SEMESTER - I

ARTIFICIAL INTELLIGENCE

1. Course Description

Programme:	**M.Sc. Computer Science (AI & ML)**	**Max. Hours: 60**
Course Code:	**P26/CAI/DSC/101**	**Hours per week: 4**
Course Type:	**DSC**	**Max. Marks: 100**
No. of credits:	**4**	

2. Course Objectives

- To understand and apply AI search strategies.
- To study logical reasoning and different knowledge representation techniques used in AI systems.
- To understand the design and working of expert systems and reasoning under uncertainty.
- To explore fuzzy logic and evolutionary computation techniques for solving complex AI problems.

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 logical reasoning and knowledge representation methods including propositional logic, predicate logic, semantic networks, and frames. (L IV)
CO3: Analyze the architecture and applications of expert systems and perform reasoning under uncertainty using probability and Bayesian networks. (L IV)
CO4: Apply fuzzy logic and evolutionary computation techniques such as genetic algorithms to solve real-world AI problems. (LIII)

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

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.(Chapter 1, 2, 3)

MODULE II:

Logical Reasoning and Knowledge Representation **15 Hours**

Knowledge representation using logic, propositional logic, predicate logic, inference rules, resolution principle, unification, automated theorem proving; Knowledge Representation- Knowledge representation issues, semantic networks, frames, scripts, conceptual dependency, knowledge representation using logic. (Chapter 4, 7)

MODULE III:

Expert Systems, Uncertainty and Probability **15 Hours**

Introduction to expert systems, architecture of expert systems, knowledge base inference engine, knowledge acquisition, explanation facility, applications of expert systems; Uncertainty and Probability- Reasoning under uncertainty, probability theory basics, Bayes theorem, Bayesian networks, certainty factors, probabilistic reasoning. (Chapter 8,9)

MODULE IV:

Fuzzy Logic and Evolutionary Computation **15 Hours**

Fuzzy set theory, crisp vs fuzzy sets, membership functions, fuzzy relations, fuzzy inference systems, fuzzy reasoning, applications of fuzzy systems; Evolutionary Computation- Genetic algorithms, representation of chromosomes, fitness function, selection methods, crossover operator, mutation operator, applications of evolutionary computation. (Chapter 10,14)

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN
Begumpet, Hyderabad-500 016.

5. References

1. Artificial Intelligence by Saroj Kaushik, Cengage Learning, 2011.
2. Artificial Intelligence: A Modern Approach – 3E by Stuart Russell, Peter Norvig, Prentice Hall
3. Artificial Intelligence in the 21st Century - 2E by Stephen Lucci, Danny Kopec., Mercury Learning and Information, 2016
4. Artificial Intelligence: Building Intelligent Systems by Parag Kulkarni, Prachi Joshi, PHI Learning Yashwant Kanetkar, Let Us C 13E, BPS Publications.
5. Artificial Intelligence: A New Synthesis by Nils J Nilsson, Morgan Kaufmann Publishers Inc
6. Artificial Intelligence - 3E by Kevin Knight, Elaine Rich, B Nair, Tata McGraw Hill
7. Artificial Intelligence and Machine Learning by Vinod Chandra SS, Anand Hareendra S, Prentice Hall

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 contributes to national development by improving healthcare, agriculture and security through intelligent data driven systems.
2.	Global Development	The worldwide importance of AI information lies in its transformative effect on numerous sectors and components of society.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

b) Components on Skill Development/Entrepreneurship Development/Employability

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

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative	Seminars
2.	Experimental	Practical demonstrations on AI 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	

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN
Begumpet, Hyderabad-500 016.

b) Model Question Paper- End Semester Exam

ARTIFICIAL INTELLIGENCE
MODEL QUESTION PAPER
THEORY

Course Code: P26/CAI/DSC/101
Credits: 4

Max Marks: 60
Time: 2 ½ Hrs.

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

1. Explain in detail about Blind search techniques.
   OR
2. Demonstrate different Heuristic search strategies.
3. Describe in detail about Propositional logic & Predicate logic.
   OR
4. Explain in detail about Semantic Networks. List knowledge representation issues.
5. Define Expert Systems. Explain in detail about architecture of expert systems.
   OR
6. Discuss Bayes Theorem. Explain in detail about Bayesian Networks.
7. Demonstrate in detail Fuzzy set theory. Explain in detail about Fuzzy Inference systems.
   OR
8. Explain in detail about Genetic algorithms.

II. Answer any FIVE: **5x 4 = 20**

9. Discuss Intelligent Agents.
10. Explain about alpha beta pruning.
11. Describe in detail about Frames.
12. Demonstrate Unification in detail.
13. Discuss applications of Expert Systems.
14. Explain about Probabilistic Reasoning.
15. Discuss Crisp vs Fuzzy sets.
16. Describe in detail about Mutation Operator.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

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	Describe in detail about Propositional logic & Predicate logic.	CO 2	L II
4	Module 2	Explain in detail about Semantic Networks. List knowledge representation issues.	CO 2	L II
5	Module 3	Define Expert Systems. Explain in detail about architecture of expert systems.	CO 3	L I, L III
6	Module 3	Discuss Bayes Theorem. Explain in detail about Bayesian Networks.	CO 3	L II
7	Module 4	Demonstrate in detail Fuzzy set theory. Explain in detail about Fuzzy Inference systems.	CO 4	L III
8	Module 4	Explain in detail about Genetic algorithms.	CO 4	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	Describe in detail about Frames.	CO 2	L II
12	Module 2	Demonstrate Unification in detail.	CO 2	L III
13	Module 3	Discuss applications of Expert Systems.	CO 3	L II
14	Module 3	Explain about Probabilistic Reasoning.	CO 3	L II
15	Module 4	Discuss Crisp vs Fuzzy sets.	CO 4	L II
16	Module 4	Describe in detail about Mutation Operator.	CO 4	L II

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

a) 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	Understand	15
2	1,2	Analyze	15
3	1, 2	Apply	15
4	1, 2	Analyze	15

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

SEMESTER - I
ARTIFICIAL INTELLIGENCE
PRACTICAL

1. Course Description

Programme:	**M.Sc. Computer Science (AI & ML)**	**Max. Hours: 60**
Course Code:	**P26/CAI/DSC/101/P**	**Hours per week: 4**
Course Type:	**DSC**	**Max. Marks: 50**
No. of credits:	**2**	

2. Course Objectives

1.Develop knowledge of basic AI techniques using python programming language.
2.To understand game logics, Expert Systems and Fuzzy Logics.

3. Course Outcomes

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

CO1: Identify and Apply Artificial Intelligence concepts to solve real world problems.
CO2: Use relevant Python libraries to generate accurate solutions for AI domain problems

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. **Game Playing**
   a. **Constraint Satisfaction**
   b. **Minimax**
   c. **Alpha-beta pruning**

- Implement a Tic-Tac-Toe AI agent using the Minimax algorithm with Alpha-Beta pruning.
- Write a program to solve the N-Queens Problem using Constraint Satisfaction techniques.
- Develop a program to generate a University Timetable Scheduling system using Constraint Satisfaction Problem (CSP) methods.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

3. Expert Systems, Uncertainty and Probability

- Design an expert system for diagnosing common diseases. The system should include a knowledge base, inference engine, knowledge acquisition module, and explanation facility to assist users in identifying diseases based on symptoms.
- Develop a decision support system that determines whether a loan should be approved or rejected based on customer data. Apply Bayes theorem to calculate the probability of loan approval.
- Design a Bayesian network model to predict weather conditions such as rain or sunshine based on factors like humidity, temperature, and wind speed.

4. Fuzzy Logic and Evolutionary Computation

- Design a fuzzy logic system to control room temperature in an air conditioning system using membership functions and fuzzy inference rules.
- Develop a fuzzy logic-based traffic signal control system that adjusts signal timings based on traffic density and waiting time at intersections.
- Implement a Genetic Algorithm to solve an optimization problem such as finding the shortest route between cities or optimizing a mathematical function using selection, crossover, and mutation operations.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

5. Model Question Paper

ARTIFICIAL INTELLIGENCE
PRACTICAL

COURSE CODE: P26/CAI/DSC/101/P **MAX.MARKS: 50**
EXAM DURATION: 2Hrs.

Answer any one of the following.

1. Write a program to implement depth first search.
2. Write a program to implement A* algorithm.
3. Write a program to solve the N-Queens Problem using Constraint Satisfaction techniques.
4. Write a program to implement expert systems in diagnosing disease.
5. Write a program to design fuzzy logic system to control room temperature in an air conditioning system

Prepared by	Checked & verified by	Approved by
Ms. Khalida Tabassum **Teaching Faculty**	**Dr. Sr. Sujatha Yeruva** **(HoD, Dept. of Computer Science)**	**Dr. Uma Joseph** **(Principal,** **St. Francis College for Women)**

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

SEMESTER - I

APPLIED DATA SCIENCE WITH PYTHON

1. Course Description

Programme: M. Sc
Course Code: P26/CAI/ DSC/102
Type of Course: DSC
No. of Credits: 4

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

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)

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

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

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

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**

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

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	

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

b) Model Question Paper – End Semester Exam Theory

APPLIED DATA SCIENCE WITH PYTHON

Course Code: P26/ CAI/ DSC/102
Credits: 4

MAX MARKS: 60
TIME: 2½ 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**.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

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

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD, Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

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

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

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

APPLIED DATA SCIENCE WITH PYTHON
Practical Syllabus

1. Course Description

Programme:	**M. Sc**	**Max. Hours:**	**40**
Course Code:	**P26/ CAI/ DSC/102/P**	**Hours per week:**	**2**
Type of Course:	**DSC-1**	**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. **Bloom's Level:** Apply (L3)

CO2:
Develop data analysis workflows by performing **data loading, cleaning, wrangling, statistical exploration, and visualization** using Python tools like pandas, matplotlib, and seaborn. **Bloom's Level:** Create (L6)

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.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

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.

5. Model Question Paper – End Semester Exam Practical

APPLIED DATA SCIENCE WITH PYTHON

Programme : M.Sc.
Course Code : P26/ CAI/ DSC/102/P
Type of Course : DSC-1
No. of credits : 2
Max. Marks: 50

SECTION – A

Answer ALL questions:

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 DataFrame and display descriptive statistics.

OR

2. Built-in Data Structures and File Handling
   a) Write a Python program demonstrating list, tuple, set, and dictionary operations.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

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.

SECTION – B

Answer ALL questions:

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

OR

4. Data Wrangling and Visualization
   a) Create two pandas DataFrames 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).

Prepared by	Checked &Verified by	Approved by
Dr. Sr. Sujatha Yeruva Teaching faculty	Dr. Sr. Sujatha Yeruva HoD	Prof. Uma Joseph Principal

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

SEMESTER - I

FULL STACK DEVELOPMENT

1. Course Description

Programme: M.Sc. Computer Science (AI & ML)
Course Code: P26/CAI/DSC/103
Type of Course: DSC
No. of Credits: 4

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

2. Course Objectives

- To understand the essential JavaScript concepts for web development.
- To style Web applications using bootstrap.
- To utilize React JS to build front end User Interface.
- To understand the usage of API's to create web applications using Express JS.
- To store and model data in a no sql database.

3. Course Outcomes

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

CO1: ***Apply*** JavaScript to build dynamic and interactive Web projects. (L III)

CO2: *Implement* user interface components for JavaScript-based Web using React.JS. (L III)

CO3: ***Apply*** Express/Node to build web applications on the server side. (L III)

CO4: ***Develop*** data model in an open source nosql database. (L VI)

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

4.Course content

MODULE I: **15 Hours**

JavaScript

Basic JavaScript Instructions, Statements, Comments, Variables, Data Types, Arrays, Strings, Functions, Methods & Objects, Decisions & Loops.

Document Object Model: DOM Manipulation, Selecting Elements, Working with DOM Nodes, Updating Element Content & Attributes, Events, Different Types of Events, How to Bind an Event to an Element, Event Delegation, Event Listeners. Form enhancement and validation.

MODULE II: **15 Hours**

Introduction to MERN

Introduction to MERN: MERN components, Server less Hello world. React Components: Issue Tracker, React Classes, Composing Components, Passing Data Using Properties, Passing Data Using Children, Dynamic Composition.

MODULE III: **15 Hours**

React State and Express

React State: Initial State, Async State Initialization, Updating State, Lifting State Up, Event Handling, Stateless Components, Designing Components, State vs. Props, Component Hierarchy, Communication, Stateless Components.

Express, REST API, GraphQL, Field Specification, Graph Based, Single Endpoint, Strongly Typed, Introspection, Libraries, The About API GraphQL Schema File, The List API, List API Integration, Custom Scalar types, The Create API, Create API Integration, Query Variables, Input Validations, Displaying Errors.

MODULE IV: **15 Hours**

MongoDB and Modularization and Webpack

MongoDB: Basics, Documents, Collections, Databases, Query Language, Installation, The Mongo Shell, MongoDB CRUD Operations, Create, Read, Projection, Update, Delete, Aggregate, MongoDB Node.js Driver, Schema Initialization, Reading from MongoDB, Writing to MongoDB.

Modularization and Webpack ,Back-End Modules Front-End Modules and Webpack Transform and Bundle, Libraries Bundle ,Hot Module Replacement, Debugging DefinePlugin: Build Configuration, Production Optimization.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

5.Reference Books

1. Jon Duckett, "JavaScript & jQuery: Interactive Front-End Web Development", Wiley, 2014.
2. Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node. Apress, 2019.

6. Syllabus Focus

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

S. No	Local/Regional/National /Global Development Needs	Relevance
1.	National	Enabling scalable digital governance platforms
2.	Global	Enabling global cloud web applications

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Module I, II, III, IV	Hands- on Practicals
Employability	Module I, II, III, IV	Students gain employable skills for roles such as **Frontend, Backend, Full Stack, and Web Application Developer**.

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Presentations and Seminars
2.	Experiential Learning	Quiz
3.	Problem solving	Troubleshoot (debug) code

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

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	

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

CBCS 2026

b) Model Question Paper – End Semester Exam Theory

FULL STACK DEVELOPMENT

Course Code: P26/CAI/DSC/103 **MAX MARKS: 60**
Credits: 4 **TIME: 2 ½ hours**

SECTION – A (Long Essay Type)

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

1. Define DOM; contrast Capturing/Bubbling; how to stop propagation?

OR

2. Explain JS Scope and the UX/Security goals of Form Validation.
3. Define MERN and trace data flow from DB to UI.

OR

4. Explain React Lifecycle: compare Mounting vs. Unmounting.

5. Explain REST vs. GraphQL in MERN apps.

OR

6. Detail the process of setting up a Create API using GraphQL.
7. Contrast (SQL) with (NoSQL) like MongoDB. Explain the concepts of "Collections" and "Schema-less" design.

OR

8. Explain the theoretical necessity of a Module Bundler like Webpack. Discuss the concepts of "Dependency Graphs" and "Code Splitting.

SECTION –B (Short Essay Type)

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

9. Explain the functional differences between Primitive and Reference data types regarding memory storage.
10. Compare the security and performance implications of using textContent versus innerHTML when updating DOM element content.
11. Describe the architectural concept of a Serverless Hello World and how it differs from a traditional server-hosted MERN application.
12. Explain the specific role of props. children in allowing a parent component to serve as a generic wrapper or layout for nested content.
13. Discuss how "Race Conditions" can affect data consistency in React.
14. Explain the role of Middleware in an Express/REST environment.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

15. Explain the concept of Projections in a MongoDB Read operation.
16. Explain how Hot Module Replacement (HMR) optimizes the development build.

Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE			**4Q X 10 M = 40 M**	
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Bloom's Taxonomy Level)**
1	Module 1	Define DOM; contrast Capturing /Bubbling; how to stop propagation?	CO1	Level III
2	Module 1	Explain JS Scope and the UX/Security goals of Form Validation.	CO1	Level III
3	Module 2	Define MERN and trace data flow from DB to UI	CO2	Level III
4	Module 2	Explain React Lifecycle: compare Mounting vs. Unmounting.	CO2	Level III
5	Module 3	Explain REST vs. GraphQL in MERN apps.	CO3	Level III
6	Module 3	Detail the process of setting up a Create API using GraphQL.	CO3	Level III
7	Module 4	Contrast (SQL) with (NoSQL) like MongoDB. Explain the concepts of "Collections" and "Schema-less" design.	CO4	Level VI
8	Module 4	Explain the theoretical necessity of a Module Bundler like Webpack. Discuss the concepts of "Dependency Graphs" and "Code Splitting..	CO4	Level VI
SECTION B - ANSWER ANY 5 OUT OF 8 (To compulsorily have ONE question from each module)			**5Q X 4 M = 20 M**	
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Bloom's Taxonomy Level)**
9	Module 1	Explain the functional differences between Primitive and Reference data types regarding memory storage.	CO1	Level III
10	Module 1	Compare the security and performance implications of using textContent versus innerHTML when updating DOM element content.	CO1	Level III
11	Module 2	Describe the architectural concept of a Serverless Hello World and how it	CO2	Level III

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

		differs from a traditional server-hosted MERN application.		
12	Module 2	Explain the specific role of props. children in allowing a parent component to serve as a generic wrapper or layout for nested content.	CO2	Level III
13	Module 3	Discuss how "Race Conditions" can affect data consistency in React.	CO3	Level III
14	Module 3	Explain the role of Middleware in an Express/REST environment.	CO3	Level III
15	Module 4	Explain the concept of Projections in a MongoDB Read operation.	CO4	Level VI
16	Module 4	Explain how Hot Module Replacement (HMR) optimizes the development build.	CO4	Level VI

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)	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	2	Create	15
2	1	Analyze	15
3	1	Understand	15
4	2	Create	15

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

FULL STACK DEVELOPMENT
Practical Syllabus

1. Course Description

Programme:	**M.Sc. Computer Science (AI & ML)**	**Max. Hours:**	**30**
Course Code:	**P26/CAI/DSC/103/P**	**Hours per week:**	**2**
Type of Course:	**DSC**	**Max. Marks:**	**50**
No. of Credits:	**1**		

2. Course Objectives

- To develop practical full-stack development skills by building dynamic web applications using JavaScript, React, Node.js, and RESTful APIs.

3. Course Outcomes

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

CO1: ***Apply*** JavaScript and React.js to develop dynamic, interactive, and modular web interfaces.

CO2: ***Implement*** server-side web applications using Node.js/Express and design data models in NoSQL databases.

4. Course Content

1. **JavaScript Fundamentals**

   a. Write a JavaScript program that accepts two numbers from the user, computes their **sum and average using reusable functions**, logs the results to the console, and displays the sum using an **alert box**.

   b. Create an array containing **five city names** and perform operations such as displaying the array length, dynamically adding a city, removing the first city, finding the index of a specified city, and sorting the cities alphabetically before logging the updated array.

2. **String Processing and Functions**

   a. Write a JavaScript program to read a string from the user, determine its **length**, extract a substring using `substring()` or `slice()`, replace a specified word using `replace()`, and display the updated string.

   b. Implement a function `isPalindrome(str)` that determines whether a given string is a **palindrome**, ignoring case and whitespace, and return the result.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

3. **JavaScript Objects and Dynamic Properties**

   Create an object named **student** with properties `name`, `grade`, `subjects`, and a method `displayInfo()` that prints student details.

   Write a script to dynamically add a **passed property** based on the grade (true if grade ≥ 50, otherwise false) and iterate through the object using a loop to display all **keys and values**.

4. **DOM Manipulation and Event Handling**

   Create an HTML page with a **button labeled "Click Me"**, and add an event listener that logs a message to the console when clicked.
   Add an image element and implement a **mouseover event** that changes the image border color.
   Also implement a **keyboard event listener** that logs the key pressed by the user.

5. **React Application – Issue Tracking System**

   Develop a **React application** that displays a list of issues using **static data**, where each issue contains a **title, description, and status (Open/Closed)**. Render the list dynamically using a **functional component and the `map()` function**.

6. **React State Management – Counter Component**

   Create a React Counter component with a state variable count initialized to 0.
   Implement buttons to increment and decrement the count, simulate fetching initial data using useEffect() or componentDidMount(), and extend the component with additional buttons to double the count value and reset the count to zero

7. **Node.js and Express REST API**

   Install Express.js and create a basic server that responds with a message at the root endpoint.
   Design a REST API for managing products with endpoints for retrieving all products, adding a new product, retrieving a product by ID, updating a product, and deleting a product.
   Implement middleware for request logging and use express.json() to handle JSON request bodies.

8. **MongoDB Integration with Node.js and React**
   Install the MongoDB Node.js driver and write a script to connect to a database named shop, performing CRUD operations (insert, find, update, delete).

   Define a Product schema using Mongoose and store data in the products collection.

   Create an Express API endpoint /products to retrieve products and use React fetch() to display them.

   Implement a POST /products endpoint to add new products and dynamically update the product list in the React interface.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

CBCS 2026

5. Model Question Paper – End Semester Exam Practical

FULL STACK DEVELOPMENT

Programme : M.Sc. Computer Science (AI & ML)
Course Code : P26/CAI/DSC/103/P
Type of Course: DSC **Max. Marks: 50**
No. of credits : 1 **Time: 2 Hours**

Answer any ONE of the Following

1. Create an HTML page with a text input field and a button. When the button is clicked, display the entered text in a paragraph element. Add another event listener to change the background color of the page when the mouse moves over a specific section.
2. Create a React functional component that displays a list of tasks (use static data). Each task should contain a task name and completion status. Render the tasks dynamically using map() and visually indicate whether a task is completed or pending.
3. Create a React functional component that displays a list of students with their name and grade using static data. Use map() to render the list and highlight students who scored above a specified grade threshold.
4. Create an HTML page with a simple form containing name and email fields and a submit button. When the form is submitted, display the entered details on the page without refreshing it and log the data to the console..
5. Create a React functional component that displays a list of tasks using static data. Each task should have a title, assigned person, and status (Completed/Pending). Use map() to render the list and highlight tasks that are pending using a different background color.

-

Prepared by	Checked &Verified by	Approved by
Ms. Afeefa Noorain Teaching faculty	Dr. Sr. Sujatha Yeruva HoD	Prof. Uma Joseph Principal

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

CBCS2026

SEMESTER - I
NETWORKING AND CLOUD COMPUTING

1. Course Description

Programme: M.Sc. Computer Science(AI&ML) **Max.Hours: 60**
Course Code: P26/CAI/DSC/104 **Hoursperweek:4**
Course Type DSC **Max.Marks:100**

2. Course Objectives

- Understand the fundamentals of computer networks and Internet communication
- 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: Remember and Explain the basic taxonomy and terminology of computer networks. (LI)
CO2: Apply and understand the cloud implementation and administration. (L II & L III)

CO3: Analyze & understand the need for security mechanisms to ensure data protection, privacy, and system reliability. (L II & IV)

CO4: Compute & Design the appropriate architectural patterns to meet scalability, availability, and performance requirements. (L IV)

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

CBCS2026

4. **Course Content**

MODULEI: **15 Hours**

An Introduction to Networks

Network Communication, types of Networks, Network Protocols, Ethernet, The Internet. Transmission Control Protocol/Internet Protocol, Domain Name System-DNS Infrastructure, Protocol, Performance; Casestudy:BuildingLocalAreanetwork and TCP/IP.

MODULEII: Introduction to Cloud Computing **15 Hours**

Understanding 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;

Case Study: SaaS: Salesforce.com, CRM, Online Collaboration Services IaaS: AWS, Open Stack; PaaS: IBM Blue mix, GAE.

MODULEIII: **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 IV: **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 2ndVM 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

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

5. Reference Books:

1. Internet Infrastructure Networking, Webservices and Cloud Computing by RichardFox , WeiHao, 2017.
2. Cloud Computing Concepts, Technology & Architecture Thomas Erl, Zaigham Mahmood, and Ricardo Puttini.
3. DavidMarshall,WadeA.Reynolds,AdvancedServerVirtualization:VMwareandMicrosoftPlatformin theVirtualData Center, Auerbach.
4. Cloud Computing: Web-BasedApplicationsThatChangetheWayYouWorkandCollaborateOnline-Michael Miller -Que2008.
5. Cloud Computing: principlesandparadigmsbyBuyya,Rajkumar|Broberg,JamesGoscinski,Andrzej.

6.SyllabusFocus

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.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

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.

7. Pedagogy

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

8. 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		

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

CBCS2026

b) Model Question Paper-End Semester Exam

NETWORKING AND CLOUD COMPUTING

THEORY

Course Code: P26/CAI/DSC/104 **MAXMARKS:60**

Credits:4 **TIME: 2 1/2 hrs.**

SECTION – A (Long Essay Type)

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

1. Describe Network Protocols and Ethernet technology.

OR

2. Explain in detail Transmission Control Protocol/Internet Protocol.

3. Explain Cloud deployment model.

OR

4. Define Cloud Computing and describe its goals, advantages (benefits), risks, and challenges.

5. Explain in detail about Multitenant Technology in cloud.

OR

6. Explain in detail Cloud Security Threats.

7. Discuss the Load Balancing Architecture used in cloud environments.

OR

8. Describe the concept of Dynamic Scalability Architecture in cloud computing.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

SECTION –B (Short Essay Type)

II Answer any FIVE of the following: **Marks: 5 x 4 = 20**

9. What is Network Communication? Explain the types of networks.
10. Explain in detail cloud delivery models.
11. Write about Domain Name System.
12. Write short note on cloud service providers.
13. Write a short note on Threat Agents.
14. Write short notes on Redundant Storage Architecture.
15. Explain the steps involved in accessing images from second VM
16. What are the advantages of redundant storage architecture?

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

CBCS2026

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 Cloud deployment model	CO 1	Level II
2	Module 1	Define Cloud Computing and describe its goals, advantages (benefits), risks, and challenges	CO 1	Level II
3	Module 2	Explain in detail about Multitenant Technology in cloud.	CO 2	Level IV
4	Module 2	Explain in detail Cloud Security Threats	CO 2	Level II
5	Module 3	Discuss the Load Balancing Architecture used in cloud environments.	CO 3	Level V
6	Module 3	Describe the concept of Dynamic Scalability Architecture in cloud computing.	CO 3	Level V
7	Module 4	Explain Service Level Agreements (SLAs) and describe the guidelines for SLA creation in cloud computing	CO 4	Level II, IV
8	Module 4	Explain the Hypervisor Clustering Architecture and Load Balanced Virtual Server Instances Architecture with neat diagrams.	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	Explain in detail cloud delivery models.	CO 1	Level II
10	Module 1	Write short note on cloud service providers	CO 1	Level III
11	Module 2	Write a short note on Threat Agents	CO 2	Level IV
12	Module 2	Write short notes on Redundant Storage Architecture.	CO 2	Level II
13	Module 3	Write about Domain Name System.	CO 3	Level V
14	Module 3	Write Short notes on Resource Reservation Architecture with examples	CO 3	Level III
15	Module 4	Write short notes on SLA.	CO 4	Level IV
16	Module 4	Explain the steps involved in accessing images from second VM	CO 4	Level IV

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

CBCS2026

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		CO 1	Level I
2	Module 1		CO 1	Level I
3	Module 2		CO 2	Level III
4	Module 2		CO 2	Level III
5	Module 3		CO 3	Level V, VI
6	Module 3		CO 3	Level V, VI
7	Module 4		CO 4	Level V, VI
8	Module 4		CO 4	Level V, VI
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have ONE question from each module)				**4Q X 5 M = 20 M**
9	Module 1		CO 1	Level I
10	Module 1		CO 1	Level I
11	Module 2		CO 2	Level III
12	Module 2		CO 2	Level II
13	Module 3		CO 3	Level V& VI
14	Module 4		CO 4	Level V& VI

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		8	
2	15	CO-2	2		(By taking	

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

3	15	CO-3	2	4x10=40	two questions from each Module)	5x4=20
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

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

CBCS2026

NETWORKING AND CLOUD COMPUTING PRACTICAL

1. Course Description

Programme: M. Sc. Computer Science (AI & ML) **Max. Hours: 60**
Course Code: P24/CAI/DSC/104/P **Hoursperweek:4**
Course Type: DSC **Max.Marks:50**
No.ofcredit:2

2. Course Objectives

1. Tointroducetheterminology,technologyanditsapplications
2. TointroducetheRaspberryPIplatform,thatiswidelyusedinIoTapplications

3. Course Outcomes

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

CO1: Design and develop basic IoT-based prototypes.
CO2. Illustrate cloud storage concepts and virtualization in cloud systems.

4. Practical Sessions

1. Simulators using Packet Tracer–VLAN design, Routing, Subnetting, Gateway configuration.
2. AWS Essentials Introduction to Amazon Web Services, EC2: Compute services, Networking, infrastructure and reliability Storage and database services.
3. Amazon Elastic Block Store (Amazon EBS).

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

CBCS2026

4. Amazon Simple Storage Service (AmazonS3).
5. Amazon Elastic File System (Amazon EFS).
6. Virtual Private Cloud (VPC),Identity and Access.
7. Management (IAM)and Security on AWS.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

5. Model Question Paper – End Semester Exam Practical

NETWORKINGANDCLOUDCOMPUTING

Programme: M.Sc.
Course Code : P26/ CAI/ DSC/202/P
Type of Course: DSC **Max. Marks: 50**
No. of credits: 2

Answer any ONE of the Following

1. Send a message to communicate in the given Network for the given topology.
2. Create Instance for the Public DNS and useS3 bucket to share the data in public.

Prepared by	Checked& verified by	Approved by
Ms. Shobana **Teaching faculty**	**Dr. Sr. Sujatha Yeruva** **HoD**	**Prof. Uma Joseph** **Principal**

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

SEMESTER – I

DATA ANALYSIS USING POWER BI

1. **Course Description**

Programme: M.Sc. Computer Science (AI & ML) **Max. Hours: 30**
Course Code: P26/CAI/GE/101 **Hours per week: 2**
Course Type: GENERIC ELECTIVE **Max. Marks: 50**
No. of credits: 2

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)

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

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University
Hyderabad-500 007

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

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.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University
Hyderabad-500007

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	

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

b) Model Question Paper- End Semester Exam

DATA ANALYSIS USING POWERBI

MODEL QUESTION PAPER

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

I. Answer any One **1x 30 = 30 M**

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
- Pie Chart: Literacy Rate comparison between states.

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.

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

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

HOD Computer Science
ST FRANCIS COLLEGE FOR WOMEN,
Begumpet, Hyderabad-500 016.