience/visitor metric
SO-8	Identifying social media listening tools	Google Ad words , Yahoo clues Collecting insights through search data Audience Analysis Tools	Identifying known issues	Report use cases	Mobile app performance
SO-9	Social media listening tools - Examples	Audience Analysis Use Cases Audience analysis tool types Audience analysis Techniques - Event Triggers	Crisis day monitoring and ongoing reporting	Building central repository of information	Social CRM Social CRM initiative
SO-10	Understanding social media engagement software	Content Audits-Optimizing Content Distribution	Corrections after crisis	Search analytics for digital strategy	Future of Digital Data
SO-11	Social media engagement software - Examples	Analyzing Content Consumption. Engagement Analysis Tools	Improving customer service	Search analytics for content strategy and planning	Business Intelligence
SO-12	social media engagement software - Examples	Social Media Engagement Software (SMES), using SMES, study of different SMES in the market.	Social customer service conflict	Search analytics for paid advertising	Recent Use cases of BI

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

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

Resources			
1.	Chuck Hemann and Ken Burbary, "Digital Marketing Analytics: Making Sense of Con Data in a Digital World", Que Publishing, 1 edition, ISBN-13: 978-0789750303, 2013.	2.	Simon Kingsnorth, "Digital Marketing Strategy: An Integrated Approach to Online Mark Kogan Page Publisher, First edition, ISBN-13: 978-0749474706, 2016.
3.	Dave Chaffey, Fiona Ellis-Chadwick, "Digital Marketing – Strategy, Implementation Practice", Pearson Education, Sixth edition, ISBN-13: 978-1292077611, 2016.	4.	Eric Enge, Andy Crestodina, Larry Kim, Steve Rayson and Chad White, "How thTurn Marketing Analytics Into Effective Marketing Strategies", Alexa, An Amazon Com https://blog.alexa.com/wp-content/uploads/2016/12/How-to-Pros-Turn-MarketingAnal into-Effective-Marketing-Strategies-ebook.pdf

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

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

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

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

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

Title & Session Outcomes	Blockchain Introduction	Database Vs. Blockchain Architecture	The Structure of Blockchain	Introduction to Crypto currency	Ethereum
Duration (hour)	06	06	06	06	06
SO-1	Introduction to Blockchain Technology	Blockchain Architecture	Structural unit of the Blockchain	Introduction to Cryptocurrency	Overview of Ethereum
SO-2	History of Blockchain	Classification of Blockchain	Pool of transactions	Public key cryptography	Need for Ethereum
SO-3	Need for Block chain	Characteristics of Blockchain	Transaction verification	Cryptographic Hash functions and its types	Purpose of Ethereum
SO-4	Basic features of Blockchain	Public and Private Blockchain	Broadcasting the transaction	Introduction to Bitcoin	Bitcoin vs Ethereum

SO-5	Working of Blockchain	Consortium and hybrid Blockchain	Consensus Mechanisms	Mining	Smart contracts in Ethereum
SO-6	Blockchain applications and challenges	Centralized Vs Decentralized system	Block confirmation and Ledger maintenance	Purpose and process of mining	Advantages and disadvantages of Ethereum

Assessment

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

Strategies

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

Resources

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

Designers

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

Code	PAD25P01L	Course Name	Internship	Course Category	P	Project Work, Internship In Industry / Higher Technical Institutions	L	T	P	C
							0	0	0	2

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

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

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

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

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

SEMESTER – IV

Course Code	PAD25P02L	Course Name	Project Work	Course Category	P	Project Work, Internship In Industry / Higher Technical Institutions	L	T	P	C
							0	0	20	10

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

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

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

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

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