HSNC University, Mumbai

(2026-2027)

Ordinances and Regulations

With Respect to

Choice Based Credit System (CBCS)

For the Programmes Under

The Faculty of Science and Technology

For the Course

Data Science & Business Analytics

Curriculum – Second Year Undergraduate Programmes

Semester-III and Semester -IV

(2026-2027)

Course Structure

Semester – III			
Course Code	**Course Type**	**Course Name**	**Credits**
	Major	Data Structures and Algorithm Design	3
	Major	Python Programming	3
	Minor	Calculus for Data Science & Optimization	3
	Multidisciplinary (MDS)	Predictive Analysis using SPSS	3
	Skill Enhancement Course (SEC)	Visual Analytics using Tableau & Power BI	3
	Ability Enhancement Course (AEC)	MIL	2
	GE	Fundamentals of Microeconomics/ An Overview of Indian Classical Music	3
	Discipline Specific Practical	Data Structure and Algorithm Design Practical	1
		Python Programming Practical	1
		Calculus for Data Science & Optimization Practical	1
Total Credits			20

Semester – IV			
Course Code	**Course Type**	**Course Name**	**Credits**
	Major	Machine Learning-I	3
	Major	Database Management System	3
	Minor	Advanced Statistical modelling and Predictive Analytics	3
	Multidisciplinary (MDS)	Visual Analytics using Tableau & Power BI	3
	Skill Enhancement Course (SEC)	Business Analytics	3
	Ability Enhancement Course (AEC)	MIL	2
	GE	Fundamentals of Macroeconomics/ An Overview of Indian Classical Dances	3

	Discipline Specific Practical	Machine Learning-I Practical	1
		Database Management System Practical	1
		Advanced Statistical modelling and Predictive Analytics Practical	1
Total Credits			20

Data Structures and Algorithm Design

Course Name: Data Structures and Algorithm Design		Course Code:	
Session Per Week(1 session is 60 minutes)		3	
Credits		3	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal	-	15

Course outcomes:

1. Understand the basic concepts and principles of data structures and algorithms
2. Implement and analyse various data structures, such as arrays, linked lists, stacks, queues, trees, and graphs
3. Design and implement efficient algorithms for searching, sorting, and manipulating data
4. Analyze the complexity of algorithms using Big-O notation and understand the principles of algorithmic analysis
5. Apply different data structures and algorithms to solve real-world problems
6. Understand the importance of choosing the right data structure and algorithm for a given problem
7. Develop problem-solving and algorithmic thinking skills
8. Understand the trade-offs between different data structures and algorithms in terms of time and space complexity
9. Apply various data structures and algorithms in programming languages such as C, C++, Java, or Python

Unit	Content	No. of lectures
1: Fundamentals & Linear Data Structures	**1.1 Introduction:** Need of Data Structures in Data Science, Data vs Data Structure, Abstract Data Type (ADT), Algorithm basics and pseudocode, Time & space complexity (Big-O only – intuitive) **1.2 Linear Data Structures:** Arrays (1D, 2D, limitations, **sparse array and matrix**), Stacks (implementation + applications: expression evaluation, push & Pop), Queues (simple queue, circular queue, priority queue – **Insertion and Deletion**), Linked Lists (Singly & Doubly only, Traversing, Insertion, Deletion, representing and solving polynomial expression) **1.3 Recursion:** Concept and simple examples, comparison with iteration, advantages and limitations of recursion	**15**
2: Non-Linear Data Structures	**2.1 Trees:** Basic terminology, Binary Tree and traversal (Inorder, Preorder, Postorder), Binary Search Tree (insert, search, delete) **Heaps & Priority Queues:** Heap concept (Min/Max Heap) , Basic operations (insert, delete), Application in priority queues	**15**

	Graphs: Introduction and applications, Representation (Adjacency matrix & list), Traversals: BFS and DFS	
3: Algorithms & Problem Solving	**Algorithm Design Techniques:** Divide & Conquer (basic idea + merge sort), Greedy (simple problems like activity selection), Introduction to Dynamic Programming (concept only) **Searching & Sorting:** Linear Search, Binary Search, Bubble Sort, Insertion Sort, Merge Sort, Quick Sort **Hashing:** Basic concept, Hash functions, Collision handling (chaining only)	**15**

Self – Learning Topics (Unit wise)

Sub Unit	Topics
1	Need of Data Structures in Data Science, Limitations of Array, Applications of stack, Skip Lists. Advantages and Limitations of Recursion.
2	Definitions and Concepts, Representation of binary tree, Binary tree traversal (In order, post order, preorder). Representation of graphs (adjacency matrix, adjacency list), Graph traversal algorithms: BFS, DFS.
3	Divide & Conquer (basic idea), Greedy (simple problems like activity selection), Binary Search.

Course Name: Data Structure and Algorithm Design Practical	**Course Code**	
Session Per Week (1 session is 60 minutes)	**2**	
Credits	**1**	

Suggestive List of Practical: Data Structure and Algorithm Design Practical	
1	Practical to implement various operations of Single and Multi-dimensional Arrays, Sparse Matrices
2	Practical to demonstrate push and pop operations in stack.
2	Practical based on conversion of expressions from one to another using stacks.
3	Practical to implement various operations of singly linked list
4	Practical to implement various operations of doubly linked list
5	Practical to implement various operations of queue
6	Practical based on BST
7	Practical based on priority queue
8	Implementing sorting algorithms
9	Implementing searching algorithms
10	Practical based on Hash functions

Reference books:

1. Problem Solving with Algorithms and Data Structures using Python, Bradley N. Miller and David L. Ranum, Franklin, Beedle & Associates
2. Data Structures and Algorithms in Python, Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Wiley Publications

3. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
4. An Introduction to Data Structures with Applications by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill
5. Data Structures, by S. Lipschutz
6. Python Data Structures and Algorithms, Benjamin Baka
7. Grokking Algorithms, Aditya Bhargava, Manning Publications

Python Programming

Course Name: Python Programming		**Course Code:**	
Session Per Week (1 session is 60 minutes)		**3**	
Credits		**3**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2**	**60**
	Internal	**-**	**15**

Course outcome:

1. Understand the basics of Python programming language, including syntax, data types, and control structures.
2. Develop problem-solving skills using Python through hands-on programming exercises and projects.
3. Learn how to work with various data structures in Python, such as lists, dictionaries, and tuples.
4. Gain proficiency in writing functions and modules to create reusable code.
5. Learn how to handle exceptions and errors in Python programs.
6. Understand the concept of object-oriented programming in Python, including classes and inheritance.
7. Gain knowledge of how to work with files and databases using Python.
8. Learn how to use popular libraries and frameworks in Python, such as NumPy, Pandas, and Django.
9. Develop skills in web scraping, data analysis, and visualization using Python.
10. Gain practical experience in building and deploying Python applications.

Unit	Content	No. of lectures
1	Introduction to Python programming, key words and identifiers, basic data types, Variables, Lists, Tuples and Strings, Dictionaries and sets, operators. **Numpy arrays**: Creating arrays crating n-dimensional arrays using np.array and array operations(indexing and slicing, transpose, mathematical operations) , Control statements: if, if-else, if-else-if, while loop, for loop **Functions**: built in functions, user-defined functions, defining functions, Recursion Different searching & sorting algorithms.	**15**
2	Classes and objects, methods, constructors, inheritance, polymorphism, exceptional handling, file input/ output. Modules & packages Introducing Pandas Objects, Creating series and data frames and Operations on series and data frames Reading and writing data: From and to Excel and CSV files Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Datasets: Concat and Append, Combining Datasets: Merge and Join, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series, High-Performance **Pandas:** eval() and query().	**15**

3	**Data Handling and Visualisation:** **Data Manipulation**: Selecting random N rows, removing duplicate row(s), dropping a variable(s), Renaming variable(s), sub-setting data, creating a new variable(s), selecting of random fraction of row(s), appending of row(s) and column(s), simulation of variables. **Data Processing:** Data import and export, setting working directory, checking structure of Data, Changing type of variable, Data split into training and Test **Data Visualization:** Simple bar diagram, subdivided bar diagram, multiple bar diagram, pie diagram, Box plot for one and more variables, histogram, frequency polygon, scatter plot, correlation plot Time series, Relationship maps, Heat maps, Geo Maps, 3-D Plots, Higher Dimensional Plots, Word clouds using Matplotlib, Plotly, Seaborn, ggplot2, Creating Dashboard, Comparison of Data Sets and Storytelling with using Panda Profiling, Sweetviz, Autoviz. Story telling on Data Sets Iris /Pigeons/Car Design Data Set.	**15**

Self – Learning Topics (Unit wise)

Sub Unit	Topics
1	Introduction to Python programming, key words and identifiers, basic data types, Variables, Lists, Tuples and Strings, Dictionaries and sets, operators.
2	Reading and writing data: From and to Excel and CSV files Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data
3	Simple bar diagram, subdivided bar diagram, multiple bar diagram, pie diagram, Box plot for one and more variables, histogram, frequency polygon, scatter plot using Matplotlib, Plotly, Seaborn, ggplot2

Course Name: Python Programming Practical	**Course Code**	
Session Per Week (1 session is 60 minutes)	**2**	
Credits	**1**	

Suggestive list of Practical: Python programming Practical	
1	**Practical based on basic python operators**
2	**Practical based on basic python functions**
3	**Practical based on creating an array**
4	**Practical based on array operators**
5	**Practical based on creating data frame**
6	**Practical based on data frame operators**
7	**Practical based on creating pivot table**
8	**Practical based on combining datasets**
9	**Practical based on data manipulation**
10	**Practical based on data visualization**

Reference books:

1	Mark Lutz: Programming Python, O'Reilly Media, 4th Edition.
2	Wes McKinney: Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, O'Reilly Media, 2nd Edition.
3	Kenneth A. Lambert: The Fundamentals of Python: First Programs, 2011, Cengage Learning.

Calculus for Data Science & Optimization

Course Name: Calculus for Data Science & Optimization		**Course Code:**	
Session Per Week (1 session is 60 minutes)		**3**	
Credits		**3**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2**	**60**
	Internal	**-**	**15**

Course Outcomes

After completing the course the students will be able to:

CO1: Apply concepts of limits, continuity, and differentiation to analyze functions of one variable.

CO2: Compute and interpret derivatives of functions and apply them to solve basic analytical problems.

CO3: Evaluate partial derivatives and gradients for functions of several variables.

CO4: Analyze and solve optimization problems involving single and multivariable functions.

CO5: Implement gradient-based optimization techniques using computational tools such as MATLAB.

Unit	Content	No. of Lectures
Unit I: Fundamentals of Univariate Calculus	1. Limits • Concept of limits and graphical interpretation • Algebra of limits • Standard limits and indeterminate forms 2. Continuity • Definition of continuity • Types of discontinuities • Continuity of elementary functions 3. Differentiation • Definition of derivative and formula • Rules of differentiation (sum, product, quotient, chain rule) • Higher-order derivatives 4. Derivatives of Standard Functions • Trigonometric, exponential, logarithmic functions • Implicit differentiation 5. Applications of Derivatives (Basic) • Tangents and normals • Increasing and decreasing functions	15
Unit 2: Multivariable Calculus and Partial Differentiation	1.Functions of Several Variables • Definition and examples • Graphical representation of curves 2. Partial Derivatives • Definition and computation • Higher-order partial derivatives 3. Chain Rule and Total Derivatives • Chain rule for multivariable functions • Total differentiation 4. Gradient and Directional Derivatives • Gradient vector and its properties • Directional derivatives and geometric interpretation 5. Applications of Partial Differentiation • Tangent planes and normal lines • Basic problems involving multivariable functions	15
Unit 3: Applications of Differentiation and Optimization	1. Extreme Value Problems (Single Variable) • Local maxima and minima • First and second derivative tests • Optimization problems 2. Optimization in Several Variables • Critical points • Second derivative test for functions of two variables • Constrained and unconstrained optimization (basic idea) 3. Gradient-Based Optimization • Concept of gradient descent • Algorithm and working principle • Learning rate and convergence 4. Applications in Real Life • Cost, profit, and revenue optimization • Engineering and data science applications	

Course Name: Calculus for Data Science & Optimization Practical	Course Code	
Session Per Week (1 session is 60 minutes)	**2**	
Credits	**1**	

Suggestive List of Practical:

Practical should be based on:

7. Plotting functions and evaluating limits graphically using MATLAB
8. Numerical differentiation and visualization of derivatives
9. Computation of partial derivatives and gradient using MATLAB
10. Visualization of multivariable functions (surface plots and contour plots)
11. Solving optimization problems (maxima/minima) using MATLAB
12. Implementation of Gradient Descent algorithm in MATLAB

Reference Books:

1. Carr, Mike. *Advanced Calculus for Data Science*. 1st Edition. CRC Press.
2. Stewart, James. *Calculus: Early Transcendentals*. 8th Edition. Cengage Learning, 2015.
3. Stewart, James. *Multivariable Calculus*. 8th Edition. Cengage Learning, 2016.
4. Kreyszig, Erwin. *Advanced Engineering Mathematics*. 10th Edition. Wiley, 2011.
5. Bittinger, Marvin L. *Calculus and Its Applications*. 10th Edition. Pearson, 2015.

Online Resources

Multivariate Calculus by Prof. S. K. Gupta, Prof. Sanjeev Kumar from IIT Roorkee available on the Swayam portal https://onlinecourses.nptel.ac.in/noc26_ma61/preview
Optimisation for Machine Learning: Theory and Implementation by Prof. Pravesh Biyani from IIT Delhi available on the Swayam portal https://onlinecourses.nptel.ac.in/noc26_cs78/preview

Skill Enhancement Program

Visual Analytics using Tableau & Power BI

Course Name: Visual analytics using Tableau & Power BI		Course Code:	
Session Per Week (1 session is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2	50

Course outcomes:

1. Ability to create visually appealing and interactive data visualizations using Power BI and Tableau tools.
2. Proficiency in connecting, importing, and transforming data from various sources to create insightful reports and dashboards.
3. Understanding of data analysis techniques and best practices for using Power BI and Tableau to interpret and communicate data effectively.
4. Knowledge of how to customize and format visualizations to present data in a clear and engaging manner.
5. Skills in collaborating and sharing reports with team members and stakeholders using Power BI and Tableau sharing features.
6. Understanding of how to leverage advanced features in Power BI and Tableau to perform complex data analysis and create dynamic visualizations.
7. Ability to use Power BI and Tableau to monitor and analyse key performance indicators (KPIs) and make data-driven decisions.
8. Confidence in applying Power BI and Tableau skills in real-world business scenarios to solve complex data visualization challenges.

Unit	Content	No. of Lectures
1	**1. Introduction** 1.1 Introduction to Data Literacy: Introduction & Exploring Data 1.2 Recognizing Well-Structured Data: Data Characteristics, Data Organization & Data Restructuring 1.3 Exploring Variables and Field Types: Understanding variable types and field types, View variables in visualizations, Discrete and continuous variables 1.4 Exploring Aggregation and Granularity: Exploring aggregation, and Exploring granularity 1.5 Understanding Distributions: Distribution of discrete variables & Distributions of continuous variables—histograms Distributions of continuous variables—box plots	15

	1.6 Discover data analysis Introduction Overview of data analysis Roles in data Tasks of a data analyst **2. Power BI** 2.1 Get started with Power BI Building blocks of Power BI Tour and use of Power BI 2.2 Import data into power BI Introduction Import data from: • Files (csv, Excel) • Relational data source • NoSQL database • online services • Azure Analysis Services Selecting a storage mode and its significance Fixing performance issues Resolving data import errors 2.3 Clean, transform, and load data in Power BI Introduction Shape the initial data Simplify the data structure Evaluate and change column data types Combine multiple tables into a single table Profile data in Power BI Use Advanced Editor to modify M code 2.4 Design a semantic model in Power BI Introduction Work with tables Create a date table Work with dimensions Define data granularity Work with relationships and cardinality 2.5 Create a Pivot Table and Chart in Power BI on the data imported. 2.6 Add calculated tables and conditional columns to Power BI Desktop models Introduction Create Calculated Columns Learn about row context Choose a technique to add a column 2.7 Add measures to Power BI Desktop models Introduction to DAX and Measures Create simple measures Create compound measures Create quick measures Compare calculated columns with measures 2.8 Optimize a model for performance in Power BI Introduction to performance optimization Review performance of measures, relationships, and visuals Optimize DirectQuery models with table level storage Design visually appealing reports	

	Select report visuals Select report visuals to suit the report layout Format and configure visualizations Work with key performance indicators 2.9 Configure Power BI report filters Introduction to designing reports for filtering Apply filters to the report structure Apply filters with slicers Work with bookmarks	
2	**Introduction to Tableau** 3.1 Connect to and Customize Data Connecting to Data Customizing a Data Source Working with a Data Extract 3.2 Organize Data and Create Filters Creating Groups in Your Data Creating Hierarchies in Your Data Understanding Filtering in Tableau Filtering Your Data Sorting Your Data Using Sets to Highlight Data 3.3 Build Common Views Working with Dates to Visualize Time-Based Data Creating Custom Date Fields and Hierarchies Comparing Multiple Measures in Views Using Scatter Plots to Show Relationships Between Measures Creating Spreadsheet-like Views Using Text Tables Using a Highlight Table to Show Specific Values Showing Breakdowns of the Whole Using Pie Charts Showing Breakdowns of the Whole Using Tree Maps Using Bar-in-Bar Charts and Bullet Graphs to Compare Measures 3.4 Map Geographic Data Creating Symbol and Filled Maps Creating a Density Map 3.5 Create Calculated Fields Creating Calculated Fields for Deeper Analysis Working with String and Type Conversion Functions Working with Date Functions Working with Aggregate Functions 3.6 Apply Table Calculations Using Quick Table Calculations to Analyze Data 3.7 Apply Analytics Highlighting Values with Reference Lines and Bands Using Parameters to Control Data in the View Using Histograms and Box & Whisker Plots to Show Distribution 3.8 Work with Multiple Data Sources Creating Relationships between Tables Joining Tables Using a Common Field Using Unions to Combine Data Blending Multiple Data Sources Using a Common Field 3.9 Create Dashboards and Stories Building a Dashboard	**15**

	Creating Interactive Dashboards Using Actions Refining a Dashboard Telling Stories with Data	

Self-learning Topics

Unit	Topics
1	**Introduction :** Introduction to Data Literacy: Introduction & Exploring Data 1.2 Recognizing Well-Structured Data: Data Characteristics, Data Organization & Data Restructuring Clean, transform, and load data in Power BI Shape the initial data Simplify the data structure Evaluate and change column data types
2	Connect to and Customize Data Connecting to Data Customizing a Data Source Scatter Plots, Working with Date Functions, Histograms and Box & Whisker Plots

Course Name: Visual analytics using Tableau & Power BI Practical		**Course Code:**	
Session Per Week (1 session is 60 minutes)		**2**	
Credits		**1**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**25**
	Internal	**-**	**-**

Suggestive List of Practical:

1. Introduction & Data Loading
2. Data Cleaning & Preparation
3. Basic Visualizations
4. Data Transformation
5. Interactive Dashboards
6. Time-Series Visualization
7. Geographical Visualization
8. Advanced Charts
9. Drill-Down & Drill-Through Features
10. KPI & Business Dashboard Design
11. Data Blending & Relationships
12. Storytelling with Data
13. Publishing & Sharing Reports
14. Real-World Case Study

Reference Books:

Power BI and Tableau: A Complete Guide for Beginners to Learn and Master Data Visualization with Power BI and Tableau by David Kelly
Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software" by Dan Murray
Practical Tableau: 100 Tips, Tutorials, and Strategies from a Tableau Zen Master" by Ryan Sleeper

Multi-Disciplinary Course

Predictive Analytics using SPSS

Course Name: Predictive Analytics using SPSS		Course Code:	
Session Per Week(1 session is 60 minutes)		3	
Credits		3	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal	-	15

Course outcome:

1. Demonstrate an understanding of basic statistical concepts and the role of SPSS in data analysis.
2. Identify and use appropriate data types and formats in SPSS for various types of data analysis.
3. Generate and interpret descriptive statistics using SPSS, including measures of central tendency, variability, and distribution.
4. Conduct hypothesis testing and interpret the results using various statistical tests in SPSS.
5. Create and customize visual representations of data in SPSS, such as charts and graphs.
6. Understand and apply statistical techniques for comparing groups and analysing relationships between variables in SPSS.
7. Evaluate and interpret output from statistical analyses in SPSS to draw meaningful conclusions and make data-driven decisions.
8. Demonstrate proficiency in using SPSS software to perform a wide range of data analysis tasks effectively and efficiently.
9. Apply ethical standards and best practices in data analysis using SPSS to ensure the accuracy and validity of results.
10. Communicate findings from data analysis in SPSS to various audiences effectively, both verbally and in writing.

Unit	Content	No. of Lectures
1	**Managing Data in SPSS** 1.1 Creating and Editing Data File 1.2 Data Manipulation: Sorting Data, Merging and Appending Data/files, Aggregating/summarizing Data, Reshaping Data, Recording Variables, Sub setting Data, Data Type Conversions, Sampling, Renaming-formatting data, Handling duplicates/Missing values, computing new variables, Selecting cases 1.3 Visualization for Univariate, Bivariate and Multivariate Data 1.4 Diagram Vs Graphs, Creating available Graphs, Histograms & Density Plot: • Dot Plots – Bar Plots(Column, Subdivided, Percentage)	15

	• Line Charts – Pie Charts –Boxplots – Scatterplots **Story telling on dataset Titanic dataset:** (http://biostat.mc.vanderbilt.edu/wiki/pub/Main/DataSets/titani c3.csv)	
2	**Multi-Dimensional Scaling (MDS) & Correspondence Analysis and Statistical Test:** 2.1 **Multi-Dimensional Scaling (MDS) & Correspondence Analysis:** • Objective of MDS, Comparing MDS to other interdependence techniques, Research design, Assumption of MDS, Deriving MDS & assessing over fit, Validating MDS, Objective of correspondence analysis., Research design, • Assumptions of correspondence analysis, Deriving of CA & assessing overall fit. 2.2 Reliability Analysis: Coefficient alpha and split half reliability 2.3 Cross tabulation and Chi Square Analyses, Cramer V, Phi, Fisher Exact Test, odds Ratio 2.4 ANOVA: Introduction, Model specification, Assumptions, • Post hoc Analysis for One Way and Two Way ANOVA **Story telling** using **grades.sav**Post hoc Analysis for One Way and Two Way ANOVA **Story telling** using **grades.sav**	**15**
3	**Statistical Modeling:** 3.1 **Bivariate Correlations, partial correlations, Multiple Correlations**: 3.2 Introduction, Examples, Scatter Diagram, Computation for quantitative and qualitative Data. **Story telling** using **grades.sav** 3.3 **Simple Linear Regression:** Introduction to linearity in parameters and variables, Linear Regression Vs Nonlinear Regression, Model and Assumptions, Residuals, R^2, adjusted R^2, Overall significance of model, Significance of Individual Coefficient, Confidence intervals for the regression coefficients. 3.4 **Multiple Linear Regression**: Model and Assumptions, correlation matrix, Forward Selection Method, Backward Selection Methods, Stepwise Selection Method, Variable Selection and Model Building. • First Order Test: Interpretation of output: Residuals, R^2, adjusted R^2, Overall significance of model, Significance of Individual Coefficient, Confidence intervals for the regression coefficients. • Second Order Test: Test for Autocorrelation detection and treatment, Multicolinearity detection and treatment, Hetroscaditicity detection and treatment, Outlier detection and treatment. **Story telling on dataset mtcars.** **Story telling on datasets a-year-of-pumpkin-prices data/ others (https://www.kaggle.com/usda/a-year-of-pumpkin-prices a)**	**15**

Teaching of the unit will be done through teaching mode and through self-learning mode. Evaluation of self-learning topics to be undertaken before the concluding lecture instructions of the respective UNIT.

Self-Learning topics (Unit wise)

Sub Unit	Topics
1	Formatting data, Handling duplicates/Missing values, computing new variables, selecting cases, Creating available Graphs, Histograms & Density Plot
2	Data Pre-processing, Chi Square Analyses, Cramer V, Phi, Fisher Exact Test, odds Ratio ANOVA: Introduction, Model specification, Assumptions, Post hoc Analysis for Two Way ANOVA

Reference books:

SPSS for Windows Step by Step A Simple Guide and Reference by Darren George and Paul Mallery, Pearson
Field, A. (2013). Discovering statistics using IBM SPSS statistics (4th ed.). SAGE Publications.
Brian C. Cronk, How to Use SPSS®: A Step-By-Step Guide to Analysis and Interpretation Paperback

GENERAL ELECTIVE

Course Title: Basics of Microeconomics

Credits: 3

Course Objectives (CO):

- Familiarise microeconomic concepts, including the Opportunity Cost Principle, Production Possibility Curve, demand and supply dynamics, elasticity, and consumer and producer surplus.
- Gain knowledge in production functions, cost and revenue concepts, break-even analysis, and market structures (Perfect Competition, Monopoly, Monopolistic Competition, and Oligopoly).

Learning Outcomes (LO):

- Remember fundamental concepts opportunity cost, production possibility curve, elasticity, and market structures.
- Understand the significance the significance of demand and supply functions, including shifts and equilibrium changes, in real-world market scenarios.
- Analyse different market structures (perfect competition, monopoly, monopolistic competition, and oligopoly) to identify how firms achieve equilibrium in different environment

Benchmark Intuitions:

- **Reserve Bank of India**
- **Indian Council for Research on International Economic Relations**

UNIT	Content	No. of Lectures
I	**Fundamentals of Market Analysis and Consumer Behaviour** 1.1 Scope & importance of Microeconomics Basic tools: Opportunity Cost Principle, Production possibility curve. 1.2 Demand & Supply function: Meaning, determinants & types. Shifts in the Demand and Supply Curves and Equilibrium , Applications of demand and supply analysis: Government intervention- price control and rationing 1.3 Elasticity: Meaning, Significance, Types and Measurement of Elasticity of Demand(Price, Income, Cross and Promotional),Relationship between Price Elasticity of Demand and Revenue Concepts. numerical on Elasticity.	**20**
II	**Production Economics** 2.1 Production Function: Meaning, Short Run Analysis with the law of Variable Proportion. Long Run Production Function: Law of Returns to scale, Economics and Diseconomies of scale. 2.2 Cost & Revenue Concepts-Accounting and economics cost, implicit and explicit cost, fixed and variable cost. Total, average and marginal cost. Revenue concepts: Types -Average, marginal and total revenue ,Numerical on output, cost, revenue and profit 2.3 Break Even Analysis (with business application)	**20**
III	**Market Structures** Market Structure: Perfect Competition - Features,. Monopoly- Features, Sources of monopoly power Monopolistic competition – Features , Oligopoly – Features	**5**

Self-Learning topics (Unit wise):

Sr. No	Unit	Topic
1	1	Relevance of Elasticity
2	2	Break Even Analysis
3	3	Forms of Market

Online Resources:

https://www.my-mooc.com/en/video/break-even-analysis-explained-1aa39463-b5aa-4209-beef-a510fb048aa9
https://onlinecourses.nptel.ac.in/noc22_hs42/preview

Reference Books

1. Mehta, P.L.: Managerial Economics – Analysis, Problem and Cases (S. Chand& Sons, N. Delhi, 2000)
2. Hirchey .M., Managerial Economics, Thomson South western (2003).
3. Salvatore, D.: Managerial Economics in a global economy (Thomson South Western Singapore, 2001)
4. Frank R.H, Bernanke.B.S.,Principles of Economics (Tata McGraw Hill (ed.3)
5. Gregory Mankiw., Principles of Economics, Thomson South western (2002)

Evaluation Pattern For 75 Marks

Summative Assessment	Formative Assessment	Total Marks
50	**25**	**75**

Evaluation Pattern
Formative Assessment
25 marks

Sr. No.	Particulars	Marks
1	Assignment/ SLE	20
3	Active participation in routine class instructional deliveries	05

Summative Assessment
Semester End Examination- 50 Marks

External Paper Pattern

Q.1	A or B (8marks) C or D (7marks)	15 Marks
Q2	A or B (8marks) C or D (7marks)	15 Marks
Q3	Attempt any 4 out of 6 (each is of 5 marks)	20 Marks

SEMESTER IV

Machine Learning – I

Course Name: Machine Learning-I		Course Code:	
Session Per Week (1 session is 60 minutes)		3	
Credits		3	
		Hours	Marks
Evaluation System	Theory Examination	2	60
	Internal	-	15
	Practical Examination	2	25

Course Objectives

- To introduce the **fundamental concepts of Machine Learning** and its role in data science.
- To provide knowledge of **basic supervised machine learning algorithms** such as regression, classification.
- To develop skills for **data pre-processing, feature selection, and model building**.
- To enable students to **evaluate and compare machine learning models** using performance metrics.

Course Outcomes

After completion of this course, students will be able to:

CO1: understand the **fundamental concepts of Machine Learning** and its role in data science.

CO2: gain knowledge of **basic supervised machine learning algorithms** such as regression, classification.

CO3: develop skills for **data pre-processing, feature selection, and model building**.

CO4: evaluate and compare machine learning models using performance metrics

Unit	Content	No. of Lectures
Unit I: Introduction to Machine Learning & Data Pre-processing	**Introduction:** Definition and scope of Machine Learning, Applications **Types of learning:** Supervised and Unsupervised Learning, Reinforcement learning **Machine Learning Process:** Data collection and data understanding, Feature Engineering, Model training and testing, Model evaluation and deployment overview **Data Pre-processing:** Data cleaning techniques, Handling missing values, Outlier detection **Feature Engineering:** Encoding categorical variables (Label, One-hot encoding), Feature selection techniques, Dimensionality basics	15
Unit 2: Supervised Learning – Regression	**Model Evaluation Basics:** Train-test split, Cross-validation, Overfitting and Underfitting, Bias-Variance concept **Introduction to Regression:** Concept and types of regression, Simple Linear and Multiple Linear regression **Advanced Regression:** Polynomial Regression **Model Evaluation Metrics:** Mean Absolute Error (MAE), Mean Squared Error (MSE), Root Mean Squared Error (RMSE), R^2 and Adjusted R^2 **Applications:** Sale Forecasting, Demand Prediction	15
Unit 3: Supervised Learning – Classification	**Introduction to Classification:** Classification vs Regression **Classification Algorithms:** Logistic Regression, Decision Tree Classifier **Model Evaluation:** Confusion Matrix, Accuracy, Precision, Recall, F1-score **Applications:** Spam detection, Customer churn prediction	15

Self – Learning Topics (Unit wise)

Unit	Topics
1	**Introduction:** Definition and scope of Machine Learning, Applications, **Machine Learning Process:** Data collection and data understanding, **Data Pre-processing:** Data cleaning techniques
2	Train-test split, Concept and types of regression **Applications:** Sale Forecasting, Demand Prediction
3	**Introduction to Classification:** Classification vs Regression **Applications:** Spam detection, Customer churn prediction

Course Name: Machine Learning I Practical	**Course Code:**

Session Per Week(1 session is 60 minutes)		**2**	
Credits		**1**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**25**
	Internal	**-**	**-**

Suggestive List of Practical:

Practical should be based on:

- Data Pre-Processing
- Implementation of Regression models
- Implementation of Classification Models
- Case Study on Dataset analysis.

Reference Books:

1. Babcock, J. (2016), Mastering Predictive Analytics with Python, PACKT Open Source
2. Konasani, Venkata Reddy & Kadre, Shailendra, Machine Learning and Deep Learning Using Python and TensorFlow, McGraw Hill
3. Miller, J. D. & Forte, R. M. (2015), Mastering Predictive Analytics with R (2nd Ed.), PACKT Open Source
4. Lantz, B. (2013), Machine Learning with R (2nd Ed.), PACKT Open Source
5. Kuhn, Max & Johnson, Kjell, Applied Predictive Modeling
6. Géron, Aurélien, Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow, O'Reilly
7. Müller, Andreas C. & Guido, Sarah, Introduction to Machine Learning with Python
8. James, Gareth et al., An Introduction to Statistical Learning
9. Kelleher, John D. et al., Fundamentals of Machine Learning for Predictive Data Analytics
10. Mitchell, Tom M., Machine Learning

Database Management System

Course Name: Database Management System		**Course Code:**	
Session Per Week (1 session is 60 minutes)		**3**	
Credits		**3**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2**	**60**
	Internal	**-**	**15**

Course outcome:

1. To define program-data independence, data models for database systems, database schema and database instances.
2. To recall Relational Algebra concepts, and use it to translate queries to Relational Algebra.
3. To classify the methodology of conceptual modeling through Entity Relationship model.
4. To identify the methodology of logical model and also identify the methodology of physical model.

To distinguish Structure Query Language statements used in creation and manipulation of database

Unit	Content	No. of lectures
1	**1.1 Introduction to DBMS:** Database, DBMS – Definition, Overview of DBMS, Advantages of DBMS, Levels of abstraction, Data independence, DBMS Architecture **1.2 Data models:** Architecture (1-tier, 2-tier, 3-tier and N-tier), Relational, Hierarchical, Network Data Model **1.3 Entity Relationship Model:** Entities, attributes, entity sets, relations, relationship sets, weak entities, aggregation / generalization, Conceptual Design using ER (entities VS attributes, Entity Vs relationship, binary Vs ternary, constraints beyond ER) **1.4 ER to Table**: Entity to Table, Relationship to tables with and without key constraints. **1.5 Transaction management:** Transaction, Concurrency, ACID Properties, States of Transaction **1.6 Schema refinement and Normal forms:** Functional dependencies, first, second, third, and BCNF normal forms	**15**
2	**2.1 Relational Algebra:** operations (selection, projection, set operations, union, intersection, difference, cross product, Joins – conditional, equijoin and natural joins, division) **2.2 Categories of SQL Commands:** Creating Databases, Using Database, Data Definition Language, Data Manipulation Language, Data Control Language and Transaction Control Language, Backing Up and Restoring databases **2.3 Integrity Constraints:** Integrity of Data, Entity Integrity Constraints (Primary, Unique, Composite Keys), Domain Integrity Constraint (Check, Not NULL), Referential Integrity Constraints **2.4 Aggregate Functions:** Definition, Average, Count, Sum, Min,	**15**

	Max, Group by and Having Clause **2.5 Clauses:** IN, Between, Distinct, LIKE operator, Limit, Offset, Order By	
3	**3.1 Functions:** String Functions (concat, instr, left, right, mid, length, lcase/lower, ucase/upper, replace, strcmp, trim, ltrim, rtrim), Math Functions (abs, ceil, floor, mod, pow, sqrt, round, truncate) Date Functions (adddate, datediff, day, month, year, hour, min, sec, now, reverse) **3.2 Joining Tables:** inner join, outer join (left outer, right outer, full outer), Cross Join **3.3 Sub queries:** Sub queries with IN, EXISTS, sub queries restrictions, Nested sub queries, ANY/ALL clause, correlated sub queries **3.4 Database Protection:** Security Issues, Threats to Databases, Security Mechanisms, Role of DBA, Discretionary Access Control **3.5 Views:** Creating, altering dropping, renaming and manipulating views	**15**

Self – Learning Topics (Unit wise)

Sub Unit	Topics
1	**Entity Relationship Model:** Entities, attributes, entity sets, relations, relationship sets, weak entities, aggregation / generalization, Conceptual Design using ER (entities VS attributes, Entity Vs relationship, binary Vs ternary, constraints beyond ER)
2	**Relational Algebra:** operations (selection, projection, set operations, union, intersection, difference, cross product, Joins –conditional, equijoin and natural joins, division)
3	**Database Protection:** Security Issues, Threats to Databases, Security Mechanisms, Role of DBA, Discretionary Access Control

Course Name: Database Management System Practical	**Course Code**	
Session Per Week (1 session is 60 minutes)	**2**	
Credits	**1**	

Suggestive list of Practical: Database Management System Practical	
1	For given scenario, Draw E-R diagram and convert entities and relationships to table.
2	Write relational algebra queries on the tables created in Practical-1.
3	Perform queries for: Viewing all databases, creating a Database, viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table, Saving (Commit) and Undoing (rollback)
4	Perform queries for: Altering a Table, Dropping / Truncating / Renaming Tables, backing up / Restoring a Database

5	Perform queries for: Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause)
6	Queries involving: Date Functions, String Functions, Math Functions
7	Join Queries: Inner Join, Outer Join, Full Outer Join
8	Sub queries: With IN clause, With EXISTS clause
9	Views: Creating Views (with and without check option), Dropping views, Selecting from a view
10	DCL statements: Granting and revoking permissions.

Reference books:

1.	Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education, Sixth Edition, 2010.
2.	Ramakrishnam Gehrke, Database Management Systems, McGraw-Hill, 2007.
3.	Joel Murach, Murach's MySQL, Murach, 2012.
4.	Avi Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, McGraw-Hill

Advanced Statistical Modelling and Predictive Analytics

Course Name: Advanced Statistical Modelling and Predictive Analytics		**Course Code:**	
Sessions Per Week (1 session is 60 minutes)		**3**	
Credits		**3**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2**	**60**
	Internal	**-**	**15**
	Practical Examination	**2**	**25**

Course outcome:

1. Demonstrate an understanding of basic statistical concepts and the role of SPSS in data analysis.
2. Identify and use appropriate data types and formats in SPSS for various types of data analysis.
3. Generate and interpret descriptive statistics using SPSS, including measures of central tendency, variability, and distribution.
4. Create and customize visual representations of data in SPSS, such as charts and graphs.
5. Understand and apply statistical techniques for comparing groups and analysing relationships between variables in SPSS.
6. Evaluate and interpret output from statistical analyses in SPSS to draw meaningful conclusions and make data-driven decisions.
7. Perform Exploratory and Confirmatory Factor Analysis (EFA & CFA) to validate factor structures.
8. Integrate mediating and moderating variables in SEM to explore complex relationships.
9. Implement advanced SEM techniques like mediation, moderation, and mediated moderation.

Unit	Content	No. of Lectures
1	Managing Data in SPSS Creating and Editing Data File Data Manipulation: Sorting Data, Merging and Appending Data/files, Aggregating/summarizing Data, Reshaping Data, Recording Variables, Sub setting Data, Data Type Conversions, Sampling, Renaming-formatting data, Handling duplicates/Missing values, computing new variables, Selecting cases Visualization for Univariate, Bivariate and Multivariate Data Diagram Vs Graphs, Creating available Graphs, Histograms & Density Plot: • Dot Plots – Bar Plots (Column, Subdivided, Percentage) • Line Charts – Pie Charts –Boxplots – Scatterplots	**15**
2	Reliability Analysis: Coefficient alpha and split half reliability	**15**

	Cross tabulation and Chi Square Analyses, Cramer V, Phi, Fisher Exact Test, odds Ratio ANOVA: Introduction, Model specification, Assumptions, Post hoc Analysis for One Way and Two Way ANOVA **Bivariate Correlations, partial correlations, Multiple Correlations**: Introduction, Examples, Scatter Diagram, Computation for quantitative and qualitative Data. **Simple Linear Regression:** Introduction to linearity in parameters and variables, Linear Regression Vs Nonlinear Regression, Model and Assumptions, Residuals, R^2, adjusted R^2, Overall significance of model, Significance of Individual Coefficient, Confidence intervals for the regression coefficients. **Multiple Linear Regression**: Model and Assumptions, correlation matrix, Forward Selection Method, Backward Selection Methods, Stepwise Selection Method, Variable Selection and Model Building. • First Order Test: Interpretation of output: Residuals, R^2, adjusted R^2, Overall significance of model, Significance of Individual Coefficient, Confidence intervals for the regression coefficients. • Second Order Test: Test for Autocorrelation detection and treatment, Multicolinearity detection and treatment, Hetroscaditicity detection and treatment, Outlier detection and treatment.	
3	Exploratory and Confirmatory Factor Analysis: conceptualization, Difference between exploratory & confirmatory factor analysis Objective of EFA, EFA model & assessing measurements, Model validity Objective of CFA, CFA model & assessing measurements, Model validity Developing Path Diagrams, Developing Overall Models and identifying Issues, Key Decision Area: Identification and Estimation Interpretation, Model Validity: 4 types of validity, Bootstrapping, Model Diagnostics' Basics of Structural Equation Modelling (SEM) Mediation Analysis in SEM: incorporating mediating variables Moderation Analysis in SEM: incorporating moderating variables Mediated Moderation Analysis: incorporating both	**15**

Self-Learning topics (Unit wise)

Sub Unit	Topics
1	Formatting data, Handling duplicates/Missing values, Computing new variables, Selecting cases, Creating available Graphs, Histograms & Density Plot
2	Chi Square Analyses, Cramer V, Phi, Fisher Exact Test, odds Ratio ANOVA: One Way and Two Way ANOVA
3	Objective of EFA, EFA model & assessing measurements, Model validity, Mediation Analysis in SEM: incorporating mediating variables

Reference books:

SPSS for Windows Step by Step A Simple Guide and Reference by Darren George and Paul Mallery, Pearson
Field, A. (2013). Discovering statistics using IBM SPSS statistics (4th ed.). SAGE Publications.
Brian C. Cronk, How to Use SPSS: A Step-By-Step Guide to Analysis and Interpretation Paperback
Mike W.L.Cheung, Meta Analysis: A structural equation modeling Approach,Wiley
Rex B. Kline(2011), Principles and Practice of Structural Equation Modeling, Third Edition, TheGuilford Press, New York London
Joseph F. Hair Jr. William C. Black Barry J. Babin Rolph E. Anderson, Multivariate Data Analysis, Pearson New International Edition, 7th Edition

Course Name: Advanced Statistical Modelling and Predictive Analytics Practical	**Course Code**
Sessions Per Week (1 session is 60 minutes)	**2**
Credits	**1**

Suggestive List of Practical: Advanced Statistical Modelling and Predictive Analytics Practical	
1	Data Creation and Preparation
2	Data Manipulation and Transformation
3	Data Visualization
4	Reliability and Association Analysis
5	ANOVA and Correlation Analysis
6	Regression and Advanced Modelling

Skill Enhancement Course

Business Analytics

Course Name: Business Analytics		Course Code:	
Session Per Week (1 session is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	1.5	50

Course outcome:

CO1: Understand the fundamentals of business analytics and the importance of data-driven decision making.
CO2: Describe key concepts, applications, and challenges of data mining in business contexts.
CO3: Analyze real-world case studies to interpret the role of data mining and analytics.
CO4: Identify different types of data, attributes, and perform basic statistical analysis.
CO5: Apply data visualization techniques to effectively present data and insights.
CO6: Understand and implement data pre-processing techniques such as cleaning, integration, and transformation.
CO7: Apply normalization, smoothing, and data reduction methods for data preparation.
CO8: Analyze associations and correlations to discover patterns and relationships in data.
CO9: Apply classification techniques such as decision trees and rule-based methods for prediction.
CO10: Evaluate models and interpret results to support business decision-making and problem solving.

Unit	Content	No. of lectures
1	**Business Analytics & Data Mining Foundations** 1.1 Business Analytics Overview: Introduction to startup landscape, product lifecycle management, basics of business analytics, and competing on analytics. 1.2 Fundamentals of Data Mining: Basic concepts, need, applications, challenges, case studies, OLAP, and major issues in data mining. 1.3 Data Understanding: Types of data, statistical description, data visualization, and measures of similarity and dissimilarity.	15
2	**Data Preparation & Mining Techniques** 2.1 Data Pre-processing: Overview, data cleaning, integration, reduction, transformation, discretization, normalization, and smoothing of data. 2.2 Association & Correlation: Basic concepts, methods of association rule mining, and correlation analysis. 2.3 Classification Techniques: Basic concepts, decision tree induction, rule-based classification, and model evaluation and selection.	15

Self – Learning Topics (Unit wise)

Sub Unit	Topics
1	basics of business analytics,

	Types of data, statistical description, data visualization, and measures of similarity and dissimilarity.
2	data cleaning, integration, reduction, smoothing of data, correlation analysis.

Course Name: Business Analytics Practical	**Course Code**	
Session Per Week (1 session is 60 minutes)	**2**	
Credits	**1**	

List of Practical: Business Analytics Practical	
1	Leveraging Business Analytics for Startup Growth
2	Exploring Real-World Data Mining Applications
3	Understanding and Visualizing Business Data
4	Preparing Data for Effective Analysis
5	Discovering Patterns Through Association and Correlation
6	Building Predictive Models with Classification Techniques

Reference books:

1	Dunham, Margaret H, Data Mining: Introductory and Advanced Topics, Prentice Hall.
2	Witten, Ian and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Second Edition, Morgan Kaufmann.
3	Han, J., Kamber, M., & Pei, J. Data mining: Concepts and techniques (3rd ed.). Waltham: Morgan Kaufmann, 2011.
4	Baeza and Yates, Modern Information Retrieval, Addison Wesley.
5	Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw – Hill.
6	Ramez elmasri and shamkant b.Navathe,“fundamental data base systems”, third edition, Pearson Education,2008.

Multi-Disciplinary

Visual Analytics using Tableau & Power BI

Course Name: Visual representation using Tableau & Power BI		Course Code:	
Session Per Week (1 session is 60 minutes)		2	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2	50

Course outcomes:

1. Ability to create visually appealing and interactive data visualizations using Power BI and Tableau tools.
2. Proficiency in connecting, importing, and transforming data from various sources to create insightful reports and dashboards.
3. Understanding of data analysis techniques and best practices for using Power BI and Tableau to interpret and communicate data effectively.
4. Knowledge of how to customize and format visualizations to present data in a clear and engaging manner.
5. Skills in collaborating and sharing reports with team members and stakeholders using Power BI and Tableau sharing features.
6. Understanding of how to leverage advanced features in Power BI and Tableau to perform complex data analysis and create dynamic visualizations.
7. Ability to use Power BI and Tableau to monitor and analyse key performance indicators (KPIs) and make data-driven decisions.
8. Confidence in applying Power BI and Tableau skills in real-world business scenarios to solve complex data visualization challenges.

Unit	Content	No. of Lectures
1	**1. Introduction** 1.1 Introduction to Data Literacy: Introduction & Exploring Data 1.2 Recognizing Well-Structured Data: Data Characteristics, Data Organization & Data Restructuring 1.3 Exploring Variables and Field Types: Understanding variable types and field types, View variables in visualizations, Discrete and continuous variables 1.4 Exploring Aggregation and Granularity: Exploring aggregation, and Exploring granularity 1.5 Understanding Distributions: Distribution of discrete variables & Distributions of continuous variables—histograms Distributions of continuous variables—box plots 1.6 Discover data analysis Introduction	15

Overview of data analysis
Roles in data
Tasks of a data analyst

2. Power BI

2.1 Get started with Power BI

Building blocks of Power BI
Tour and use of Power BI

2.2 Import data into power BI

Introduction
Import data from:

- Files (csv, Excel)
- Relational data source
- NoSQL database
- online services
- Azure Analysis Services

Selecting a storage mode and its significance
Fixing performance issues
Resolving data import errors

2.3 Clean, transform, and load data in Power BI

Introduction
Shape the initial data
Simplify the data structure
Evaluate and change column data types
Combine multiple tables into a single table
Profile data in Power BI
Use Advanced Editor to modify M code

2.4 Design a semantic model in Power BI

Introduction
Work with tables
Create a date table
Work with dimensions
Define data granularity
Work with relationships and cardinality

2.5 Create a Pivot Table and Chart in Power BI on the data imported.

2.6 Add calculated tables and conditional columns to Power BI Desktop models

Introduction
Create Calculated Columns
Learn about row context
Choose a technique to add a column

2.7 Add measures to Power BI Desktop models

Introduction to DAX and Measures
Create simple measures
Create compound measures
Create quick measures
Compare calculated columns with measures

2.8 Optimize a model for performance in Power BI

Introduction to performance optimization
Review performance of measures, relationships, and visuals
Optimize DirectQuery models with table level storage
Design visually appealing reports
Select report visuals
Select report visuals to suit the report layout

	Format and configure visualizations Work with key performance indicators 2.9 Configure Power BI report filters Introduction to designing reports for filtering Apply filters to the report structure Apply filters with slicers Work with bookmarks	
2	**Introduction to Tableau** 3.1 Connect to and Customize Data Connecting to Data Customizing a Data Source Working with a Data Extract 3.2 Organize Data and Create Filters Creating Groups in Your Data Creating Hierarchies in Your Data Understanding Filtering in Tableau Filtering Your Data Sorting Your Data Using Sets to Highlight Data 3.3 Build Common Views Working with Dates to Visualize Time-Based Data Creating Custom Date Fields and Hierarchies Comparing Multiple Measures in Views Using Scatter Plots to Show Relationships Between Measures Creating Spreadsheet-like Views Using Text Tables Using a Highlight Table to Show Specific Values Showing Breakdowns of the Whole Using Pie Charts Showing Breakdowns of the Whole Using Tree Maps Using Bar-in-Bar Charts and Bullet Graphs to Compare Measures 3.4 Map Geographic Data Creating Symbol and Filled Maps Creating a Density Map 3.5 Create Calculated Fields Creating Calculated Fields for Deeper Analysis Working with String and Type Conversion Functions Working with Date Functions Working with Aggregate Functions 3.6 Apply Table Calculations Using Quick Table Calculations to Analyze Data 3.7 Apply Analytics Highlighting Values with Reference Lines and Bands Using Parameters to Control Data in the View Using Histograms and Box & Whisker Plots to Show Distribution 3.8 Work with Multiple Data Sources Creating Relationships between Tables Joining Tables Using a Common Field Using Unions to Combine Data Blending Multiple Data Sources Using a Common Field 3.9 Create Dashboards and Stories Building a Dashboard Creating Interactive Dashboards Using Actions Refining a Dashboard Telling Stories with Data	**15**

Self learning Topics

Unit	Topics
1	**Introduction :** Introduction to Data Literacy: Introduction & Exploring Data 1.2 Recognizing Well-Structured Data: Data Characteristics, Data Organization & Data Restructuring Clean, transform, and load data in Power BI Shape the initial data Simplify the data structure Evaluate and change column data types
2	Connect to and Customize Data Connecting to Data Customizing a Data Source Scatter Plots, Working with Date Functions, Histograms and Box & Whisker Plots

Course Name: Visual representation using Tableau & Power BI Practical		**Course Code:**	
Session Per Week(1 session is 60 minutes)		**2**	
Credits		**1**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**25**
	Internal	**-**	**-**

Suggestive List of Practical:

1. Introduction & Data Loading
2. Data Cleaning & Preparation
3. Basic Visualizations
4. Data Transformation
5. Interactive Dashboards
6. Time-Series Visualization
7. Geographical Visualization
8. Advanced Charts
9. Drill-Down & Drill-Through Features
10. KPI & Business Dashboard Design
11. Data Blending & Relationships
12. Storytelling with Data
13. Publishing & Sharing Reports
14. Real-World Case Study

Reference Books:

Power BI and Tableau: A Complete Guide for Beginners to Learn and Master Data Visualization with Power BI and Tableau by David Kelly
Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software" by Dan Murray
Practical Tableau: 100 Tips, Tutorials, and Strategies from a Tableau Zen Master" by Ryan Sleeper

General Elective

Course Title: Basics of Macroeconomics

Credits: 3

Course Objective (CO):

- Understand macroeconomic principles such as the circular flow of income, national income measurement, business cycles, inflation, and monetary policy
- Explore fiscal policy, budgetary structures, foreign investments (FDI and FPI), balance of payments, and foreign exchange markets.
- Prepare learners to apply the knowledge of macroeconomics concepts in national and global economic scenarios.

Learning Outcomes (LO):

- Evaluate fiscal and monetary policies, including their objectives and instruments, to determine their effectiveness in managing economic growth and stability.
- To critically assess the merits and demerits of FDI and FPI for domestic and global economies.

Benchmark Intuitions:

- **Reserve Bank of India**
- **Indian Council for Research on International Economic Relations**

UNIT	Content	No. of Lectures
I	**Introduction to Macro Economics and National Income** 1.1 Macroeconomics: scope and significance; Circular flow of income-closed economy: two- sector and three-sector models, open economy: four sector model, Leakages and injections - their impact on circular flow of income. 1.2 Concepts of national Income: GNP, GDP, NNP at market prices, NNP at factor cost, Personal Income, Disposable Income, Real and Nominal GDP, Green GDP, Measurement Of National Income 1.3 Business cycles: meaning, features and phases.	15

II	**Basic Macroeconomic Theory and Policy** 2.1 Consumption, Saving and Investment Multiplier 2.2 Inflation: Features, Causes and Effects 2.3 Unemployment and its relationship with Inflation - Phillips curve 2.4 Monetary Policy: Meaning, objectives, instruments, Role of RBI 2.5 Fiscal policy: Meaning, Functioning, Objectives and Instruments ,Union Budget – an overview	**20**
III	**International Financial Framework** **1.1**Foreign Investments: FDI and FPI, their comparison, merits and demerits of FDI **1.2** Balance of Payments – structure – types of disequilibrium – measures to correct disequilibrium in BOP **1.3** Foreign Exchange Markets: Fixed and Flexible exchange rates – Managed Float exchange rate system, Spot and Forward rate of exchange	**10**

Self-Learning topics (Unit wise):

Sr. No	Unit	Topic
1	1	Measurement of National Income
2	2	Union Budget
3	3	Exchange rate systems

Online Resources:

https://onlinecourses.nptel.ac.in/noc22_hs67/preview
https://onlinecourses.swayam2.ac.in/e-learning/preview/cec22_hs08

Reference Books

1. Mankiw N. G. , Macroeconomics
2. Ahuja H. L., Modern Economics—S. Chand Company Ltd. New Delhi
3. Dornbush,Fisher and Startz, Macroeconomics--Tata – McGraw Hill , New Delhi
4. Dwivedi, D.N. (2001), Macro Economics : Theory and Policy, Tata McGraw Hill, New Delhi

Evaluation Pattern For 75 Marks

Summative Assessment	Formative Assessment	Total Marks
50	**25**	**75**

Evaluation Pattern

Formative Assessment

25 marks

Sr. No.	Particulars	Marks
1	Assignment/ SLE	20
3	Active participation in routine class instructional deliveries	05

Summative Assessment

Semester End Examination- 50 Marks

External Paper Pattern

Q.1	A or B (8marks) C or D (7marks)	15 Marks
Q2	A or B (8marks) C or D (7marks)	15 Marks
Q3	Attempt any 4 out of 6 (each is of 5 marks)	20 Marks