SEMESTER - I

APPLIED DATA SCIENCE WITH PYTHON

1. Course Description

Programme:	**M.Sc. Data Science**	**Max. Hours:**	**60**
Course Code:	**P26/CDS/DSC/101**	**Hours per week:**	**4**
Type of Course:	**DSC**	**Max. Marks:**	**60**
No. of Credits:	**4**		

2. Course Objectives

- Understand the fundamental concepts of NumPy arrays and Pandas data structures for performing efficient data manipulation and vectorized computations.
- Apply statistical techniques and Exploratory Data Analysis (EDA) methods to summarize, interpret, and visualize datasets.
- Analyze data by performing data cleaning, preparation, and transformation, including loading, storing, and handling various data file formats.
- Develop and evaluate meaningful insights by wrangling, combining, reshaping, and visualizing data using appropriate plotting techniques.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Explain the fundamental concepts of NumPy arrays and Pandas data structures for efficient data manipulation and vectorized computation. (L II)

CO2: Perform data loading, storage, and handling of various file formats using Python libraries. (L III)

CO3: Analyze datasets using Exploratory Data Analysis (EDA), sampling distributions, and statistical significance testing to identify patterns and insights. (L IV)

CO4: Construct data pipelines by cleaning, wrangling, combining, reshaping, and visualizing data to effectively present analytical results. (L VI)

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4. Course content

MODULE I: **15 Hours**

Built-In Data Structures, NumPy Basics and Pandas

Built-In Data Structures, Functions, and Files, Data Structures and Sequences, Functions, Files and the Operating System; NumPy Basics: Arrays and Vectorized Computation, The NumPy ndarray: A Multidimensional Array Object, Pseudorandom Number Generation, Universal Functions, Array-Oriented Programming with Arrays, File Input and Output with Arrays, Linear Algebra; Getting Started with pandas, Introduction to pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics

MODULE II: **15 Hours**

Exploratory Data Analysis

Exploratory Data Analysis, Elements of Structured Data, Rectangular Data, Estimates of Location, Estimates of Variability, Exploring the Data Distribution, Exploring Binary and Categorical Data, Correlation, Exploring Two or More Variables; Data and Sampling Distributions, Random Sampling and Sample Bias, Selection Bias, Sampling Distribution of a Statistic, The Bootstrap, Confidence Intervals, Normal Distribution, Long-Tailed Distributions, Student's t-Distribution, Binomial Distribution, Poisson and Related Distributions; Statistical Experiments and Significance Testing, A/B Testing, Hypothesis Tests, Resampling, Statistical Significance and P-Values, t-Tests, Multiple Testing, Degrees of Freedom, ANOVA, Chi-Square Test, Multi-Arm Bandit Algorithm, Power and Sample Size

MODULE III: **15 Hours**

Data Loading, Storage, and File Formats and Data Cleaning and Preparation

Data Loading, Storage, and File Formats, Reading and Writing Data in Text Format, Binary Data Formats, Interacting with Web APIs, Interacting with Databases; Data Cleaning and Preparation, Handling Missing Data, Data Transformation, Extension Data Types, String Manipulation, Categorical Data

MODULE IV: **15 Hours**

Data Wrangling, Plotting and Visualization

Data Wrangling: Join, Combine, and Reshape, Hierarchical Indexing, Combining and Merging Datasets, Reshaping and Pivoting; Plotting and Visualization, A Brief matplotlib API Primer, Plotting with pandas and seaborn, Other Python Visualization Tools

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5. Reference Books

1. Wes McKinney, Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter, 3rd Edition, O'Reilly, 2022
2. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly, 2017
3. Jake VanderPlas, Python Data Science Handbook, O'Reilly, 2016
4. Stefanie Molin, Hands-On Data Analysis with NumPy and pandas, Packt Publishing, 2019
5. Fabio Nelli, Python Data Analytics: With Pandas, NumPy, and Matplotlib, Apress/Springer, 2023

6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

S. No	Student Centric Methods Adopted	Type/Description of Activity
1.	National	**Solving** data analysis problems **using NumPy and pandas based on datasets from national surveys such as** Census data, agriculture statistics, or education datasets.
2.	Global	**Performing** Exploratory Data Analysis (EDA) **on** international open datasets **(e.g., global health, climate, or economic data) to identify patterns and trends.**

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Module I & II	Hands- on Practicals
Employability	Module III & IV	Mini project involving **data cleaning, data wrangling, and visualization**

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7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Students present **data analysis case studies** and discuss insights derived from datasets using Python tools.
2.	Experiential Learning	Hands-on lab sessions using **NumPy, pandas, and visualization libraries** to perform real-time data analysis tasks.
3.	Problem solving	Solving **data cleaning, transformation, and statistical analysis problems** using Python programming.

8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination- 60%
CO1	CIA 2 – Test 1: MCQ's, Quiz test or subjective	Written Exam
CO2	CIA 1 - Subjective	
CO3		
CO4	CIA 2 – Test 2: MCQ's or Presentation	

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b) Model Question Paper – End Semester Exam Theory

APPLIED DATA SCIENCE WITH PYTHON

Course Code: P26/CDS/ DSC/101 **MAX MARKS: 60**
Credits: 4 **TIME: 2 1/2 hours**

SECTION – A (Long Essay Type)

Answer ALL questions: **Marks: 4 x 10 = 40**

1. Explain **NumPy arrays and vectorized computation**. Discuss the features of **ndarray** with suitable examples.

OR

2. Describe the **Pandas data structures** and explain essential functionality with examples.
3. Explain the concept of **Exploratory Data Analysis (EDA)** and discuss different methods used to explore data distribution.

OR

4. Describe **statistical experiments and significance testing**. Explain hypothesis testing, p-values, and t-tests with examples.
5. Explain different **data loading and storage techniques in Python**. Discuss reading and writing data in text and binary formats.

OR

6. Describe the techniques used in **data cleaning and preparation**, including handling missing data and data transformation.
7. Explain **data wrangling techniques** such as joining, combining, and reshaping datasets using pandas.

OR

8. Discuss **plotting and visualization techniques in Python** using matplotlib, pandas, and seaborn.

SECTION –B (Short Essay Type)

II. Write short notes on any **FIVE** of the following: **Marks: 5 x 4 = 20**

9. Explain **built-in data structures in Python** with examples.
10. Write short notes on **universal functions and pseudorandom number generation in NumPy**.
11. What are **sampling distributions**? Explain random sampling and sample bias.
12. Explain **ANOVA and Chi-Square test** with suitable examples.
13. Explain different methods of **handling missing data** in data analysis.
14. Write short notes on **string manipulation and categorical data in pandas**.
15. What is **hierarchical indexing** in pandas? Explain its advantages.
16. Write short notes on **plotting with pandas and seaborn**.

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Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE			**4Q X 10 M = 40 M**	
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Explain NumPy arrays and vectorized computation. Discuss the features of ndarray with suitable examples.	CO 1	Level II
2	Module 1	Describe the Pandas data structures and explain essential functionality with examples.	CO 1	Level II
3	Module 2	Explain the concept of Exploratory Data Analysis (EDA) and discuss different methods used to explore data distribution.	CO 3	Level IV
4	Module 2	Describe statistical experiments and significance testing. Explain hypothesis testing, p-values, and t-tests with examples.	CO 3	Level IV
5	Module 3	Explain different data loading and storage techniques in Python. Discuss reading and writing data in text and binary formats.	CO 2	Level III
6	Module 3	Describe the techniques used in data cleaning and preparation, including handling missing data and data transformation.	CO 4	Level VI
7	Module 4	Explain data wrangling techniques such as joining, combining, and reshaping datasets using pandas.	CO 4	Level VI
8	Module 4	Discuss plotting and visualization techniques in Python using matplotlib, pandas, and seaborn.	CO 4	Level IV
SECTION B - ANSWER ANY 5 OUT OF 8 (To compulsorily have ONE question from each module)			**5Q X 4 M = 20 M**	
9	Module 1	Explain built-in data structures in Python with examples.	CO 1	Level II
10	Module 1	Write short notes on universal functions and pseudorandom number generation in NumPy.	CO 1	Level II
11	Module 2	What are sampling distributions? Explain random sampling and sample bias.	CO 3	Level IV
12	Module 2	Explain ANOVA and Chi-Square test with suitable examples.	CO 3	Level IV
13	Module 3	Explain different methods of handling missing data in data analysis.	CO 4	Level VI
14	Module 3	Write short notes on string manipulation and categorical data in pandas.	CO 4	Level VI
15	Module 4	What is hierarchical indexing in pandas? Explain its advantages.	CO 4	Level VI
16	Module 5	Write short notes on plotting with pandas and seaborn	CO 4	Level VI

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c) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4x10=40	6 (By taking at least one question from each Module)	4x5=20
2	15	CO-3	2			
3	15	CO-2 & 3	2			
4	15	CO-4	2			

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (hrs)
1	1	Understand	15
2	2	Apply	15
3	1, 2	Analyze	15
4	1, 2	Create	15

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APPLIED DATA SCIENCE WITH PYTHON
Practical Syllabus

1. Course Description

Programme:	**M.Sc. Data Science**	**Max. Hours:**	**40**
Course Code:	**P26/CDS/ DSC/101/P**	**Hours per week:**	**2**
Type of Course:	**DSC**	**Max. Marks:**	**50**
No. of Credits:	**2**		

2. Course Objectives

1. To enable students to implement Python-based data analysis techniques using built-in data structures, NumPy arrays, and pandas for efficient data manipulation and computation.
2. To develop practical skills in loading, cleaning, wrangling, analyzing, and visualizing datasets using Python libraries such as NumPy, pandas, matplotlib, and seaborn to derive meaningful insights.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Apply Python libraries such as NumPy and pandas to create, manipulate, and analyze datasets using built-in data structures and array-based computations. (L3)

CO2: Develop data analysis workflows by performing data loading, cleaning, wrangling, statistical exploration & visualization using Python tools like pandas, matplotlib, and seaborn. (L6)

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4. Course Content

1. Write a Python program to demonstrate built-in data structures (list, tuple, set, dictionary) and perform operations such as insertion, deletion, and searching.
2. Write a Python function to read data from a text file and count the frequency of each word.
3. Create a NumPy array and perform basic operations such as indexing, slicing, reshaping, and aggregation (sum, mean, max).
4. Generate random numbers using NumPy pseudorandom number generator and compute descriptive statistics.
5. Demonstrate the use of NumPy universal functions (ufuncs) for element-wise operations on arrays.
6. Create a pandas Series and DataFrame, perform indexing, filtering, and summarizing statistics.
7. Load a dataset using pandas and perform basic exploratory data analysis (EDA) including summary statistics and data distribution.
8. Write a program to visualize the distribution of a variable using histogram and box plot.
9. Perform correlation analysis between two variables and interpret the result.
10. Demonstrate random sampling from a dataset and explain sampling bias.
11. Implement a t-test or hypothesis test on a dataset to determine statistical significance.
12. Perform ANOVA or Chi-Square test on a suitable dataset and interpret the output.
13. Write a program to read and write data in different formats such as CSV, JSON, and Excel using pandas.
14. Retrieve data from a web API and store it in a pandas DataFrame.
15. Demonstrate handling missing data using methods such as dropping, filling, or interpolation.
16. Perform data transformation operations such as normalization or scaling.
17. Write a program to perform string manipulation and cleaning operations in pandas.
18. Convert a dataset column into categorical data and analyze its categories.
19. Demonstrate joining and merging two datasets using pandas.
20. Perform data reshaping using pivot tables and stacking/unstacking.
21. Implement hierarchical indexing in pandas and perform data selection.
22. Create line plots, bar charts, and scatter plots using matplotlib.
23. Visualize relationships in data using seaborn (pairplot, heatmap, boxplot).
24. Build a complete data analysis workflow: load dataset → clean data → analyze → visualize results.

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5. Model Question Paper – End Semester Exam Practical

APPLIED DATA SCIENCE WITH PYTHON

Programme: M.Sc. Data Science
Course Code: P26/CDS/ DSC/101/P **Duration:2 Hours**
Type of Course: DSC **Max. Marks: 50**
No. of credits: 2

Answer any ONE of the following:

1. NumPy and Pandas Operations
   a) Create a NumPy array of 10 random integers between 1 and 100.
   b) Perform the following operations:
      - Find the mean, median, and standard deviation.
      - Reshape the array into a 2×5 matrix.
      - Apply a universal function to compute the square root of each element.
   c) Convert the array into a pandas Data Frame and display descriptive statistics.

2. Built-in Data Structures and File Handling
   a) Write a Python program demonstrating list, tuple, set, and dictionary operations.
   b) Read a text file and count the frequency of each word using a dictionary.
   c) Display the top 5 most frequent words in the file.

3. Exploratory Data Analysis and Visualization
   a) Load a CSV dataset using pandas.
   b) Perform basic exploratory data analysis:
      - Display summary statistics.
      - Check for missing values and handle them.
   c) Compute the correlation between two numerical variables.
   d) Visualize the data using:
      - Histogram
      - Scatter plot
      - Box plot

4. Data Wrangling and Visualization
   a) Create two pandas Data Frames and perform merge/join operations.
   b) Demonstrate hierarchical indexing and data selection.
   c) Reshape the dataset using pivot table or stacking/unstacking.
   d) Plot the data using seaborn or matplotlib (bar chart or heatmap).

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SEMESTER – I

AI & ML

1. Course Description

Programme: M.Sc. Data Science
Course Code: P26/CDS/DSC/102
Course Type: DSC
No. of credits: 4

Max. Hours: 60
Hours per week: 4
Max. Marks: 100

2. Course Objectives

- To understand and apply AI search strategies.
- To study classification and regression models used for predictive analysis and performance evaluation.
- To understand advanced machine learning algorithms.
- To explore unsupervised learning techniques, including dimensionality reduction and clustering for pattern discovery in datasets.

3. Course Outcomes

On completion of the course, the student will be able to:

CO1: Understand the basic principles of Artificial Intelligence and search strategies. (L II)
CO2: Analyze and apply classification and regression models for prediction tasks. (LIV)
CO3: Analyze machine-learning algorithms such as SVM, Decision Trees, and ensemble methods. (LIV)
CO4: Apply dimensionality reduction and clustering techniques to analyze datasets. (LIII)

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4. Course Content

MODULE I:

Introduction of AI and Problem Solving by Searching **15 Hours**

Introduction: The foundations of Artificial Intelligence, AI disciplines and related fields, AI techniques, AI applications, Intelligent agents, characteristics of intelligent systems, problem characteristics in AI; Problem solving using state space search- Problem formulation, state space representation, production system, control strategies, Blind search techniques: BFS,DFS,DLS, ID, Heuristic search: Generate and Test, Hill climbing, Best First Search, A* algorithm; Problem reduction and game playing- Problem reduction techniques, AND-OR graphs, AO* algorithm , constraint satisfaction, game playing concepts, game trees, minimax algorithm, alpha-beta pruning, applications of game search.

MODULE II:

Fundamentals of Machine Learning, Classification and Regression Models **15 Hours**

The Machine Learning Landscape- Introduction, examples, types of machine learning systems, main challenges, testing and validating; Classification- MNIST, training a binary classifier, performance measures, multiclass classification, error analysis, multilabel classification, multioutput classification; Training Models- Linear Regression, gradient descent, polynomial regression, learning curves, regularized linear models, logistic regression.

MODULE III:

Support Vector Machines, Decision Trees, Ensemble Learning and Random Forests **15 Hours**

Support Vector Machines- Linear SVM classification, nonlinear SVM classification, SVM regression. Decision Trees- Training and visualizing a decision tree, making predictions, estimating class probabilities, the CART training algorithm, computational complexity, Gini Impurity or Entropy, regularization hyperparameters, regression, instability; Ensemble Learning and Random Forests- voting classifiers, Bagging and Pasting, Random patches & random subspaces, random forests, Boosting, stacking.

MODULE IV:

Dimensionality Reduction and Clustering **15 Hours**

Dimensionality Reduction- Introduction, main approaches for dimensionality reduction, PCA, kernel PCA, LLE, other dimensionality reduction techniques; Clustering, Gaussian mixtures.

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5. References

1. Artificial Intelligence by Saroj Kaushik, Cengage Learning, 2011.
2. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition, by AurélienGéron, O'reilly Media.
3. Machine Learning for Absolute Beginners, by Oliver Theobald, 2020.
4. Introduction to Machine Learning with Python, by Andreas C. Müller & Sarah Guido, O'Reilly Media.
5. Machine Learning by Subramanian, Chandra Mouli, Amit Kumar Das, Saikant
6. Dutt, Pearson Publications, I edition, 2018.
7. Machine Learning by Tom Mitchell, McGraw Hill, 2013.

6.Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

S.No	Local /Regional/National /Global Development Needs	Relevance
1	National Development	AI & ML supports national development by enabling data-driven decision-making and industrial automation.
2	Global Development	AI & ML has the potential to address a wide range of global development needs by leveraging data- driven insights to inform decision-making and drive positive change across various sectors like agriculture, health, finance etc.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Modules I & II	Hands- on Practical's
EMP	Modules III & IV	Mini Project

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7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative	Seminars
2.	Experimental	Practical demonstrations on AI & ML techniques
3.	Problem solving	Programming assignments

8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination- 60%
CO1	CIA 2 – Test 1: MCQ's, Quiz test or subjective	Written Exam
CO2	CIA 1 - Subjective	
CO3		
CO4	CIA 2 – Test 2: MCQ's or Presentation	

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b) Model Question Paper- End Semester Exam

AI & ML

MODEL QUESTION PAPER THEORY

Course Code: P26/CDS/DSC/102 **Max Marks: 60**
Credits: 4 **Time: 2 ½ Hrs.**

I: Answer the following: **4x 10 = 40**

1. Explain in detail about Blind search techniques.
   OR
2. Demonstrate different Heuristic search strategies.

3. Define classification. Explain in detail about performance measures.
   OR
4. Describe in detail about linear regression.
   OR
5. Compare and contrast linear SVM classification and nonlinear SVM classification.
   OR
6. Demonstrate in detail about visualization of decision tree by following the required steps.
7. Explain in detail about principal component analysis.
   OR
8. Define clustering. Explain k-means clustering with an example.

II: Answer any Five: **5 x 4 = 20**

9. Discuss Intelligent Agents.
10. Explain about alpha beta pruning.
11. Discuss about challenges of machine learning.
12. Differentiate between batch and stochastic gradient descent.
13. Explain in detail about SVM regression.
14. Explain about Bagging and Boosting.
15. Discuss Manifold Learning.
16. Describe in detail about DBSCAN.

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Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE				**4Q X 10 M = 40 M**
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Explain in detail about Blind search techniques.	CO 1	L II
2	Module 1	Demonstrate different Heuristic search strategies.	CO 1	L III
3	Module 2	Define classification. Explain in detail about performance measures	CO 2	L I, L II
4	Module 2	Describe in detail about linear regression.	CO 2	L II
5	Module 3	Compare and contrast linear SVM classification and nonlinear SVM classification.	CO 3	L IV
6	Module 3	Demonstrate in detail about visualization of decision tree by following the required steps.	CO 3	LIII
7	Module 4	Explain in detail about principal component analysis.	CO 4	L II
8	Module 4	Define clustering. Explain k-means clustering with an example.	CO 4	L I, L II
SECTION B - ANSWER ANY 5 OUT OF 8 (To compulsorily have ONE question from each module)				**5Q X 4 M = 20 M**
9	Module 1	Discuss Intelligent Agents.	CO 1	L II
10	Module 1	Explain about alpha beta pruning.	CO 1	L II
11	Module 2	Discuss about challenges of machine learning.	CO 2	L II
12	Module 2	Differentiate between batch and stochastic gradient descent.	CO 2	L IV
13	Module 3	Explain in detail about SVM regression.	CO 3	L II
14	Module 3	Explain about Bagging and Boosting.	CO 3	L II
15	Module 4	Discuss Manifold Learning.	CO 4	L II
16	Module 4	Describe in detail about DBSCAN.	CO 4	L II

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c)Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4x10=40	8 (By taking two questions from each Module)	5x4=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

NOTE: From
Section-A any 4 questions can be answered (INTERNAL CHOICE).
Section-B any 5 questions can be answered. (EXTERNAL CHOICE)

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (hrs)
1	1	Understand	15
2	1,2	Analyze	15
3	1, 2	Analyze	15
4	1, 2	Apply	15

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SEMESTER I
AI & ML PRACTICAL

1. Course Description

Programme: M.Sc. Data Science
Course Code: P26/CDS/DSC/102/P
Course Type: DSC
No. of credits: 2

Max. Hours: 60
Hours per week: 4
Max. Marks: 50

2. Course Objective

1. To Develop knowledge of basic AI techniques using python programming language.
2. To understand various types of supervised and unsupervised learning.

3. Course Outcomes

CO1: Applying Artificial Intelligence concepts to solve real world problems and Scikit-learn to represent data and model evaluation.
CO2: Exploring Supervised and Unsupervised learning algorithms for data analysis.

4. Course Content

1. Search Strategies
    a. BFS
    b. DFS
    c. DLS
    d. ID
    e. Hill Climbing
    f. A* Search
    g. AO* Search

- Implement an Intelligent Traffic Navigation System to determine the shortest path between two locations using BFS or A* search algorithm.
- Design a robot path planning system to find an optimal path in a grid environment using heuristic search algorithms.

2. Implementation of performance measures
    a. Cross-Validation
    b. Confusion matrix
    c. Precision and Recall
    d. ROC Curve

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- Develop a machine learning model to classify emails as spam or non-spam by applying text preprocessing, feature extraction, and classification algorithms. Evaluate the model using performance measures such as precision, recall, confusion matrix, and ROC curve.
- Build a classification model to recognize handwritten digits using the MNIST dataset. Apply data preprocessing techniques and train binary and multiclass classifiers to evaluate prediction accuracy.

3. Supervised Learning:
    a. Linear Regression.
    b. Logistic Regression
    c. Support Vector Machines
    d. Building decision trees
    e. Bagging and Boosting

- Design a machine learning model using linear regression to predict house prices based on features such as area, location, and number of rooms. Evaluate model performance using regression metrics.
- Develop a logistic regression model to predict whether customers are likely to discontinue a service based on usage data and customer attributes.
- Implement a Support Vector Machine (SVM) classifier to detect fraudulent credit card transactions by analyzing transaction patterns and identifying anomalies.

4. Unsupervised Learning:
    a. Transformation of data using Principal Component Analysis
    b. Applying k-Means Clustering
    c. Applying DBSCAN

- Use decision tree algorithms to predict diseases based on patient medical data and symptoms. Visualize the decision tree and interpret classification results.
- Develop a recommendation system using ensemble learning techniques such as Random Forest to recommend products based on user preferences and purchase history.
- Apply clustering algorithms such as k-means to group customers based on purchasing patterns and demographic features.
- Develop a recommendation system by analyzing user preferences and grouping similar users or movies using clustering techniques.
- Apply dimensionality reduction techniques using Principal Component Analysis (PCA) to reduce image data dimensions while preserving essential information.

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5. Model Question Paper

AI & ML Practical

COURSE CODE: P26/CDS/DSC/102/P

Duration: 2 Hours
Max.Marks: 50

Answer any one of the following.

1. Write a program to implement A* algorithm.
2. Show the representation of data applying Linear Regression.
3. Implement a Support Vector Machine (SVM) classifier to detect fraudulent credit card transactions.
4. Transformation of data using Principal Component Analysis using Un Supervised Learning.
5. Implement k-means clustering using sample of data.

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Ms. Khalida Tabassum **Teaching Faculty**	**Dr. Sr. Sujatha Yeruva** **Head of the Department**	**Dr. Uma Joseph** **Principal**

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SEMESTER - I

DESIGN AND ANALYSIS OF ALGORITHMS

1. Course Description

Programme:	**M.Sc. Data Science**	**Max. Hours:**	**60**
Course Code:	**P26/CDS/DSC/103**	**Hours per week:**	**4**
Type of Course:	**DSC**	**Max. Marks:**	**100**
No. of Credits:	**4**		

2. Course Objectives

- To understand and explain the functionality of algorithms.
- To Apply greedy approach to solve a fractional knapsack problem dynamic programming.
- To Analyze basic graph and tree algorithms.
- To Explore and classify design and analysis techniques for NP-Hard and NP-Complete Problems

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Understand and explain algorithms efficiency using asymptotic notations. (L I).

CO2: Analyze Greedy algorithm design techniques and dynamic programming. (LII)

CO3: Apply traversals techniques to find connected components in a graph c graph and tree algorithms. (L III)

CO4: Analyze the concepts of NP-hard problems. (L IV)

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4. Course Content

MODULE I: **15 Hours**

Introduction to Algorithms and Data structures

Introduction: Definition of an Algorithm, Algorithm Specification, Growth of Functions. Elementary Data Structures: Stacks and Queues, Trees, Dictionaries, Priority Queues, Graphs. Divide-and-Conquer: The master method for solving recurrences, Strassen's algorithm for Matrix Multiplication, Merge Sort, Quick Sort, Description and performance of Quick Sort. Heap sort.

MODULE II: **15 Hours**

Greedy Method and Dynamic Programming

Hash Tables, Binary Search Trees: Building, Querying, Inserting and Deleting in a Binary Search Tree. Red-Black Trees, B-Trees.

MODULE III: **15 Hours**

Graphs Traversal Techniques and Branch-Bound

Dynamic Programming: Elements of Dynamic Programming, Matrix-chain multiplication and Optimal Binary Search Trees as primary examples. Greedy Algorithms: Elements of greedy strategy, Activity-selection problem and Huffman codes as primary examples.

MODULE IV: **15 Hours**

Advanced Design and Analysis Techniques

Review of Fundamental Graph Algorithms, Minimum Spanning Trees: Kruskal and Prim, Single-Source Shortest Paths: Bellman-Ford and Dijkstra's algorithm. All-Pairs Shortest Paths: Floyd-Warshall algorithm. A brief Introduction to P and NP.

5. Reference Books

1. Cormen, T. (2009). Introduction to algorithms. Cambridge, Mass: MIT Press
2. E Horowitz, S Sahni, S Rajasekaran, (2007): Fundamentals of Computer Algorithms, 2/e, Universities Press.
3. T.H. Cormen, CE Leiserson, R.L Rivert, C Stein, (2010): Introduction to Algorithms,3/e, PHI.
4. R. Pannerselvam (2007): Design and Analysis of Algorithms, pHL
5. Hari Mohan Pandey, (2009): Design, Analysis and Algorithm, University Science press

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6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

S. No	Student Centric Methods Adopted	Type/Description of Activity
1.	National	Solve the graph problems based on exam patterns like **GATE/UGC-NET.**
2.	Global	Overall, the analysis of algorithms is essential for driving innovation, improving efficiency, ensuring accessibility, and addressing global challenges in various domains.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Module I & II	Practical Hands-on.
Employability	Module III & IV	Strong skills in algorithms helps individuals identify skill gaps and align their career paths with job market demands.

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Presentations
2.	Experiential Learning	Quiz
3.	Problem solving	Group discussions and skill activities

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8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA -40%	End Semester Examination-60%
CO1	CIA 2 – Test 1: MCQ's, Quiz test or subjective	Written Exam
CO2	CIA 1 – Subjective	
CO3		
CO4	CIA 2 – Test 2: MCQ's or Presentation	

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b) Model Question Paper – End Semester Exam Theory

DESIGN AND ANALYSIS OF ALGORITHMS

Course Code: P26/CDS/DSC/103 **MAX MARKS: 60**
Credits: 4 **TIME: 21/2Hours**

Note: This question paper consists of Section A and B. The answer to Section A & B must be written in the answer book given.

SECTION – A (Long Essay Type)

Answer ALL questions: **Marks: 4 x 10 =40**

1. Explain Strassens's algorithm for matrix multiplication.

OR

2. Describe Quick Sort algorithm illustrating with an example.
3. Explain Binary Search Tree in detail along with Tree traversals.

OR

4. Describe B-Trees and discuss the procedure to delete a key from it.
5. Describe Optimal Binary Search Trees.

OR

6. Explain Activity Selection problem.
7. Describe Floyd – Warshall algorithm for all pair shortest paths.

OR

8. Explain Dijkstra's algorithm for solving Single-Source Shortest Path.

SECTION –B (Short Essay Type)

II. Write short notes on any **FIVE** of the following: **Marks: 5 x 4 = 20**

9. Define Algorithm and discuss Asymptotic notations.
10. Write a short note on Stacks and Queues.
11. Explain Hash tables and describe how collisions can be resolved.
12. Explain in brief about Red Black trees.
13. Explain Huffman Codes.
14. Discuss about elements of dynamic programming in brief.
15. Explain Breadth First Search.
16. Describe Kruskal's algorithm to find minimum cost spanning tree.

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Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE			4Q X 10 M = 40 M	
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Explain Strassen's algorithm for matrix multiplication.	CO 1	LI
2	Module 1	Describe Quick Sort algorithm illustrating with an example.	CO 2	L II
3	Module 2	Explain Binary Search Tree in detail along with Tree traversals.	CO 2	L I
4	Module 2	Describe B-Trees and discuss the procedure to delete a key from it.	CO 2	L II
5	Module 3	Describe Optimal Binary Search Trees.	CO 3	LII
6	Module 3	Explain Activity Selection problem.	CO 3	LIII
7	Module 4	Describe Floyd – Warshall algorithm for all pair shortest paths.	CO 4	L II
8	Module 4	Explain Dijkstra's algorithm for solving Single-Source Shortest Path.	CO 4	L IV

SECTION B - ANSWER ANY 5 OUT OF 8 (To compulsorily have ONE question from each module)			5Q X 4 M = 20 M	
9	Module 1	Define Algorithm and discuss Asymptotic notations.	CO 1	L I
10	Module 1	Write a short note on Stacks and Queues.	CO 1	L II
11	Module 2	Explain Hash tables and describe how collisions can be resolved.	CO 2	L I
12	Module 2	Explain in brief about Red Black trees.	CO 2	L II
13	Module 3	Explain Huffman Codes.	CO 3	L II
14	Module 3	Discuss about elements of dynamic programming in brief.	CO 3	L III
15	Module 4	Explain Breadth First Search.	CO 4	L II
16	Module 4	Describe Kruskal's algorithm to find minimum cost spanning tree.	CO 4	L IV

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c) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4x10=40	8 (By taking two questions from each Module)	5x4=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (hrs)
1	1, 2	Understand	15
2	1,2	Apply	15
3	1, 2	Analyze	15
4	1, 4	Apply	15

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DESIGN AND ANALYSIS OF ALGORITHMS

Practical Syllabus

1. Course Description

Programme:	**M.Sc. Data Science**	**Max. Hours:**	**40**
Course Code:	**P26/CDS/DSC/103/P**	**Hours per week:**	**2**
Type of Course:	**DSC**	**Max. Marks:**	**50**
No. of Credits:	**2**		

2. Course Objectives

1. To implement the efficient algorithms and explain graphs.
2. Develop problem-solving and algorithmic skills.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Implement and execute tree, graph algorithms.
CO 2: Solve, optimize algorithms and dynamic programming.

4.Course Content

1. Implementation of Stack using Array (Push, Pop and Display operations).
2. Implementation of Queue using Arrays.
3. Program to demonstrate Merge Sort.
4. Program to demonstrate Quick Sort.
5. Program to demonstrate Heap Sort.
6. Program to create a Binary Search Tree and perform inorder traversal.
7. Program to create a Binary Search Tree and perform preorder traversal.
8. Program to create a Binary Search Tree and perform postorder traversal.
9. Program to construct and display a simple Graph.
10. Program to implement Breadth-first Search on a Graph.
11. Program to implement Depth-first Search on a Graph.
12. Program to implement Topological Sort on a Directed Graph.
13. Implement Dijkstra's algorithm to find a shortest path on a Directed Graph.
14. Implement Bellman-Ford algorithm to find a single source shortest path.
15. Program to implement a Hash Table.
16. Program to demonstrate Huffman codes.
17. Program to illustrate Activity Selection Problem

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5.Model Question Paper – End Semester Exam Practical

DESIGN AND ANALYSIS OF ALGORITHMS

Programme: M.Sc. Data Science
Course Code: P26/CDS/DSC/103/P
Type of Course: DSC
No. of credits: 2

Duration: 2 Hours
Max. Marks: 50

Answer any ONE of the Following

1. Write a Program to demonstrate Merge Sort.
2. Write a Program to create a Binary Search Tree and illustrate Tree Traversals on it.
3. Write a Program to implement Depth-first Search on a Graph.
4. Write a Program to implement Topological Sort on a Directed Graph.
5. Write a Program to illustrate Activity Selection Problem.

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SEMESTER - I
CLOUD COMPUTING

1. Course Description

Programme: M.Sc. Data Science
Course Code: P26/CDS/DSC/104
Course Type: DSC

Max. Hours: 60
Hours per week:4
Max.Marks:100

2. Course Objectives

- Ability to design and deploy Cloud Infrastructure.
- Understand cloud security issues and solutions.
- Ability to understand the role of Virtualization Technologies.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Apply and understand the cloud implementation and administration. (L II & L III)

CO2: Analyze & understand the need for security mechanisms to ensure data protection, privacy, and system reliability. (L II & IV)

CO3: Understand & Design the appropriate architectural patterns to meet scalability, availability, and performance requirements. (LII &V).

CO4: Understand and analyze advanced cloud architecture patterns and evaluate service quality metrics and Service Level Agreements (SLAs) for reliable cloud service delivery. (LII & IV)

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4. Course Content

MODULE I: **15 Hours**

Introduction to Cloud Computing

Basic concepts and Terminology, Goals and Benefits, Risks and challenges; Fundamental Concepts and Model: Roles and Boundaries, Cloud Characteristics. Cloud Delivery Models, Cloud Deployment Models;

MODULE II: **15 Hours**

Introduction to Virtualization Technology

Cloud-Enabling Technology: Operating System-Based Virtualization Technology, Hardware-Based Virtualization, Web Technology, Multitenant Technology; Fundamental Cloud Security: Basic Terms and Concepts, Threat Agents, Cloud Security Threats.

MODULE III: **15 Hours**

Cloud Computing Architecture

Fundamental Cloud Architectures: Workload Distribution Architecture, Resource Pooling Architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, Elastic Disk Provisioning Architecture, Redundant Storage Architecture.

Case study: VirtualBox-based Web Server creation, Images/Snapshots access webpage from 2nd VM on another subnet work 3. EC2 AWS – S3 bucket based static web pages. Use this page as astartpageviaEC2 webserver 4. AWS–Local balancing and auto scaling.

MODULE IV:

Advanced Cloud Architectures and SLAs

Hypervisor Clustering Architecture, Load Balanced Virtual Server Instances Architecture, Non-Disruptive Service Relocation Architecture, Zero Downtime Architecture, Cloud Balancing Architecture, Resource Reservation Architecture.

Service Quality Metrics and SLAs- Service Quality Metrics, SLA Guidelines.

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5. Reference Books:

1. Cloud Computing Concepts, Technology & Architecture Thomas Erl, Zaigham Mahmood, and Ricardo Puttini. Publisher: Person Edition Published: August,2023
2. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VM ware and Microsoft Platform in the Virtual Data Center, Auerbach.
3. Cloud Computing: Web-Based Applications That Change the Way YouWork and Collaborate Online-Michael Miller -Que2008.
4. Cloud Computing: principles and paradigms by Buyya, Rajkumar| Broberg, James Goscinski, Andrzej.

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Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local/Regional/National /Global Development Needs	Relevance
Global Development	The global development for computer networks and cloud computing is driving innovation, economic growth, and societal transformation on a global scale, shaping the way we communicate, collaborate, and interact with information in the digital age.

b) **ComponentsonSkillDevelopment/EntrepreneurshipDevelopment/Employability**

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module I & II	By developing these skills, individuals can pursue careers in computer networks and cloud computing.
EMP	Module III & IV	There is a growing need for networking and cloud computing professionals due to increasing cloud adoption, cybersecurity demands, and digital transformation.

5. Pedagogy

S.No	Student Centric Methods Adopted	Type/Description of Activity
1.	Participative	Seminars
2.	Experimental	Quiz
3.	Compute	Hand on cloud Service providers

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6. Course Assessment Plan

a) WeightageofMarksinContinuousInternalAssessmentsandEndSemesterExamination

CO	Continuous Internal Assessments-CIA-40%	EndSemesterExamination-60%
CO1	CIA1–Written	Written Exam
CO2	CIA2–Skill Enhancement	
CO3	CIA3– Lab	
CO4		

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b) Model Question Paper-End Semester Exam

CLOUD COMPUTING

THEORY

Course Code: P26/CDS/DSC/104 **MAX MARKS:60**
Credits:4 **TIME: 2 ½ Hours.**

SECTION – A (Long Essay Type)

I. Answer ALL questions: **Marks: 4 x 10 =40**

1.Explain the basic concepts and terminology of cloud computing in detail.

OR

2.Explain the key characteristics of cloud computing with suitable examples.

3.Analyze the role of web technologies in enabling cloud services with real-world applications.

OR

4.Explain in detail the different types of virtualization technologies with examples.

5.Evaluate the effectiveness of load balancing in cloud environments.

OR

6.Assess the benefits of auto scaling in AWS environments.

7.Explain the importance of SLAs in cloud services.

OR

8.Compare and analyze hypervisor clustering and cloud balancing architectures.

SECTION –B (Short Essay Type)

II Answer any <u>FIVE</u> of the following: **Marks: 5 x 4 = 20**

9. Describe the fundamental concepts of cloud computing including roles and boundaries.
10. What is meant by cloud deployment model?
11. Explain common cloud security threats.
12. List and explain basic terms in cloud security.
13. Critique the use of S3 for static web hosting.
14. Justify the need for redundant storage architecture.
15. Differentiate between cloud balancing and resource reservation.
16. What is zero downtime architecture? Explain briefly.

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Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE				**4Q X 10 M = 40 M**
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Explain the basic concepts and terminology of cloud computing in detail.	CO 1	Level II
2	Module 1	Explain the key characteristics of cloud computing with suitable examples	CO 1	Level II
3	Module 2	Analyze the role of web technologies in enabling cloud services with real-world applications.	CO 2	Level IV
4	Module 2	Explain in detail the different types of virtualization technologies with examples.	CO 2	Level II
5	Module 3	Evaluate the effectiveness of load balancing in cloud environments.	CO 3	Level V
6	Module 3	Assess the benefits of auto scaling in AWS environments	CO 3	Level V
7	Module 4	Explain the importance of SLAs in cloud services.	CO 4	Level II, IV
8	Module 4	Compare and analyze hypervisor clustering and cloud balancing architectures.	CO 4	Level II, IV

SECTION B - ANSWER ANY 4 OUT OF 8 (To compulsorily have ONE question from each module)				**5Q X 4 M = 20 M**
9	Module 1	Describe the fundamental concepts of cloud computing including roles and boundaries.	CO 1	Level II
10	Module 1	What is meant by cloud deployment model?	CO 1	Level III
11	Module 2	Explain common cloud security threats.	CO 2	Level IV
12	Module 2	List and explain basic terms in cloud security.	CO 2	Level II
13	Module 3	Critique the use of S3 for static web hosting.	CO 3	Level V
14	Module 3	Justify the need for redundant storage architecture.	CO 3	Level III
15	Module 4	Differentiate between cloud balancing and resource reservation.	CO 4	Level IV
16	Module 4	What is zero downtime architecture? Explain briefly	CO 4	Level IV

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c) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4x10=40	8 (By taking two questions from each Module)	5x4=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (hrs.)
1	1, 2	Analyze	15
2	1,2	Apply	15
3	1, 2	Analyze	15
4	1, 4	Apply	15

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CLOUD COMPUTING
Practical Syllabus

1. Course Description

Programme: M. Sc. Data Science | **Max. Hours: 60**
Course Code: P26/CDS/DSC/104/P | **Hours per week:4**
Course Type: DSC | **Max.Marks:50**
No. of credits: 2

2. Course Objectives

- Understand cloud computing and virtualization concepts.
- Implement virtual machines and networking using virtualization tools.
- Deploy web applications using cloud platforms like AWS.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: To demonstrate the creation and deployment of **cloud-based web services using AWS services such as EC2 and S3**
CO2. Illustrate cloud storage concepts and virtualization in cloud systems.

4. Practical Sessions

1. AWS Essentials Introduction to Amazon Web Services, EC2: Compute services, Networking, infrastructure and reliability Storage and database services.
2. Amazon Elastic Block Store (Amazon EBS).
3. Amazon Simple Storage Service (AmazonS3).
4. Amazon Elastic File System (Amazon EFS).
5. Virtual Private Cloud (VPC), Identity and Access.
6. Management (IAM)and Security on AWS.

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5. Model Question Paper – End Semester Exam Practical

CLOUD COMPUTING

Practical

Programme: M.Sc. Data Science
Course Code: P26/CDS/DSC/104/P
Type of Course: DSC
No. of credits: 2

Duration: 2 Hours
Max. Marks: 50

Answer any ONE of the Following

1. EC2 Instance with Public DNS & S3 Public Data Sharing

A small organization wants to deploy a web server using AWS. They create a virtual machine using **Amazon Web Services EC2** and make it accessible over the internet using its **Public DNS**. The organization also wants to store files (images, documents, and static content) in an **Amazon S3 bucket** and make them publicly accessible so that users visiting the web server can download/view these files.

- Explain the steps to create an EC2 instance and obtain its Public DNS.
- Describe how to create an S3 bucket and upload files.
- Explain how to make S3 bucket objects publicly accessible

2. **Startup Web Application Deployment**

A startup company wants to launch an e-commerce website. They expect low traffic initially but anticipate rapid growth. They need scalable compute resources, reliable storage, and a database to manage customer and product data.

- Which AWS services would you recommend for compute, storage, and database?
- How would you use **EC2** to host the application?

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SEMESTER – I

DATA ANALYTICS & VISUALIZATION

1. **Course Description**

Programme: M.Sc. Data Science
Course Code: P26/CDS/GE/101
Course Type: GENERIC ELECTIVE
No. of credits: 2

Max. Hours: 30
Hours per week: 2
Max. Marks: 50

2. **Course Objectives**

To enable students to understand, analyze, and apply Microsoft Power BI tools for transforming large datasets into meaningful insights through data preparation, modeling, and interactive dashboards.

3. **Course Outcomes**

On completion of the course the student will be able to:

CO1: Analyze datasets using data preparation and modeling techniques. (LII)
CO2: Apply Power BI to build interactive dashboards for data analytics. (L III)

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4. Course Content

MODULE I: Introduction, Data Preparation and Modelling (15 Hrs)

Introduction to Business Intelligence and Data Analytics, Overview of Microsoft Power BI architecture, Components of Power BI: Power BI Desktop, Power BI Service, Power BI Mobile, Installation and interface of Power BI Desktop, Data sources in Power BI, importing data from Excel, CSV, SQL, databases, and web sources, Data cleaning and transformation using Power Query Editor, Handling missing values and data formatting, Basic aggregate and logical functions

MODULE II: Data Visualization, Dashboards and Applications (15 Hrs)

Data visualization concepts in Power BI, creating charts and visualizations: bar charts, line charts, pie charts, tables, matrices, and maps, Filters, slicers, and drill-down analysis, Designing interactive reports and dashboards, Applications of Power BI in AI, ML, and data analytics projects.

Case study: Building a dashboard for data analysis

5. References

1. Brett Powell, Microsoft Power BI Cookbook, Packt Publishing.
2. Adam Aspin, Pro Power BI Desktop, Apress.
3. Dan Clark, Beginning Power BI, Apress.
4. Marco Russo and Alberto Ferrari, The Definitive Guide to DAX, Microsoft Press.
5. Microsoft Learn – Power BI Documentation (https://learn.microsoft.com/power-bi)

Online Resources

1. Microsoft Learn – Power BI Documentation
2. https://learn.microsoft.com/power-bi
3. https://www.geeksforgeeks.org/power-bi

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6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National / Global Development Needs	Relevance
National Development	Power BI enables governments and organizations to analyze national data related to healthcare, education, agriculture, economy, and infrastructure for effective planning and policy development.
Global Development	Power BI helps analyze and visualize international data such as global health, climate change, economic trends, and sustainable development indicators to support worldwide decision-making.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Modules 1	Learning visualisations and dashboards builds critical analytical and computational skills essential for the digital age.
EMP	Modules 2	POWERBI increases job readiness and opens opportunities across diverse industries.

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative	Seminars, Presentations
2.	Problem solving	To enhance skills for developing projects requirements

8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA -20 Marks	End Semester Examination-30 Marks
CO1	CIA 1 – Assignment-10 Marks	Answer 1 out of 4 questions
CO2	CIA 2 – Skill test -10 Marks	

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b) Model Question Paper- End Semester Exam

DATA ANALYTICS & VISUALIZATION

MODEL QUESTION PAPER

Course Code: P26/CDS/GE/101 **Max Marks: 30**
Credits: 2 **Time: 1 Hr**

I. Answer any One

Year	State	Population (Millions)	Literacy Rate (%)	Unemployment Rate (%)	GDP (Billion $)
2020	Andhra Pradesh	53	67	5.2	120
2020	Telangana	39	72	4.8	110
2021	Andhra Pradesh	54	68	5.0	125
2021	Telangana	40	73	4.5	115
2022	Andhra Pradesh	55	69	4.9	130
2022	Telangana	41	74	4.3	120
2023	Andhra Pradesh	56	70	4.7	135
2023	Telangana	42	75	4.1	125

Data Import
Create an Excel or CSV file using the given dataset and import the data into Power BI Desktop.

1. Data Preparation

Using Power Query Editor, perform the following tasks:

- Rename the column GDP (Billion $) as GDP
- Ensure correct data types for all columns
- Remove any unnecessary spaces or formatting errors.

2. Data Visualization

Create the following visualizations:

- Bar Chart: GDP by State
- Line Chart: Population growth over Years

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- Pie Chart: Literacy Rate comparison between states.

3. Interactive Analysis

Add the following features to the report:

- Slicer for Year
- Filter for State
- Enable Drill-down analysis for GDP across Years.

4. Dashboard Creation

Design an interactive dashboard to analyze National Development indicators using at least four visualizations from the dataset.

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (Hrs)
1	1	1	15
2	2	4	15

Prepared by	Checked &verified by	Approved by
Ms. Jyothi Reddy Teaching Faculty	Dr.Sr. Sujatha Yeruva Head of the Department	Dr.Uma Joseph Principal

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