RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

Rathinam Tech Zone, Eachanari, Coimbatore – 641021.

DEPARTMENT OF INFORMATION TECHNOLOGY

Syllabus for

M.Sc.Data Science and Business Analysis

(I-IV Semester)

2024 – 2026 Batch onwards

Vision and Mission of the Institution

Vision

To emerge as a world-renowned Institution that is integrated with industry to impart Knowledge, Skills, Research Culture and Values in youngsterswhocanacceleratethe overall development of India

Mission

To provide quality education at affordable cost, build academic and research excellence, maintain eco-friendly and robust infrastructure, and to create a team of well qualified faculty who can build global competency and employability among the youth of India.

Motto

Transform the youth into National Asset

Vision and Mission of the Department

Vision

To become a globally recognized deparment which is deeply connected with tech industry, fostering, transfer of knowledge and skills, instilling a research culture and values in aspiring computer scientists, empowering them to drive India's holistic technological advancement.

Mission

To import quality based education by enhancing the talent, innovative idea, and problem solving skill and to promote the research project by establishing industrial linkage and entrepreneurial setup.

Motto

Industry – Ready Education

Program Educational Objectives (PEO)

PEO1	Graduates of this programme will establish as effective professionals by learning technical skills in Business Analytics field and can pursue higher education by accruing knowledge and research.
PEO2	To impart sound theoretical foundation and In-depth practical knowledge to analyse the key business processes that drive the value chain of an organization throughout the entire product life cycle.
PEO3	Implement a classroom + practical oriented curriculum that helps students understand the Business Analytics Techniques and associated advanced techniques. To understand and analyse models, tools and techniques for enforcement of business analyst to different business industries.
PEO4	Provide solutions, assessments and validation to a broad range of situations by eliciting, planning, monitoring and analysing enterprise requirements.
PEO5	Provide a platform for students to understand various Business Analytics techniques of data preprocessing, storing, descriptive and predictive analytics.
PEO6	Prepare data for statistical analysis, perform basic exploratory and descriptive analysis, and apply statistical techniques to analyze data
PEO7	To learn and explore how visualization makes decision makers to understand the business in quick and taking rightful decisions.

Mapping of Institute's Mission to PEO

Institute's Mission	PEO's
To provide quality education at affordable cost, build academic and research excellence maintain eco-friendly and robust infrastructure, and	PEO1, PEO2
To create a team of well qualified faculty who can build global competency and employability among the youth of India.	PEO2, PEO3

Mapping of Department Mission to PEO

Department Mission	PEO's
Develop and deploy advanced data analytics tools to analyze large volumes of data from various sources, providing a comprehensive view of operations, trends, and potential risks.	PEO2, PEO3
Utilize predictive analytics and machine learning to forecast future trends, enabling proactive decision-making.	PEO3,PEO5
Provide analytic support to decision-makers, helping to interpret complex data and translate it into actionable strategies.	PEO5, PEO6,PEO7
Monitor and analyze financial data to ensure budget adherence and optimize cost-efficiency across projects.	PEO6, PEO7
Facilitate data-driven discussions in stakeholder meetings to aid in understanding and decision-making.	PEO6. PEO7

Program Outcomes (PO):

PO1	**:**	To a given scenario, students will be able to analyze the problem, design strategies and technical requirement to solve them with the meaningful insights for business development.
PO2	**:**	Student will be able to understand the suitable statistical technique for algorithmic design of the given problem statement
PO3	**:**	Students will be able to apply clean the data and pre-process them to get ready for the model building and implement the model in the system for required decision making process.
PO4	**:**	Students will be able to apply their knowledge of machine learning for the better built model with bringing up of meaningful insights to the decision makers.
PO5	**:**	Students will be able to develop new or improved innovative business processes from gap analysis through process design in support of a company's strategic objectives in a socially responsible manner.
PO6	**:**	Students will be able to Learn and identify business opportunities and design solutions and they will be able to discover how to optimize project investments
PO7	**:**	Students will be able to apply descriptive, predictive and prescriptive analytics to business modelling and decision-making

Program Specific Outcomes (PSO):

PSO1	**:**	Able to apply advanced analytical techniques, including statistical analysis, machine learning, and data mining, to interpret complex datasets and solve real-world problems.
PSO2	**:**	Engage in ongoing learning to keep up with the rapidly evolving fields of data science and business analytics, adapting to new tools, technologies, and methodologies.
PSO3	**:**	Demonstrate the ability to innovate with analytics techniques and approaches to solve new, emerging, or complex business problems.

Correlation between the PO/PSO and the PEOs

Program Outcomes		PEO 1	PEO 2	PEO 3
PO1	:	3	1	3
PO2	:	3	2	3
PO3	:	1	2	3
PO4	:	3	1	3
PO5	:	3	3	2
PO6	:	2	3	3
PO7	:	2	3	1
PO8	:	3	2	1
PO 9	:	2	2	3
PO 10	:	3	2	1
PO 11	:	2	1	1
PO 12	:	3	2	2
PSO1	:	2	3	1
PSO2	:	3	2	2
PSO3	:	2	3	3
PSO4	:	3	2	2
PSO5		2	3	3

3 – Strong correlation; 2-moderate correlation; 1-Less correlation; Blank-no correlation

Components considered for Course Delivery is listed below:

a. Class room Lecture
b. Laboratory class and demo
c. Assignments
d. Mini Project
e. Project
f. Online Course
g. External Participation
h. Seminar
i. Internship

Mapping of POs with Course Delivery:

Program Outcome	Course Delivery								
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**
PO1	3	3	1	1	2	1	3	3	1
PO2	3	3	2	3	3	1	1	2	3
PO3	3	3	1	3	1	1	1	2	3
PO4	2	3	2	3	3	1	1	3	1
PO5	3	2	1	3	1	3	3	3	3
PO6	2	3	1	3	3	1	2	3	3
PO7	2	3	1	3	1	1	2	3	3
PO8	2	2	1	2	3	3	2	3	3
PO9	1	1	2	3	3	3	2	3	3
PO10	2	1	2	3	2	2	2	2	2
PO11	1	1	2	2	2	3	3	3	3
PO12	1	2	3	2	2	2	3	3	3
PSO1	2	3	1	3	2	3	1	3	3
PSO2	3	2	2	3	3	2	2	3	2
PSO3	2	3	3	2	2	3	3	2	3
PSO4	3	2	2	1	3	2	2	1	2

3 – Strong correlation; 2-moderate correlation; 1-Less correlation; Blank-no correlation

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

M.Sc Information Technology DEGREE PROGRAMME

*M.Sc. Data Science and Business Analysis*Regulation – 2024

(For students admitted from 2024-2025 and onwards)

Sem	Part	Type	Sub Code	Subject	Credit	Per Week	CIA	ESE	Total
1.1	3	C1		Core-I-Database Management Systems	4	5	50	50	100
1.2	3	C2		Core-II-Business Intelligence	4	5	50	50	100
1.3	3	C3		Core-III Business Statistics and Probability	4	5	50	50	100
1.4	3	C4		Core-IV Data Analytics using Excel	4	5	50	50	100
1.5	3	SEC 1		Skill - I (Practical / Training) R Programming Language	4	5	50	50	100
1.6	3	ELE 1		Elective-1 Operations Research / Business Economics	4	5	50	50	100
2.1	3	C5		Core V-Linux Administration	4	5	50	50	100
2.2	3	C6		Core VI- Business Ethics – I	4	5	50	50	100
2.3	3	C7		Core VII- Sentiment Analytics	4	5	50	50	100
2.4	3	C8		Core VIII- Market Research and Analytics	4	5	50	50	100
2.5	3	SEC 2		Skill - II (Practical / Training) Python Programming	4	5	50	50	100
2.6	3	ELE 2		Elective-2 Big Data Analytics/Data Visualization	4	5	50	50	100
3.1	3	C9		Core-IX-Advanced Machine Learning	4	6	50	50	100
3.2	3	C10		Core-X- Business Ethics – II	4	6	50	50	100
3.3	3	C11		Core – XI- Financial Econometrics	4	6	50	50	100
3.4	3	SEC 3		Skill - III (Practical / Training) Exploratory Data Analysis	4	6	50	50	100
3.5	3	ELE 4		Elective-3- Advanced Big Data Analytics/ Social Media Analytics	4	6	50	50	100
3.6	3	ITR		Internship / Industrial Training (Summer vacation at the end of II semester activity)	2		50	0	50
4.1	3	C12		Core-XII- Artificial Neural Networks and Deep Learning	4	6	50	50	100
4.2	3	SEC 4		Skill - IV (Practical / Training) Data Analytics using SQL	4	6	50	50	100
4.3	3	ELE 5		Elective-4- Natural Language Processing / Reinforcement learning	4	6	50	50	100
4.4	3	PRJ		Project with Viva-Voce	8	12	100	100	200
TOTAL					**90**	**120**	**1150**	**1100**	

Semester-I

Semester 1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Database Management System	4	5	-	-	**Core Theory**

Course Introduction

This course enables the student skills and knowledge to tackle complex database challenges, optimize database performance, and design efficient database solutions using advanced DBMS and SQL techniques.

Course Outcomes	On completion of this course, students will
CO 1:	To provide a basic introduction about DBMS. To Understand the DBMS.
CO 2:	To Provide an overview of ER Diagrams and the Relational model. To Understand key constraints in DBMS.
CO 3:	Understand the variousNormalizationand implementations.
CO 4:	Explain DB applications, embedded SQL and overview of storage and indexing.
CO 5:	Understand the concept of ACID properties and Physical Database and Tuning.

Unit I:	**Overview of Database Systems**	**[12 Periods]**

Introduction - Overview of Database Management - What is Database System - History of DBMS - Managing Structured Data - File Systems vs. DBMS - Basics of DBMS – DBMS Architecture -Overview of Relational Model - Database languages – Queries - Transaction Management - Structure & Design of a DBMS - Object Relational and semi-structured DB - Users & Administrators- Client/Server Architecture - Case Study.

Unit II:	**Database Design Models**	**[12 Periods]**

The Relational Model - Relational Calculus - Introduction to Database Design - ER Diagrams – Entities, Attributes and Relationships. Design with ER Model - Conceptual Design for Large Enterprises - UML - Case Study.
Relational Model: The Relational Model Integrity Constraints - Key Constraints – Primary Key Constraints - Foreign Key Constraints - General Constraints - Relational Algebra- Selection and Projection- Set Operation - Relational Calculus - Tuple Relational Calculus- Domain Relational Calculus - Case Study.

Unit III:	**Schema Refinement and Normal Forms**	**[12 Periods]**

DB Design - Normal forms and Atomic Domain- Functional Dependencies and Decomposition - Database Design Process
SQL: SQL queries – Union – Intersect - and Except - Nested Queries – Aggregate Queries- Null values- Joins – Views - Stored Procedures - User defined Functions – Triggers – Transactions - Case Study

Unit IV:	**DB Application Development**	**[12 Periods]**

DB Access from applications – embedded SQL, Cursors, and Dynamic SQL. Introduction to JDBC & SQL/J - Stored Procedures.
Overview of Storage and Indexing: Data on external storage - File Organizations and Indexing - Index Data Structures - Comparison of File Organizations - Indexes and Performance Tuning.
Overview of Query Evaluation: System Catalog - Operator Evaluation - Algorithms for relational operations. Introduction to Query Optimization – Alternative Plans - Case Study.

Unit V:	**Transaction Management**	**[12 Periods]**

Introduction to Transaction - ACID Properties Serializability- Transactions and Schedules - Concurrent Execution of Transactions - Lock-based concurrency control - Transaction support in SQL commit - rollback – save point - Introduction to Crash Recovery. Physical Database Design and Tuning: Introduction to Physical Database design - Index Selection - Clustering. Overview of Database Tuning - Choices in tuning queries and Views - Case Study

Text Books:

1. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke 3rd Edition, McGraw Hill 2003.
2. Database System Concepts, AbrahamSilberschatz, Henry F.Korth and S.Sudarshan, 5th Edition, McGraw Hill 2006.

Reference Books:

1. Fundamentals of Database Systems, Elmasri and Navathe, 5thEdition, Addison- Wesley, 2007.
2. An Introduction to Database Systems, C.J. Date, A. Kannan, S. Swamynatham, 8th Edition, Pearson education, 2006.

Web Resources:

1. https://www.javatpoint.com/dbms-tutorial
2. https://www.appdynamics.com/topics/database-management-systems

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	2	1	1	1	2	1	1	1
CO2	3	3	3	1	1	3	2	1	2	1	1	1
CO3	3	3	3	1	2	2	1	3	2	1	3	1
CO4	2	1	3	2	1	3	2	3	1	2	2	2
CO5	3	1	3	1	2	2	2	3	2	2	2	1

Semester 1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Database Management System Lab	**4**	**0**	**0**	**5**	**Practical**

List of Practical Programs:

1. Practical Based on Data Manipulation.
   • Adding data with Insert, • Modify data with Update, • Deleting records with Delete
2. Practical Based on Implementing the Constraints.
   • NULL and NOT NULL, • Primary Key and Foreign Key Constraint • Unique, Check and Default Constraint
3. Practical for Retrieving Data Using following clauses.
   • Simple select clause, • Accessing specific data with Where, Ordered By, Distinct and Group By
4. Practical Based on Aggregate Functions.
   • AVG, • COUNT, • MAX, • MIN, • SUM, • CUBE
5. Practical Based on implementing all String functions.
6. Practical Based on implementing Date and Time Functions.
7. Practical Based on implementing use of union, intersection, set difference.
8. Implement Nested Queries & JOIN operation.
9. Practical Based on performing different operations on a view.
10. Practical Based on implementing use of triggers, cursors & procedures.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	2	2	3	1	2	3	2	1	2	1	1	1
CO3	3	3	2	1	1	2	1	3	2	1	2	1
CO4	1	1	3	3	1	2	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Semester 1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Business Intelligence	**4**	**5**	**-**	**-**	**Theory**

Course Introduction

This course enables the basic managerial functions of planning, organizing, staffing, directing, and controlling resources to accomplish organizational goals.

Course Focus on:Skill Development/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	Developed working knowledge of fundamental terminology and frameworks in the four functions of management: Planning, Organizing, Leading and Controlling;
CO 2:	Analyze organizational case situations in each of the four functions of management
CO 3:	Identify and apply appropriate management techniques for managing contemporary organizations; and
CO 4:	Understand the skills, abilities, and tools needed to obtain a job on a management track in an organization of their choice.
CO 5:	Proficiency in controlling the business operations

Unit I:	**Introduction to Management**	**[12 Periods]**

Defining Management, Concept of Management, Nature, Importance, Management Skills, Levels of Management, Role of managers, Characteristics and Quality Managers, Evolution of Management thought, Organization and the environmental factors.

Business ethics and Social Responsibility: Concept, Shift to Ethics, Tools for Ethics.

Unit II:	**Planning**	**[12 Periods]**

Nature and purpose of planning, Planning process, Types of plans, Process of planning, Barriers to Effective Planning, Objectives, Managing by objective (MBO) Strategies, Types of strategies, Policies, Decision Making, Types of decision, Decision Making Process, Rational Decision Making

Unit III:	**Organizing**	**[12 Periods]**

Nature and purpose of organizing, Organization structure, Formal and informal groups / organization, Line and Staff authority, Departmentation, Span of control, Centralization and Decentralization, Delegation of authority, Staffing, Selection and Recruitment, Orientation, Career Development, Career stages, Training, Performance Appraisal.

Unit IV:	**Directing**	**[12 Periods]**

Creativity and Innovation, Motivation and Satisfaction, Motivation Theories, Leadership Styles, Leadership theories, Communication, Barriers to effective communication, Organization Culture, Elements and types of culture, Managing cultural diversity.

Unit V:	**Controlling**	**[12 Periods]**

Process of controlling, Types of control, Methods: Pre-control, Concurrent Control, Post-control, Budgetary and non-budgetary control Q techniques, Managing Productivity, Cost Control, Purchase Control, Maintenance Control, Quality Control, Planning operations.

Text Books:

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.

Reference Books:

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.

Web Resources:

1 https://www.ibm.com/topics/business-intelligence
2 https://www.tableau.com/learn/articles/business-intelligence

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	2	1	1	1	2	1	1	1	2	3	1	3
CO2	3	3	3	1	1	3	2	1	2	1	1	1	3	2	2	3
CO3	3	3	1	1	2	2	1	2	2	1	2	1	2	3	3	2
CO4	1	1	3	3	1	3	2	3	1	2	2	2	3	2	2	1
CO5	3	1	3	1	3	2	2	3	1	2	2	1	1	2	3	2

Semester 1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Business Statistics and Probability	**4**	**5**	**-**	**0**	**Theory**

Course Introduction

This course enables the student to explore the foundational principles of statistics and data using statistical techniques. And also to statistical methods involved in hypothesis testing, ANOVA and its importance in business performance**.**

Course Focus on:Skill Development/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	To provide the importance of statistics in different research areas.
CO 2:	To provide the basic concepts of Statistics and its evolution.
CO 3:	Able to apply suitable statistical measures to describe and summarize the data
CO 4:	Able to apply t and f test for testing the statistical measures to know the significance.
CO 5:	Able to apply ANOVA for testing significance of arithmetic mean and regression coefficients.

Unit I:	**Descriptive Statistics**	**[12 Periods]**

Data and Data Sources, Types of Data, Measures of Central Tendency – Mean, median mode for raw and grouped data, measures of dispersion – Range, standard deviation, variance, coefficient of variation, mean deviation, mean absolute deviation, measures of symmetry: Skewness and Kurtosis.

Unit II:	**Elements of Probability and Sampling Distributions**	**[12 Periods]**

Experiments and events, Basic Relations of Probability, Conditional Probability, Joint Probability, conditional probability on discrete case and continuous case, computing expectations by conditioning, introduction to Bayes theorem, problems related to Bayes Theorem, Discrete Probability Distribution (Binomial and Poisson), Continuous Probability Distribution (Normal). Various types of Probability and Non-probability Sampling, Sampling distribution of important statistic.

Unit III:	**Hypothesis Testing**	**[12 Periods]**

Introduction to testing of hypothesis, Statistical assumptions for parametric test, Level of significance, confidence level, Type I Error, Type II error, Critical value, power of the test, sampling distribution, small sample test – t test for one sample and two sample mean, F test to test the equality of two sample variance, Large Sample test – Z test for equality of single mean with population mean, equality of two sample mean, equality of single proportion with population proportion and equality of two sample proportions..

Unit IV:	**Correlation and Regression Analysis**	**[12 Periods]**

Correlation analysis, properties of correlation coefficients, significance of single correlation coefficient, significance of multiple correlation coefficients, concepts of multiple correlation and partial correlation, Introduction to linear model, concepts of factor, effect, residuals, dependency, independency, assumptions of linear model, difference between linear and nonlinear model, estimation of parameters of regression coefficients for simple and multiple linear regression model, properties of regression coefficients, significance of regression coefficients, diagnostic testing: auto correlation, multi collinearity, heteroscedasticity, normality, significance of estimated parameters in multiple linear regression.

Unit V:	**Linear Model**	**[12 Periods]**

Introduction to general linear model, assumptions of ANOVA, factors and levels in ANOVA, layout of one way ANOVA, skeleton of one way ANOVA, multiple comparison of sample means, one way analysis of variance with unequal sample sizes, two factor analysis of variance – introduction and parameter estimation, two way analysis of variance with interaction, Post ANOVA: testing of hypothesis for significance of mean using Fishers Least Significance Difference test (lsd), Tukeys test, Dunnet test, Duncan Multiple Range test.

Text Books:

1. Fundamentals of mathematical statistics – SC Gupta and VK Kapoor, Sultan Chand & Sons Publication, New Delhi

Reference Books:

1. Introduction to probability Models, Ninth Edition – Sheldon M. Ross, Elsevier Publication, Academic Press, UK
2. Introduction to Probability and Statistics for Engineers and Scientists, Third Edition - Sheldon M. Ross, Elsevier Publication, Academic Press, UK

Web Resources:

1. https://openstax.org/books/introductory-business-statistics-2e/pages/1-1-definitions-of-statistics-probability-and-key-terms
2. https://study.com/academy/lesson/application-of-statistics-in-business.html

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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CO3	3	3	2	1	2	2	1	3	2	1	2	1
CO4	1	1	3	3	1	3	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Semester 1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Analytics using Excel	**4**	**5**	**-**	**-**	**Theory**

Course Introduction

The course tailored for those who possess work with Data Entry and various Functions and Formulae of Excel Workbook. This Module enables students to do Filtering and Conditional Formatting of data, work on various analysis techniques.

Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will
CO 1:	Get the knowledge of create flexible data aggregations using pivot tables.
CO 2:	Get the Knowledge how to represent the data visually using pivot charts.
CO 3:	Ability to apply Data Analysis Tools.
CO 4:	Able to understand project work that ANOVA.
CO 5:	Preparation to Simulations, Decision Trees and Forecasting

Unit I:	**Functions and Formulas:**	**[12 Periods]**

Understanding Screen Layout - Creating Auto List & Custom List - Entering, Selecting and Editing Data - Understanding References (Relative, Absolute & Mixed) - Working on Various Functions & Formulas - Common Basic Functions - Logical Functions - Text Functions - Date & Time Functions - Lookup & Reference Functions - Mathematical Functions - Conditional Functions - Referring Data from Different Worksheet & Workbook Formula–Auditing -Various Calculation Techniques - Working on Ranges.

Unit II:	**Presentation of Data**	**[12 Periods]**

Sorting Techniques - Various Data Filtering Techniques - Formatting Techniques - Conditional Formatting - Number Formatting - Table Formatting - Protecting Sheets & Files - Understanding Various Excel Window Techniques - Viewing Excel Spreadsheet in various Layouts - Advanced Printing Techniques - Templates - Themes.

Unit III:	**Data Analysis Tools**	**[12 Periods]**

Data Consolidation - Text to Columns - Flash Fill - Remove Duplicates - Advanced Data Validation Techniques - What-if Analysis - Goal Seek - Data Table - Solver – Scenarios; Working with Tables - Creating Charts - Understanding Sparklines (Line, Column, Win/Loss) - Pivot Tables & Pivot Charts.

Unit IV:	**Data Analysis**	**[12 Periods]**

Data Analysis ToolPak – Loading and Activating, ANOVA, correlation, covariance, Descriptive Statistics, Exponential Smoothing, F-Test 2-sample for variances, Fourier Analysis, Histogram, Moving Average, Random Number Generation, Rank and Percentile, Regression, Sampling, t-test, z-test.

Unit V:	**Simulations**	[12 Periods]

Simulations, Decision Trees and Forecasting, when should we use simulation, simulation modeling cycle, Introduction to Monte Carlo Simulation, generating random values, discrete and continuous functions, Excel for simple simulation, Managerial applications of risk analysis, performing a simulation using @Risk, analyzing the simulation output, generating various plots. Simulation in forecasting, Advanced simulation techniques.

Text Books:

1. Excel 2016 Bible, John Walkenbach, Wiley, 1st Edition, 2015.
2. Excel Data Analysis - Modeling and Simulation, Hector Guerrero, Springer, 2010 Edition, 2014.
3. Excel Functions and Formulas, Bernd Held, Theodor Richardson, BPB Publications, 3rd Edition, 2017.

Reference Books:

1. Microsoft Excel 2013, Data Analysis and Business Modeling: Winston, PHI, 2014 Edition, 2014.
2. Excel Data Analysis for Dummies, Stephen L Nelson, E C Nelson, Wiley, 2nd Edition, 2014.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
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CO3	3	2	2	1	2	3	1	3	2	1	2	1	2	3	3	2
CO4	1	1	3	3	1	3	2	3	1	2	2	2	3	2	2	1
CO5	3	1	3	1	3	2	2	3	1	2	2	1	1	2	3	2

Semester 1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Data Analytics With Excel Lab	4	-	-	4	Practical
	List of Programs					

1. Printing worksheet: Select print area, see print preview, adjusting margin during print preview.
2. Page Formatting: Page layout — Orientation, size, margins: watermark. pagecolour. page borders; inserting headers and footer, inserting page numbers. date, path and filename.
3. Viewing: Easy view using freeze panes (freeze rows and columns), split windows, layout view (normal. page break and Print).
4. Saing and Sharing File: Embed, PDF. share workbooks through OneDrive. Online.
   Import and Export Data: Import Access Data. Microsoft Query.
   Import/Export Text Files. XML.
5. Protecting/Securing using file properties: Protect Workbook. Protect Sheet. Lock Cells. Read-only Workbook.
6. Template: Creating worksheet thorough template - Budget, Calendar, Holidays. Meal Planner, Invoice. Automated Invoice, Default Templates. Time Sheet. BMI calculator. Saving worksheet as template.
7. Calculations: lntering formula, editing formula, copying lbrmula. Cell references (absolute. relative and mixed). paste formula (using keyboard shortcut and fill handle).
8. Data Validation: Reject Invalid dates. Budget Limit. Prevent Duplicate Entries. Product Codes. Drop-down List. Dependent Drop-down Lists. Cm to inches. Kg to gm.

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	3	2	3	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	2	2	1	3	2	1	2	1
CO4	1	1	3	3	1	3	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Semester 1 **Skill - I**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	R- Programming	3	5	-	-	**Core Theory**

Course Introduction

R programming is to equip participants with the essential skills and knowledge needed to effectively use R for data analysis, statistical modelling, and visualization. Throughout the course, participants will gain proficiency in writing R code, understanding its syntax, and leveraging its extensive library of packages for various data manipulation tasks. By the end of the course, students should be able to independently manipulate data sets, conduct statistical analyses, create visualizations, and interpret results using R. This course aims to empower learners with practical R programming skills applicable across diverse domains such as finance, healthcare, marketing, and research, thereby enhancing their analytical capabilities and decision-making processes.

Course Focus on:**Skill Development**/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will
CO 1:	Know the Introduction andBasic Concepts of Economics
CO 2:	Understand the Demand Analysis and Forecasting
CO 3:	Understand the basics of Cost Concepts
CO 4:	Know the Risk Analysis and Decision Making
CO 5:	Know the Monetary and Fiscal Policy

Unit I:	**Introduction to R**	**[12 Periods]**

Introducing to R – R Data Structures – Help Functions in R – Vectors – Scalars – Declarations – Recycling – Common Vector Operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Element names.

Unit II:	**Matrices and operations**	**[12 Periods]**

Creating matrices – Matrix Operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns - Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.

Unit III:	**Data Frames**	**[12 Periods]**

Creating Data Frames – Matrix-like operations in frames – merging Data frames – Applying functions to Data Frames – Factors and Tables – Factors and levels – Common Functions used with factors – Working with tables – Other factors and table related functions – Control statements – Arithmetic and Boolean operators and values – Default Values for arguments – Returning Boolean Values – Functions are objects – Environment and scope issues – Writing Upstairs – Recursion – Replacement functions – Tools for Composing function code – Math and Simulation in R.

Unit IV:	**Classes and Objects**	**[12 Periods]**

S3 Classes – S4 Classes – Managing your objects – Input/output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving Graphs to files – Creating Three-Dimensional plots.

Unit V:	**Modelling in R**	**[12 Periods]**

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear Models – Time Series and Auto-Correlation – Clustering.

Text Books:

1. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011.
2. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.

Reference Books:

1. Mark Gardner, "Beginning R – The Statistical Programming Language", Wiley, 2013.
2. Robert Knell, "Introductory R: A Beginner‟s Guide to Data Visualisation, Statistical Analysis and programming in R", Amazon Digital South Asia Services Inc, 2013. Richard Cotton(2013). Learning R, O‟Reilly Media.
3. Garret Grolemund (2014). Hands-on Programming with R. O‟Reilly Media, Inc. 4 Roger D.Peng (2018). R Programming for Data Science. Lean Publishing.

Web Resources:

1 https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
2 https://onlinecourses.swayam2.ac.in/arp19_ap79/preview

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	1	1	1	2	1	1	1
CO2	3	3	2	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	2	2	1	3	2	1	2	1
CO4	1	1	3	3	1	3	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Semester 1 **Skill - I**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	R Programming Language Lab	4	-	-	4	Practical

Course Introduction

In these courses, student able to Install and configure R, set working directory, Packages and calling installed packages. Brief practices of R studio environment and functionalities of R studio

Course Focus on:Skill Development/ Entrepreneurship / Employability / **Research**

List of Programs

1. Implement basic R operations (data input, missing values, importing data into R using different formats : xlsx, CSV, Text files)
2. Use R as a calculator
3. Explore various functionalities of dataframes.
4. Create data set using data frames, list and tables.
5. Calculate the remainder after dividing 31079 into 170166719
6. Calculate the interest earned after 5 years on an investment of $2000,
7. Assuming an interest rate of 3% compounded annually.
8. Use R to calculate the area of a circle with radius 7 cm.
9. Do you think there is a difference between 48:14^2and 48:(14^2)?
10. Usingrep()and seq()as needed, create the vectors?

    00000111112222233333444444 and 12345123451234512345123451234512345

11. Create the vector

    ## [1]00011110001111000111100011110001111000111100011

    ## [34] 1 1

    and convert it to a factor. Identify the levels of the result, and then

    change the level labels to obtain the factor:

    ## [1] Male MaleMale Female FemaleFemaleFemale Male Male

    ## [10] Male Female FemaleFemaleFemale Male MaleMale Female

    ## [19] Female FemaleFemale Male MaleMale Female FemaleFemale

    ## [28] Female Male MaleMale Female FemaleFemaleFemale

    ## Levels: Male FemaleExplore various functionalities of plots

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	3	2	3	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	3	2	1	3	2	1	2	1
CO4	1	1	3	3	1	2	3	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Semester 1 **Elective - I**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Business Economics	3	5	-	-	**Core Theory**

Course Introduction

This course enables the student to explore the management with time tested tools and techniques of business economics to enable them to appreciate its relevance in decision-making. To explore the economics of information and network industries and to equip students with an understanding of how economics affect the business strategy of companies in these industries.

Course Focus on:Skill Development/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	Know the Introduction andBasic Concepts of Economics
CO 2:	Understand the Demand Analysis and Forecasting
CO 3:	Understant the basics of Cost Concepts
CO 4:	Know the Risk Analysis and Decision Making
CO 5:	Know the Monetary and Fiscal Policy

Unit I:	**Basic Concepts of Economics**	**[12 Periods]**

Introduction to Economics , Basic Economic Problem, Circular Flow of Economic Activity , Nature of the firm - rationale, objective of maximizing firm value as present value of all future profits, maximizing, satisficing, optimizing, principal agent problem, Accounting Profit and Economic Profit , Role of profit in Market System , Adam Smith and Invisible Hand.

Unit II:	**Demand Analysis and Forecasting**	**[12 Periods]**

Determinants of Market Demand at Firm and Industry level – Elasticity of Demand - Market Demand Equation – Use of Multiple Regression for estimating demand – Case study on estimating industry demand (formulating equation and solving with the aid of software expected)

Demand and Supply: Market Equilibrium – Pricing under perfect competition, monopolistic competition, Case study on pricing under monopolistic competition, Oligopoly - product differentiation and price discrimination; price- output decision in multi-plant and multi-product firms.

Unit III:	**Cost Concepts**	**[12 Periods]**

Cost Concept, Opportunity Cost, Marginal, Incremental and Sunk Costs, Cost Volume Profit Analysis, Breakeven Point, Case Study on marginal costs.

Unit IV:	**Risk Analysis and Decision Making**	**[12 Periods]**

Concept of risk, Expected value computation, Risk management through Insurance, diversification, Hedging, Decision Tree Analysis, CaseStudy on Decision tree technique.

Unit V:	**Monetary and Fiscal Policy**	**[12 Periods]**

Monetary and fiscal policy, Role of Fiscal and Monetary Policy, Money Markets, Concept of savings and investment, Business cycles , National income accounting concepts, Commercial banks and the central bank money and credit, Financial markets and asset prices

Text Books:

3. Managerial Economics, by Peterson, Lewis, Sudhir Jain, Pearson, Prentice Hall Indian Economy by Datt&Sundaram 61st Edition, S Chand
4. Managerial Economics by D. Salvatore, McGraw Hill, New Delhi.
5. Thomas Sowell, "Economics – A Common Sense Guide to the Economy", Basic Books Publishers, ISBN 978-0-465-05684-2.

Reference Books:

1. Managerial Economics by Varshney and Maheshwari, Sultan Chand and Sons, New Delhi.
6. Managerial Economics by Dr. D. M. Mithani, Himalaya Publishing House
7. Managerial Economics by Joel Dean Prentice Hall, USA.
8. Managerial Economics by H L Ahuja S Chand & Co. New Delhi

Web Resources:

3 https://www.toppr.com/guides/business-economics/introduction-to-business-economics/
4 https://study.com/academy/lesson/business-economics-definition-types-importance.html

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	1	1	1	2	1	1	1
CO2	3	3	2	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	2	2	1	3	2	1	2	1
CO4	1	1	3	3	1	3	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Semester- II

Semester II **Core - II**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Sentiment Analysis	4	4	-	-	**Core Theory**

Course Introduction

Sentiment Analytics is to provide students with the knowledge and skills necessary to effectively analyze and interpret sentiment data, utilizing advanced natural language processing techniques to extract meaningful insights from text-based sources for various applications in business, social media, and beyond.

Course Focus on:Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will
CO 1:	To understand representation and handling of opinions by people in different ways
CO 2:	To analyze different challenges in sentiment analysis
CO 3:	To understand aspect-oriented sentiment analysis classification
CO 4:	To analyze fake opinion detection and intention classification
CO 5:	To understand machine learning techniques for sentiment analysis at different levels

Unit I:	**Introduction to Sentiment Analysis**	**[12 Periods]**

Introduction: Sentiment Analysis Applications - Sentiment Analysis Research - Sentiment Analysis as Mini NLP. The Problem of Sentiment Analysis: Definition of Opinion - Definition of Opinion Summary - Affect, Emotion, and Mood - Different Types of Opinions - Author and Reader Standpoint. Document Sentiment Classification: Supervised Sentiment Classification - Unsupervised Sentiment Classification - Sentiment Rating Prediction - Cross-Domain Sentiment Classification - Cross-Language Sentiment Classification - Emotion Classification of Documents.

Unit II:	**Subjectivity Classification and Challenges**	**[12 Periods]**

Sentence Subjectivity and Sentiment Classification: Subjectivity - Sentence Subjectivity Classification - Sentence Sentiment Classification - Dealing with Conditional Sentences - Dealing with Sarcastic Sentences - Cross-Language Subjectivity and Sentiment Classification - Using Discourse Information for Sentiment Classification - Emotion Classification of Sentences.

Unit III:	**Aspect Oriented Classification**	**[12 Periods]**

Aspect Sentiment Classification: - Rules of Sentiment Composition - Negation and Sentiment - Modality and Sentiment - Coordinating Conjunction But - Sentiment Words in Non-opinion Contexts - Rule Representation - Word Sense Disambiguation and Co reference Resolution. Aspect and Entity Extraction: Frequency-Based Aspect Extraction - Exploiting Syntactic Relations - Using Supervised Learning - Mapping Implicit Aspects - Grouping Aspects into Categories - Exploiting Topic Models - Entity Extraction and Resolution - Opinion Holder and Time Extraction.

Unit IV:	**Sentiment Lexicon generation and Summarization**	**[12 Periods]**

Sentiment Lexicon Generation: Dictionary-Based Approach - Corpus-Based Approach - Desirable and Undesirable Facts. Analysis of Comparative Opinions: Problem Definition - Identify Comparative Sentences - Identifying the Preferred Entity Set - Special Types of Comparison - Entity and Aspect Extraction. Opinion Summarization and Search: Aspect-Based Opinion Summarization - Enhancements to Aspect-Based Summary - Contrastive View Summarization - Traditional Summarization - Summarization of Comparative Opinions - Opinion Search - Existing Opinion Retrieval Techniques. Mining Intentions: Problem of Intention Mining - Intention Classification - Fine-Grained Mining of Intentions.

Unit V:	**Identifying intention, fake and quality of opinion**	**[12 Periods]**

Detecting Fake or Deceptive Opinions: Different Types of Spam - Supervised Fake Review Detection - Supervised Yelp Data Experiment - Automated Discovery of Abnormal Patterns - ModelBasedBehavioral Analysis - Group Spam Detection - Identifying Reviewers with Multiple User ids - Exploiting Business in Reviews - Some Future Research Directions. Quality of Reviews: Quality Prediction as a Regression Problem - Other Methods - Some New Frontiers.

Text Books:

1 Bing Liu "Sentiment Analysis: Mining Opinions, Sentiments and Emotions, Cambridge University Press, 2015.

Reference Books:

1 Bing Liu "Sentiment Analysis and Opinion Mining, Morgan & Claypool Publishers, 2012.
2 Erik Cambria, Dipankar Das "A Practical Guide to Sentiment Analysis" Springer, 2017.

Web Resources:

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	2	1	1	1	1	1	1	3	3	3			1
CO2	3	1	1	3	2	3	1	3	3		3	2	
CO3	2	1	1	3	3	3	2	1	3	1	2	1	1
CO4	1	1	3	2	1	3	1	3	3	2		3	3
CO5	3	2	3	2	2	1	3	2		3	1		2

Semester II Core- II

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Sentiment Analytics Lab	**4**	**0**	**0**	**6**	**Practical**

List of Practical Programs:

Create algorithms of moderate complexity, and can implement them in at least two languages appropriate for data science work. Students can design more complex algorithms involving more complex data structures, and can implement their solutions in multiple languages.

List of Programs:

1.Write a program to Introduction to Sentiment Analysis with NLTK

2.Write a program to Text Pre-processing and Feature Extraction.

3. Write a program to Advanced Sentiment Analysis with Deep Learning

5. Write a program to Sentiment Analysis with Pre-trained Models

6.Write a program to Sentiment Analysis on Social Media Data.

7.Write a program to Sentiment Analysis Pipeline with Flask

8. Write the program to Text Preprocessing

9.Write the program to Visualization and Reporting

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	2	2	3	1	2	3	2	1	2	1	1	1
CO3	3	3	2	1	1	2	1	3	2	1	2	1
CO4	1	1	3	3	1	2	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Semester II **Core- II**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Marketing Research and Analytics	3	4	-	-	**Core Theory**

Course Introduction
To empower students with the necessary analytical skills and strategic insights to effectively analyze real-time data, enhancing their ability to make data-driven marketing decisions that propel business success.
Course Focus on:Skill Development/ **Entrepreneurship** / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	Analyze and interpret research data to identify market trends, customer behaviors, and competitive strategies.
CO 2:	Learn to segment markets and customize marketing messages based on detailed analytics and customer profiling.
CO 3:	Learn to measure and optimize online marketing efforts, enhancing digital presence and engagement.
CO 4:	Understand the ethical considerations in gathering, analyzing, and using marketing data, including privacy concerns and data protection regulations.
CO 5:	Apply knowledge and skills to real-world scenarios and case studies to solve practical marketing problems.

Unit I:	**The Marketing Research System**	**[12 Periods]**

Definition of MR - Basic and Applied Research – The Marketing Research Process - Types of Research - Steps in Marketing Research Process - Research Design - Data Sources - Marketing Information System – International Market Research. Sampling Process in Marketing Research– Sampling Design and Procedure – Sampling Methods – Non-probabilistic sampling Techniques – Probabilistic sampling Techniques - Sample Size determination - Sampling Errors.

Unit II:	**Measurement & Scaling in Marketing Research**	**[12 Periods]**

Measurement concept – Sources of variation in Measurement, Validity & reliability of Measurement - Attitude measurement – Scaling Procedure, Data Instruments - Data Collection- Online data collection - Collection of Secondary Data – Collection of Primary Data Methods - Field Operations - Errors and Difficulties in Data Processing, Coding and Editing. Data Analysis - - Hypothesis Testing - Report Writing - Presentation of Data.

Unit III:	**Application of Marketing Research**	**[12 Periods]**

Product Research – Motivation research – Advertising Research – Sales Control Research – Rural Marketing research - Export Marketing research, technological determinism-Keys to Community Building - Promoting Social Media Pages- Linking Social Media Accounts-The Viral Impact of Social Media Digital PR-Encourage Positive Chatter in Social Media - Identity in social media: formation of identities, communities, activist movements, and consumer markets - Social Media as business.

Unit IV:	**WEB ANALYTICS**	**[12 Periods]**

Web Analytics - Present and Future, Data Collection - Importance and Options, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Web Analytics Fundamentals, Concepts, Proposals & Reports, Web Data Analysis.

Unit V:	**SEARCH ANALYTICS**	**[12 Periods]**

Search engine optimization (SEO), non-linear media consumption, user engagement, user generated content, web traffic analysis, navigation, usability, eye tracking, online security, online ethics, content management system, data visualization, RSS feeds, Mobile platforms, User centered design, Understanding search behaviors.

Text Books:

1. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
3. Bittu Kumar, Social Networking, V & S Publishers, 2013
4. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007
5. Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress, 2004
6. TakeshiMoriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

Reference Books:

1. Naresh K. Malhotra, MARKETING RESEARCH: AN APPLIED ORIENTATION, Pearson Education, Asia.
2. Paul E. Green & Donald S. Tull, RESEARCH FOR MARKETING DECISIONS. PHI Learning Private Limited, New Delhi, 2009
3. Donald R. Cooper & Schindler, MARKETING RESEARCH CONCEPT & CASES, Tata McGrawHill Publishing Company Limited, new Delhi, 2006 S.C. Gupta, MARKETING RESEARCH, Excel Books India, 2007

Web Resources:

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	2	3		1		2		1		3			1
CO2	1		2		3	1	2		2		3	2	
CO3		1		3	2	3		2	1	1	2	1	1
CO4	2		1	2	1		1		3	2		3	3
CO5		2	3				3	2		3	1		2

Semester II **Core- II**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Business Ethics-I	3	4	-	-	**Core Theory**

Course Introduction

To Provide an Understanding of the concepts and practices in the area of Business Ethics.

Course Focus on:Skill Development/ **Entrepreneurship** / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	Appraise the need for ethics in business and identify the issues involved in business ethics.
CO 2:	Examine the various issues relating to ethics at workplace. Gender sensitivity and guidelines for managing ethics at workplace
CO 3:	Discuss the role and principles of ethics for creating ethical accounting environment and the ethical conflict resolution
CO 4:	Describe the various ethical issues with reference to marketing and the role of consumer protection councils in India
CO 5:	Demonstrate the accepted etiquette in the business context especially socio-economic behavior

Unit I:	**INTRODUCTION**	**[12 Periods]**

Meaning requirement of Ethics in Business – Need-importance for ethics in Business – Moral vs Ethics – Ethics vs Religion – Law Vs Ethics – Issues/Dilemmas involved in Business Ethics – How to handle ethical dilemmas in Business – Benefits of Business Ethics.

Unit II:	**Ethics at Worksplace**	**[12 Periods]**

Meaning Importance Role of Individual morals and standards in defining work place ethics – Factors influencing behavior – Working with opposite gender – Issues involved in HRD – Ethical issues of individual in work place – Guide lines for managing ethics in the work place.

Unit III:	**Ethics in Accounting and Finance:**	**[12 Periods]**

Meaning Importance fundamental Principles of ethics in the context of Finance and accounts – Creating an ethical accounting environment – Reasons for unethical behavior – Threats faced by finance and accounting Professional while working as an Auditor – Consultant or an Employee in an Organization – Safe guards to counter overcome threats – Ethical Conflict resolutions in the context of Finance and Accounting.

Unit IV:	**Ethics in marketing and Consumer Protection**	**[12 Periods]**

Meaning – Ethical issues involved in marketing – Need for ethical guidance – Competition meaning – Definition Consumer – Definition Competition and Consumer welfare – Grey Marketing – Consumer Protection councils in India – Rights of the Consumer – Consumer Interest vs Public Interest – Ethics in Advertisement .

Unit V:	**Business Etiquettes**	**[12 Periods]**

Meaning – Importance of Etiquettes – Etiquettes in Business cards – Business Meeting – Board Meeting – Shareholders meeting – Employees in meetings – Press Conference in Printing and electronic media – Behavior with foreign delegates – Manner of Shake hand – Dress Code in working

Hours working days – Business Meeting – Corporate Culture Functions – Etiquettes in Delivery of Speeches and addressing the People.

Text Books:

1. Business Ethics and Corporate Governance – R.K. Sharma, Puneet Goel & Pooja Bhagwan. Kalyani Publishers.

Reference Books:

1. Business Ethics: An Indian Perspective - A. C. Fernando – Pearsons India Limited.
2. Ethical Management: Text and Cases in Business Ethics and Corporate Governance - Satish Modh – Macmillan Publishers India limited.

Web Resources:

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

CourseOutcomes	ProgramOutcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**2**	**1**	**2**	**1**	**3**	**2**	**1**	**2**	**1**	**2**	**2**	**3**	**1**
CO2	**1**	**3**	**3**	**1**	**2**	**1**	**2**	**3**	**2**	**1**	**2**	**2**	**1**
CO3	**3**	**3**	**1**	**3**	**2**	**2**	**1**	**2**	**3**	**2**	**1**	**1**	**3**
CO4	**1**	**2**	**3**	**1**	**2**	**2**	**2**	**3**	**2**	**1**	**3**	**2**	**3**
CO5	**2**	**1**	**3**	**2**	**1**	**1**	**3**	**2**	**1**	**3**	**2**	**2**	**1**

Semester II **Core- II**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Linux Administration	4	4	-	-	**Core Theory**

Course Introduction

Linux Administration course is to equip students with the knowledge and practical skills required to manage and maintain Linux-based systems effectively. Throughout the course, students will gain a comprehensive understanding of Linux operating system concepts, including installation, configuration, and troubleshooting. Emphasis will be placed on essential administrative tasks such as user management, file system organization, and security implementation. The course also covers advanced topics like network configuration, service management, and automation using shell scripting. By the end of the course, students will be proficient in managing Linux environments, capable of ensuring system stability, optimizing performance, and supporting enterprise-level applications and services.

Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will
CO 1:	Explain the roles and interactions of various components within the Linux OS.
CO 2:	Create, manage, and troubleshoot file systems, including ext4, xfs, and btrfs.
CO 3:	Perform routine system administration tasks, such as system updates, package management, and system monitoring.
CO 4:	Implement and troubleshoot network services like DHCP, SSH, and FTP.
CO 5:	Perform regular security audits and vulnerability assessments to secure the system.

Unit I:	**INTRODUCTION**	**[12 Periods]**

Introduction to UNIX, Linux, GNU and Linux distributions Duties of the System Administrator, The Linux System Administrator, Installing and Configuring Servers, Installing and ConfiguringApplication Software, Creating and Maintaining User Accounts, Backing Up and RestoringFiles, Monitoring and Tuning Performance, Configuring a Secure System, Using Tools toMonitor Security.**Booting and shutting down :** Boot loaders-GRUB, LILO, Bootstrapping, Init process, rcscripts, Enabling and disabling services.**The File System :** Understanding the File System Structure, Working with Linux-SupportedFile Systems, Memory and Virtual File Systems, Linux Disk Management,NetworkConfiguration Files.

Unit II:	**System Configuration Files**	**[12 Periods]**

System wide Shell Configuration Scripts, System Environmental Settings, NetworkConfiguration Files, Managing the unit Scripts, Configuration Tool, Editing Your NetworkConfiguration.**TCP/IP Networking :** Understanding Network Classes, Setting Up a Network Interface Card(NIC), Understanding Subnetting, Working with Gateways and Routers, Configuring DynamicHost Configuration Protocol, Configuring the Network Using the Network.**The Network File System :** NFS Overview, Planning an NFS Installation, Configuring an NFSServer, Configuring an NFS Client, Using Automount Services, Examining NT'S Security.

Unit III:	**Connecting to Microsoft Networks**	**[12 Periods]**

Installing Samba, Configuring the Samba Server, CreatingSamba Users 3, Starting the SambaServer, Connecting to a Samba Client, Connecting from aWindows PC to the Samba Server.**Additional Network Services :**Configuring a Time Server, Providing a Caching ProxyServer,Optimizing Network Services, **Internet Services :** Secure Services, SSH, scp, sftp Less Secure Services (Telnet, FTP, sync,rsh, rlogin, finger, talk and ntalk, Linux Machine as a server, Configuring the xinetd Server,Comparingxinetd and Standalone, Configuring Linux Firewall Packages.

Unit IV:	**Domain Name System(DNS)**	**[12 Periods]**

Understanding DNS, Understanding Types of Domain Servers, ExaminingServerConfigurationFiles, Configuring a Caching DNS Server, Configuring a Secondary MasterDNSServer,Configuring a Primary Master

Server, Checking Configuration, **Configuring Mail Services :** Tracing the Email Delivery Process, Mail User Agent(MUA),Introducing SMTP, Configuring Sendmail, Using the Postfix Mail Server, Serving Email with POP3and IMAP, Maintaining Email Security, **Configuring' FTP Services :**Introducing vsftpd, Configuring vsftpd, Advanced FTPServerConfiguration Using SFTP.

Unit V:	**Configuring a Web Server**	**[12 Periods]**

Introducing Apache, Configuring Apache, Implementing SSI, EnablingCGI, Enabling PHP,Creating a Secure Server with SSL.**Providing Web Services :** Creating Mailing Lists, Setting Up Web-Based Email, ConfiguringanRSS Feed, Adding Search Functionality.**Optimizing Internet Services :** Optimizing LDAP Services, Optimizing DNS Services, OptimizingMail Services, OptimizingFTP Services, Optimizing Web Services, **System Administration:** updating system, upgrading and customizing kernel, AdministeringUsersand Groups Installing and Upgrading Software Packages

Text Books:

1. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014.

Reference Books:

1. Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.
2. Linux iptables Pocket Reference, Gregor N. Purdy, O'Reilly, 2004, ISBN-13: 978- 0596005696.
3. Linux Firewalls, by Michael Rash, No Starch Press, October 2007, ISBN: 978-1-59327- 141-1.
4. Network Security, Firewalls and VPNs, J. Michael Stewart, Jones & Bartlett Learning, 2013, ISBN-10: 1284031675, ISBN-13: 978-1284031676.
5. The Network Security Test Lab: A Step-By-Step Guide, Michael Gregg, Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	1	2	2	1	1	1	2	3	2	3	1
CO2	3	3	2	2	2	2	2	1	2	3	3	2	3
CO3	3	3	2	2	2	2	2	1	2	3	2	1	1
CO4	3	3	2	2	2	2	2	1	2	3	3	3	3
CO5	3	3	2	1	2	1	2	1	3	3	1	3	2

Semester II **Core- II**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Linux Administration Lab	4	-	-	4	Practical

Course Introduction

Linux Administration course is to equip students with the knowledge and practical skills required to manage and maintain Linux-based systems effectively. Throughout the course, students will gain a comprehensive understanding of Linux operating system concepts, including installation, configuration, and troubleshooting. Emphasis will be placed on essential administrative tasks such as user management, file system organization, and security implementation.

Course Focus on:Skill Development/ Entrepreneurship / Employability / Research

List of Programs

1. Installation of Operating system : Windows/ Linux
2. Illustrate UNIX commands and Shell Programming
3. Process Management using System Calls : Fork, Exec, Getpid, Exit, Wait, Close
4. Write C programs to implement the various CPU Scheduling Algorithms
5. Illustrate the inter process communication strategy
6. Implement mutual exclusion by Semaphores
7. Write a C program to avoid Deadlock using Banker's Algorithm
8. Write a C program to Implement Deadlock Detection Algorithm
9. Write C program to implement Threading
10. Implement the paging Technique using C program
11. Write C programs to implement the following Memory Allocation Methods a. First Fit b. Worst Fit c. Best Fit
12. Write C programs to implement the various Page Replacement Algorithms
13. Write C programs to Implement the various File Organization Techniques
14. Implement the following File Allocation Strategies using C programs a. Sequential b. Indexed c. Linked
15. Write C programs for the implementation of various disk scheduling algorithms
16. Write a shell script to synchronize files between two directories using rsync.
17. Write a shell script to set up an SFTP server with chrooted users and public key authentication.
18. Write a shell script to configure a Linux server for LDAP-based authentication.
19. Write a shell script to configure a high availability (HA) cluster using Pacemaker and Corosync.
20. The script should set up two nodes with a virtual IP address and a basic resource

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	3	2	3	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	3	2	1	3	2	1	2	1
CO4	1	1	3	3	1	2	3	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Semester II **Skill - II**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Python Programming Language Lab	4	-	-	4	Practical

Course Introduction

The course covers fundamental concepts such as data types, control structures, functions, and modules, progressing to more advanced topics like object-oriented programming, file handling, and exception management. Emphasis is placed on practical problem-solving skills through hands-on exercises and real-world projects, fostering the ability to design, implement, and debug Python programs effectively.

Course Focus on:Skill Development/ Entrepreneurship / Employability / **Research**

List of Programs

1. Swapping of values
2. Conversion of ASCII to Binary
3. Printing the first n row of Pascal's triangle.
4. Calculation of upper case and lower-case letters in a string
5. Programs using Tuple 19
6. Programs using conditionals
7. Programs using dictionaries
8. Programs using Boolean operators
9. Implementation of functions
10. Programs using NumPy
11. Programs using Pandas
12. Implementation of Maclaurin series
13. Programs using seaborn
14. Programs using Matplotlib

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	3	2	3	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	3	2	1	3	2	1	2	1
CO4	1	1	3	3	1	2	3	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Semester II **Elective- II**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Data Visualization	4	4	-	-	**Core Theory**

Course Introduction

Data Visualization course is to equip students with the skills to effectively communicate data insights through visual means. By the end of the course, students will understand fundamental visualization principles, proficiently use tools like Tableau and Python, design and critique visualizations, and present data-driven stories. The course emphasizes real-world application, critical evaluation, and staying updated with industry trends, ensuring students can create impactful, ethical, and clear visual representations of data.

Course Focus on:Skill Development/ Entrepreneurship / Employability /**Research**

Course Outcomes	On completion of this course, students will
CO 1:	Understand the basics of data visualization
CO 2:	Understand the importance of data visualization and the design and use of many visual components
CO 3:	Explain the process of data visualization
CO 4:	Explain the basics of interactive data visualization techniques visualization-based issues.
CO 5:	Understand the concept of various types of visulaization

Unit I:	**INTRODUCTION**	**[12 Periods]**

Introduction- context of data visualization- definition methodology, visualization design objectives. Key factors-purpose, visualization function and tone, visualization design options- data representation, data presentation,seven stages of data visualization,widgets,data visualization tools.

Unit II:	**visualizing data methods**	**[12 Periods]**

visualizing data methods- mapping, time series- connections and correlations-scatter plot maps-trees, hierarchies and recursion- networks naadgraphs, info graphics.

Unit III:	**Visualizing data process**	**[12 Periods]**

Visualizing data process- acquiring data, where to find data, tools of acquiring data from the internet, locating file for use with processing, loading text data, dealing with files and folders,listing files in a folder, asynchronous image downloads, advanced web techniques, using a database, dealing with large number of files, parsing data, level of effort, tools for gathering clues, text is best, textmarkup languages, regular expressions(regexps),grammars and BNF notation, compressed data vectors and geometry,binary data formats, advances detect work

Unit IV:	**Interactive data visualization**	**[12 Periods]**

Interactive data visualization-drawing with data,scales-axes-updates,transaction and modeinteractivity- layouts-geo-mapping- exporting frame work-T3 lstabio.

Unit V:	**Security data visualization**	**[12 Periods]**

Security data visualization-port scan visualization-vulnerability assessment and exploitation-firewall log visualization- instruction detection log visualization- attacking and defending visualization systems- creating security visualization system.

Text Books:

1. Scott Murray,"interactive data visualization for the web ",O"Reilly media,inc,2013.

Reference Books:

1. Ben fry,"visualizing data",O"Reilly media,inc,2007

2. Greg conti,"security data visualization:","graphical techniques for network analysis",No starch press inc,2007

Web Resources:

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**	**3**	**2**	**1**	**2**	**2**		**1**		**3**			**1**
CO2	**1**		**2**		**3**	**1**	**2**		**2**		**3**	**2**	
CO3		**2**	**1**	**3**	**2**	**3**		**2**	**1**	**1**	**2**	**1**	**1**
CO4	**2**		**3**	**2**	**1**		**1**		**3**	**2**		**3**	**3**
CO5	**3**	**2**	**3**	**2**		**1**	**3**	**2**		**3**	**1**		**2**

Semester-III

Semester III **Core Lab - III**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Advanced Machine learning Lab	4	-	-	5	Practical

Course Introduction

This course aims to deepen the understanding of complex machine learning concepts by engaging students in real-world problem-solving scenarios. Through a series of structured lab exercises, projects, and case studies, students will explore advanced topics such as deep learning, reinforcement learning, natural language processing, and computer vision. The lab focuses on fostering critical thinking, creativity, and innovation, enabling students to develop robust machine learning models, evaluate their performance, and optimize them for practical applications.

Course Focus on:Skill Development/ Entrepreneurship / Employability / **Research**

List of Programs

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result.
2. Create a K-Means Clustering Algorithm from Scratch in Python?
3. Implement k-nearest neighbours classification using python
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3 centroids) VAR1 VAR2 CLASS 1.713 1.586 0 0.180 1.786 1 0.353 1.240 1 0.940 1.566 0 1.486 0.759 1 1.266 1.106 0 1.540 0.419 1 0.459 1.799 1 0.773 0.186 1
5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness. Income Recreation Job Status Age group Homeowner Risk Medium skiing design single twenties no High risk High golf trading married forties yes Low risk Low speedway transport married thirties yes Med risk Medium football banking single thirties yes Low risk High flying media married fifties yes High risk Low football security single twenties no Med risk Medium golf media single thirties yes Med risk Medium golf transport married forties yes Low risk High skiing banking single thirties yes High risk Low golf unemployed married forties yes High risk Input attributes are (from left to right) income, recreation, job, status, age group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `med Risk' in the dataset?
6. Implement linear regression using python.
7. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.

8. Implement Naïve Bayes' theorem to classify the English text
9. Use the appropriate dataset for implementing feature engineering for machine learning to find
    - Missing data imputation
    - Categorical encoding
    - Outliers
    - Feature scaling
    - Mixed variables
10. Design an Optical Character Recognizer
11. Design Heart Attack risk predictor using Auto ML
12. Design Petrol price forecasting using Auto Keras
13. Design Cricket score prediction using TPOT (Auto ML)

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	3	2	3	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	3	2	1	3	2	1	2	1
CO4	1	1	3	3	1	2	3	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Semester III **Core- III**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Business Ethics-II	4	5	-	-	**Core Theory**

Course Introduction

Business ethics is to establish and maintain standards of conduct within organizations that promote integrity, fairness, and responsibility in all business activities. It involves ensuring that business practices align with legal requirements, industry regulations, and societal expectations, while also considering the impact on various stakeholders, including customers, employees, shareholders, and the community at large. Business ethics aims to foster trust and transparency, minimize conflicts of interest, and uphold principles of honesty, accountability, and respect for human rights. Ultimately, the goal is to create a culture of ethical decision-making and behavior that contributes to long-term sustainability and the well-being of both the organization and society.

Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will
CO 1:	Understand the importance of ethical decisions and the consequences of unethical decisions. Understand that the business has a social responsibility towards the society.
CO 2:	Understand the conflicting situations in the business and find solution for 'most good'. Develop and device ways of doing business globally.
CO 3:	Understand the concept of globalization and factors affecting the international business.
CO 4:	Elucidate the implications of trade theories on international business, theoretical framework for shifting patterns of production and trade.
CO 5:	Understand the strategy for selecting the modes of expansion, evaluate trade related expansions mode, contractual mode and investment mode, trade-offs in selecting the mode.

Unit I:	**Business and Society**	**[12 Periods]**

Business & ethics - Social responsibility - Environmental Pollution and control. Business and culture - Business and Government - Political system and its influence on business - Business environment - The concept and significance - constituents of business environment

Unit II:	**Theories related to Ethics**	**[12 Periods]**

Managing Ethics - Frame work of organizational ethic theories and sources, ethics across cultures, factors influencing business ethics, ethical decision making, ethical values and stakeholders, ethics and profit, Corporate governance Structure of boards, reforms in boards, compensation issues, ethical leadership for improved Corporate governance and better business education.

Unit III:	**Globalization**	**[12 Periods]**

Emergence of global institutions, drivers of globalization. National differences in Political economy-Political system, economic system and legal system. Differences in culture: values and norms, social structure, religious and ethical system, language, education, culture, implications for managers.

Unit IV:	**International Trade Theory**	**[12 Periods]**

The Global Trade and Investment Environment International Trade Theory: Introduction - An Overview of Trade Theory - Mercantilism -Absolute Advantage - Comparative Advantage - Heckscher-Ohlin Theory - The New Trade Theory - National Competitive Advantage - Porter's Diamond. The Revised Case for Free Trade - Development of the World - Trading System – WTO & development of World trade - Regional grouping of countries and its impact.

Unit V:	**The Strategy of International Business**	**[12 Periods]**

Strategy and the Firm - Profiting from Global Expansion - Pressures for Cost Reductions and Local Responsiveness - Strategic Choice. Mode of Entry and Strategic Alliances: Introduction - Entry Modes - Selecting and Entry Mode - Strategic Alliances - Making Alliances Work, Exporting, Importing and Counter trade: Introduction - The Promise and Pitfalls of Exporting - Improving Export Performance - Export and Import Financing - Export Assistance – Counter trade.

Text Books:

1. Charles W.L., Hill,Arun K Jain, International Business : Competing in the Global market place, Irwin-McGrawHill, 2009.
2. Rakesh Mohan Joshi., Internatioanl Business, Oxford Universtiy Press,2014 3 Ronald D Francis &MukthiMishra .,BusinessEhtics: An Indian Perspective, The Mc- Graw Hill companies,2009

Reference Books:

1. Business Ethics: An Indian Perspective by A.C.Fernando, Pearson, 2011.
2. Business Ethics by Stephen M. Byars, Kurt Stanberry, Openstax, 2018.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	1	2	3	2	3	1	3	3	3	2	1
CO2	3	3	2	1	2	2	1	1	1	2	3	2	2
CO3	3	3	1	3	1	1	1	2	1	1	2	1	1
CO4	3	2	2	2	2	3	3	1	3	2	3	3	3
CO5	3	2	3	3	3	3	1	3	3	3	1	3	2

Semester III **Elective- III**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Social Media Analytics	4	5	-	-	**Core Theory**

Course Introduction
To provide an overview of common text mining and social media data analytic activities and understand the complexities of processing text and network data from different data sources.
Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will
CO 1:	Understand the terminologies, metaphors and perspectives of social media analytics
CO 2:	Apply a wide range of classification, clustering, estimation and prediction algorithms on Textual data.
CO 3:	Perform social network analysis to identify important social actors, subgroups and network properties in social media sites.
CO 4:	Apply state of the art web mining tools and libraries on realistic data sets as a basis for business decisions and applications.
CO 5:	Provide solutions to the emerging problems with social media such as behavior analytics and Recommendation systems

Unit I:	**Foundation for Social Media Analytics:**	**[12 Periods]**

Foundation for Analytics: – Digital Gap – Social Media Data Sources – Defining Social Media Data –Data Sources – Estimated vs. Factual Data Sources – Data Gathering in Social Media Analytics. From Data to Insights: Actionable Analytics – Focus on objective – Plan to shape data to insights –Choosing a good analytics tool – Data Aggregation calculations and display – Data display – Social-Media and Big data – Potential Challenges. Data Identification: Professional networking sites - social sites – information sharing sites – micro blogging sites – blogs /wikis.

Unit II:	**Social Media Analytics Types, Tools and Social Network Landscape:**	**[12 Periods]**

Analytics in social media: Types of analytics. Dedicated Vs. Hybrid Tools – Dedicated tools – Hybrid tools – Data Integration Tools – Best Setup. Social Network Landscape: Concept and UX on social networks – Interactivity of social network –Content flow on social network – Interaction Pattern between users – Social-Media as a two-way channel.

Unit III:	**Analytic Process and Metrics:**	**[12 Periods]**

Analytics Process: Analysis – Insight – Investigation beyond social analytics – Shaping a method –analysis cycle – Community Activity – Resources – Attention span – Dynamic cycles – Short Periods –Long Periods – Analyst Mindset – Instinctive Analyst. Metrics: Introduction – Default and custom metrics – Metrics Categories – Graph Types – Metric Capabilities – Metrics and Strategy – Estimated Metrics – Metrics and Tactics.

Unit IV:	**Semantic Web and Social Network Analysis:**	**[12 Periods]**

Introduction to Semantic Web - Limitations of current Web - Development of Semantic Web - Emergence of the Social Web. Social Network analysis - Development of Social Network Analysis -Key concepts and measures in network analysis. Electronic sources for network analysis - Electronic discussion networks - Blogs and online communities - Web-based networks.

Unit V:	**Semantic Web and Ontology:**	**[12 Periods]**

Knowledge representation on the Semantic web: Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language.

Text Books:

1. Alex Goncalves, "Social Media Analytics Strategy - Using Data to Optimize Business Performance", Alex Goncalves, APress 2017.
2. Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.

Reference Books:

1. Ganis, Kohirkar (2016). Social media Analytics, IBM Press PTG, 1st Edition.
2. Nancy Flynn (2012). The Social Media Hand book Policies, and Best Practices, Wiley.
3. GuandongXu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking Techniques and applications", First Edition Springer, 2011.
4. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.

Web Resources:

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

CourseOutcomes	ProgramOutcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3	2	1	3	2	2	3	1	2	3	1	1	2
CO2	2	1	1	2	1	2	3	1	1	2	1	3	3
CO3	1	3	2	2	3	1	1	2	3	2	1	3	2
CO4	3	2	1		1	3	1	2	2	1	1	3	1
CO5	2	1	3	2	2	1	1	3	1	2	3	2	1

Semester III **Core- III**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Advanced Machine Learning	4	5	-	-	**Core Theory**

Course Introduction

This course covers fundamental concepts and methods of computational data analysis, including pattern classification, prediction, visualization, and recent topics in deep learning. The course will give the student the basic ideas and intuition behind modern machine learning methods as well as a bit more formal understanding of how, why, and when they work. The underlying theme in the course is statistical inference as it provides the foundation for most of the methods covered.

Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will
CO 1:	Use Deep belief networks and CNN
CO 2:	Identify machine learning techniques suitable for a given problem
CO 3:	Solve the problems using various machine learning techniques
CO 4:	Apply Feature Engineering
CO 5:	Design application using machine learning techniques

Unit I:	**Unsupervised Machine Learning & Deep Belief Networks** :	**[12 Periods]**

Principal component analysis - Introducing K-means clustering - self-organizing maps. Deep Belief Networks: Neural networks – a primer, composition of a neural network - network topologies - Restricted Boltzmann Machine, Introducing the RBM - Applications of the RBM - Further applications of the RBM - Deep belief Networks-Training a DBN - Applying the DBN - Validating the DBN.

Unit II:	**Stacked Denoising Auto encoders & Convolutional Neural Networks:**	**[12 Periods]**

Autoencoders - Introducing the autoencoder – Topology – Training - Denoising autoencoders - ApplyingadA, Stacked Denoising Autoencoders - Applying the SdA- AssessingSdA performance Convolutional Neural Networks: Introduction to CNN - Understanding the convnet topology - understanding convent layers and pooling layers - training a convent - Applying a CNN

Unit III:	**Semi-Supervised Learning & Text Feature Engineering:**	**[12 Periods]**

Introduction - understanding semi-supervised learning - Semi-supervised algorithms in action – Selftraining - implementing self-training - Finessing your self-training implementation - Contrastive Pessimistic Likelihood Estimation Text Feature Engineering: Introduction - Text feature engineering - Cleaning text data - Text cleaning with Beautiful Soup - managing punctuation and tokenizing - Tagging and categorizing words - creating features from text data – stemming - Bagging and random forests - Testing our prepared data

Unit IV:	**Feature Engineering:**	**[12 Periods]**

Introduction - creating a feature set - Engineering features for ML applications - using rescaling techniques to improve the learnability of features - creating effective derived variables - reinterpreting non-numeric features - using feature selection techniques - Performing feature

selection - Feature engineering in practice - Acquiring data via RESTful APIs, Testing the performance of our model – Twitter - Deriving and selecting variables using feature engineering techniques		
Unit V:	**Ensemble Methods & Additional Python Machine Learning Tools:**	**[12 Periods]**
Introducing ensembles - understanding averaging ensembles - using bagging algorithms - using random forests, applying boosting methods - Using XGBoost - Using stacking ensembles - Applying ensembles in practice - Using models in dynamic applications - Understanding model robustness - Identifying modeling risk factors - Strategies to managing model robustness		

Text Books:

1. John Hearty, Advanced Machine Learning with Python, Packt Publishing Ltd, 2016.

Reference Books:

1. T.M. Mitchell, "Machine Learning", McGraw-Hill,1997.
2. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019

Web Resources:

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

CourseOutcomes	ProgramOutcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**2**	**1**	**3**	**1**	**2**	**3**	**1**	**2**	**1**	**2**	**2**	**3**	**1**
CO2	**1**	**3**	**2**	**2**	**3**	**3**	**1**	**2**	**2**	**1**	**3**	**2**	**1**
CO3	**2**	**3**	**1**	**3**	**1**	**2**	**3**	**2**	**2**	**1**	**2**	**3**	**2**
CO4	**2**	**1**	**3**	**1**	**3**	**2**	**1**	**3**	**2**	**1**	**1**	**2**	**3**
CO5	**2**	**3**	**1**	**2**	**1**	**3**	**2**	**2**	**2**	**1**	**2**	**3**	**1**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Exploratory Data Analysis	**4**	**0**	**0**	**6**	**Practical**

List of Practical Programs:

1. Computation of Mean vector and covariance matrix for multivariate data set
2. Generation of multivariate data using multivariate normal distribution
3. Fitting of linear, quadratic, exponential and logistic models
4. Principal Component analysis and factor analysis
5. Linear and quadratic discriminant analysis with classification of two and three groups.
6. Cluster analysis with hierarchical clustering (single linkage, average linkage, Wards method) and non-hierarchical clustering (k-means)
7. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
8. Hive Installation and Table Operations.
9. Hive Databases, Tables, Views, Functions and Indexes.
10. Neo4j - Crud operations using datasets; Find a relationship between datasets; Construct a graph; String and aggregation operations.
11. Pig Latin scripts - sort, group, join, project, and filter operations.
12. Installation of Cassandra and perform key space and table operation; Crud operations

Semester III **Skill-III**

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	3	2	3	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	3	2	1	3	2	1	2	1
CO4	1	1	3	3	1	2	3	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Semester III **Core- III**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Artificial Neural Networks and Deep Learning	4	4	-	-	**Core Theory**

Course Introduction

Financial Econometrics course, students will have acquired a comprehensive understanding of econometric techniques and their application to financial data. Students will be proficient in analyzing and modeling financial time series data, using statistical software to perform regression analysis, hypothesis testing, and forecasting. They will develop the skills to critically evaluate econometric models, interpret empirical results, and apply these findings to real-world financial problems. Furthermore, students will be adept at identifying and addressing issues such as heteroscedasticity, autocorrelation, and non-stationarity in financial datasets. The course will also enhance their ability to conduct rigorous empirical research, providing a solid foundation for careers in finance, economics, and related fields.

Course Focus on: **Skill Development/ Entrepreneurship** / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	Demonstrate a solid understanding of basic and advanced econometric techniques, including regression analysis, hypothesis testing, and time series analysis.
CO 2:	Understand the principles and applications of time series models, including ARIMA, GARCH, and VAR models, in financial econometrics.
CO 3:	Develop critical thinking skills to solve complex financial problems by integrating theoretical knowledge with empirical data analysis.
CO 4:	Conduct empirical analysis using statistical software (e.g., R, Stata, EViews) to handle financial datasets, perform estimations, and interpret the results.
CO 5:	Apply econometric models to real-world financial data to interpret and forecast financial phenomena such as stock prices, interest rates, and exchange rates.

Unit I:	**Stochastic Process and their Properties**	**[12 Periods]**

Martingales – Random Walks – Gaussian White noise processes – Wiener Processes – Stationarity and Ergodocity, Behaviour and Valuation of Security Prices: Generalised Wiener Processes – Geometric Wiener Process and Financial Variable Behaviour in the Short Term and Long Run.

Unit II:	**Models**	**[12 Periods]**

Time – Varying Volatility Models – GARCH and Stochastic Volatility – ARCH and GARCH and their variations – Multivariate GARCH – Stochastic Volatility – Univariate Persistence Measures – Multivariate persistence – Impulse response analysis and variance decomposition – Non-orthogonal cross – Effect impulse response Analysis.

Unit III:	**Modeling regime shifts**	**[12 Periods]**

Markov Chains – Estimation – Smoothing – Rime-varying Transition probabilities – Examples cases. State Space Model and the Kalman Filter – State Space Expression – Kalman Filter Algorithm – Time-varying coefficient Models – AR(p) process – ARMA(p,q) process – Stochastic Volatility – Time-varying co-efficient.

Unit IV:	**Basic representation Model**	**[12 Periods]**

The basic present value model and its time series characteristics – the VAR representation – The present Value Model on Logarithms with time – Varying discount rates – The VAR representation for the present value model in the log linear farm – Variance Decomposition.

Unit V:	**Financial Economics and econometrics**	**[12 Periods]**

Financial Economics and econometrics literature on the internet – Econometric Package for Financial and Economic Time series – Learned Societies and Professional Associations – Organizations and Institutions – International Financial institutions and other organizations – Major Stock Exchangers, Options and Futures, Exchanges and Regulators – Central Banks.

Text Books:

1. Peijewang "Financial Econometrics: Methods and Models" Routledge – Taylor & Francis Gorup – Vikas Publishing House, Pvt Ltd.

Reference Books:

1. M.L. Jhingan "Advanced Economic Theory," Vrinda Publications (P) Ltd.
2. M.C. Vaish "Macro Economic Theory," Vikas Publishing House (P) Ltd.
3. R. D. Gupta and A.S. Rana "Keynes and Post Keynesian Economics," Kalyani Publishers.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	**Program Outcomes**												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**	**3**	**1**	**2**	**2**	**1**	**1**	**1**	**2**	**3**	**2**	**3**	**1**
CO2	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**3**	**2**	**1**	**1**
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**1**	**2**	**1**	**2**	**1**	**3**	**3**	**1**	**3**	**2**

Semester-IV

Semester IV **Elective- IV**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Natural language processing (NLP)	4	4	-	-	**Core Theory**

Course Introduction

Natural language processing (NLP) is to enable computers to understand, interpret, and generate human language in a way that is both meaningful and useful. This field encompasses a wide range of tasks, including text understanding, sentiment analysis, language translation, speech recognition, and more. By leveraging computational algorithms and linguistic principles, NLP aims to bridge the gap between human communication and computer understanding, facilitating applications such as virtual assistants, language translation services, information extraction from text, and automated text summarization. Ultimately, the goal of NLP is to empower computers to interact with humans in a natural and intuitive manner, opening up possibilities for improved human-computer interaction and the development of advanced language-based technologies.

Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will
CO 1:	Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language.
CO 2:	Demonstrate understanding of the relationship between NLP and statistics & machine learning.
CO 3:	Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, partsof-speech tagging and syntactic parsing.
CO 4:	Demonstrate the concept of semantic analysis and word sense disambiguation.
CO 5:	Understand the components of machine translation process and develop the model for NLP applications.

Unit I:	**INTRODUCTION**	**[12 Periods]**

Introduction - NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity. The role of machine learning. Brief history of the field - N-gram Language Models - The role of language models. Simple N- gram models. Estimating parameters and smoothing. Evaluating language models.

Unit II:	**Social Media Analytics Types, Tools and Social Network BASIC NLP TECHNIQUES**	**[12 Periods]**

Part of Speech Tagging and Sequence Labeling - Lexical syntax. Hidden Markov Models (Forward and Viterbi algorithms and EM training) - Basic Neural Networks. Any basic introduction to perceptron and backpropagation

Unit III:	**PARSING**	**[12 Periods]**

LSTM Recurrent Neural Networks -Syntactic parsing - Grammar formalisms and treebanks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Lexicalized PCFGs. Neural shift-reduce dependency parsing.

Unit IV:	**SEMANTIC ANALYSIS**	**[12 Periods]**

Lexical semantics and word-sense disambiguation. Compositional semantics. Semantic Role Labelling and Semantic Parsing.

Unit V:	**MACHINE TRANSLATION**	**[12 Periods]**

Information Extraction (IE) - Named entity recognition and relation extraction. IE using sequence labelling. -Machine Translation (MT) Basic issues in MT. Statistical translation, word alignment, phrase-based translation, and synchronous grammars.

Text Books:

1.Jurafsky Dan and Martin James H. "Speech and Language Processing" ,3rd Edition, 2018.

Reference Books:

1 Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana, Practical Natural Language Processing, 2020.

2 Steven Bird, Ewan Klein, Edward Loper., Natural Language Processing with Python, 2009.

Web Resources:

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	**Program Outcomes**												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**	**3**	**1**	**2**	**2**	**1**	**1**	**1**	**2**	**3**	**2**	**3**	**1**
CO2	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**3**	**2**	**1**	**1**
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**1**	**2**	**1**	**2**	**1**	**3**	**3**	**1**	**3**	**2**

Semester IV **Core- IV**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Artificial Neural Networks and Deep Learning	4	4	-	-	**Core Theory**

Course Introduction

This course aims to provide a comprehensive understanding of artificial neural networks (ANNs) and deep learning, which are foundational technologies in the field of artificial intelligence and machine learning. Students will learn the theoretical concepts and practical techniques necessary to design, implement, and evaluate neural network models. The course covers a range of topics, including the architecture and functioning of various neural networks, optimization algorithms, and the application of deep learning in diverse domains such as computer vision, natural language processing, and speech recognition. By the end of the course, students will be equipped with the skills to tackle complex problems using advanced neural network techniques and to stay abreast of the latest developments in this rapidly evolving field.

Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will
CO 1:	To understand the basics in deep neural networks
CO 2:	To understand the basics of associative memory and unsupervised learning networks
CO 3:	To apply CNN architectures of deep neural networks
CO 4:	To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
CO 5:	To apply autoencoders and generative models for suitable applications

Unit I:	**INTRODUCTION**	**[12 Periods]**

Neural Networks-Application Scope of Neural Networks-Artificial Neural, Network: An Introduction-Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.

Unit II:	**ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS**	**[12 Periods]**

Training Algorithms for Pattern Association- Auto associative Memory Network-Hetero associative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Auto associative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation, Networks-Adaptive Resonance Theory Network.

Unit III:	**THIRD-GENERATION NEURAL NETWORKS**	**[12 Periods]**

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation, Image Compression.

Unit IV:	**DEEP FEEDFORWARD NETWORKS**	**[12 Periods]**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets.

Unit V:	**RECURRENT NEURAL NETWORKS**	**[12 Periods]**

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders.

Text Books:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications, 2021.

Reference Books:

1. AurélienGéron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly, 2018.

2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.

4. Learn Keras for Deep Neural Networks, JojoMoolayil, Apress,2018

5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020

6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017.

7. S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications", PHI Learning, 2017.

8. Pro Deep Learning with TensorFlow, SantanuPattanayak, Apress,2017

9. James A Freeman, David M S Kapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	**Program Outcomes**												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**	**3**	**1**	**2**	**2**	**1**	**1**	**1**	**2**	**3**	**2**	**3**	**1**
CO2	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**3**	**2**	**1**	**1**
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**1**	**2**	**1**	**2**	**1**	**3**	**3**	**1**	**3**	**2**

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Artificial Neural Networks and Deep Learning Lab	**4**	**0**	**0**	**6**	**Practical**

List of Practical Programs:

1. Implement simple vector addition in TensorFlow.
2. Implement a regression model in Keras.
3. Implement a perceptron in TensorFlow/Keras Environment.
4. Implement a Feed-Forward Network in TensorFlow/Keras.
5. Implement an Image Classifier using CNN in TensorFlow/Keras.
6. Improve the Deep learning model by fine tuning hyper parameters.
7. Implement a Transfer Learning concept in Image Classification.
8. Using a pre trained model on Keras for Transfer Learning
9. Perform Sentiment Analysis using RNN
10. Implement an LSTM based Autoencoder in TensorFlow/Keras.
11. Image generation using GAN Additional Experiments:
12. Train a Deep learning model to classify a given image using pre trained model
13. Recommendation system from sales data using Deep Learning
14. Implement Object Detection using CNN
15. Implement any simple Reinforcement Algorithm for an NLP problem

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	2	2	3	1	2	3	2	1	2	1	1	1
CO3	3	3	2	1	1	2	1	3	2	1	2	1
CO4	1	1	3	3	1	2	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Semester IV Core- IV

Semester- IV Skill-IV

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Data Analytics in SQL Lab	**4**	**0**	**0**	**6**	**Practical**

List of Practical Programs:

1) **Consider a simplified schema for an e-commerce platform with the following tables:**
- **orders**: Contains order_id, customer_id, order_date, and total_amount.
- **order_items**: Contains order_item_id, order_id, product_id, quantity, and unit_price.
- **products**: Contains product_id, product_name, and category_id.
- **categories**: Contains category_id and category_name.

2) **Given the following schema for a social media platform:**
- **users**: Contains user_id, username, join_date.
- **posts**: Contains post_id, user_id, post_date, likes.
- **comments**: Contains comment_id, post_id, user_id, comment_date.

3) **Consider a simplified schema for an online bookstore with the following tables:**
- **books**: Contains book_id, title, author, genre, published_date.
- **sales**: Contains sale_id, book_id, customer_id, sale_date, quantity, unit_price.

4) **Determine Average Order Value (AOV):**
- Given tables orders (with order_id, customer_id, order_date, total_amount) and customers (with customer_id and customer_name), write an SQL query to calculate the average order value for each customer. Display the results sorted by customer name.

5) **Find Products with Declining Sales:**
- Given tables products (with product_id and product_name) and sales (with product_id, sale_date, quantity), write an SQL query to identify products whose sales quantity has decreased month-over-month in the year 2023

6) **Calculate Cumulative Sales by Month:**
- Given tables sales (with sale_id, sale_date, amount) and products (with product_id, product_name), write an SQL query to calculate the cumulative sales amount for each month in the year 2023, across all products.

7) **Identify First-Time Buyers:**
- Given tables customers (with customer_id and customer_name) and orders (with order_id, customer_id, order_date), write an SQL query to find customers who made their first purchase in January 2023.

8) **Identify Orders with High-Value Items:**
- Given tables orders (with order_id, customer_id, order_date, total_amount) and order_items (with order_item_id, order_id, product_id, quantity, unit_price), write an SQL query to identify orders where at least one item's unit price exceeds $500.

9) **Calculate Customer Lifetime Value (CLV):**
- Given tables customers (with customer_id and join_date) and orders (with order_id, customer_id, order_date, total_amount), write an SQL query to calculate the CLV for each customer, defined as the total amount spent by the customer since joining.

10) **Calculate Moving Average:**
- Given a table sales (with sale_date and amount), write an SQL query to calculate a 3-month moving average of sales amounts for each month in the year 2023.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	2	2	3	1	2	3	2	1	2	1	1	1
CO3	3	3	2	1	1	2	1	3	2	1	2	1
CO4	1	1	3	3	1	2	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1