DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/B.Sc./CBC & GS/17/2024

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies/Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology, **Academic Council at its meeting held on 08 April 2024 has accepted the following Syllabi under the Faculty of Science & Technology as per Choice Based Credit Grading System** as appended herewith.

Sr.No.	Courses	Semester
1.	B.Sc. Chemistry (Optional)	Vth & VIth semester
2.	B.Sc. Analytical Chemistry (Optional)	Vth & VIth semester
3.	B.Sc. Polymer Chemistry (Optional)	Vth & VIth semester
4.	B.Sc.Biochemistry (Optional)	Vth & VIth semester
5.	B.Sc.Dairy Science & Technology (Optional)	Vth & VIth semester
6.	B.Sc.Microbiology (Optional)	Vth & VIth semester
7.	B.Sc. Botany (Optional)	Vth & VIth semester
8.	B.Sc. Computer Science (Optional)	Vth & VIth semester
9.	B.Sc. Computer Science (Degree)	Vth & VIth semester
10.	B.Sc.Information Technology (Optional)	Vth & VIth semester
11.	B.Sc.Information Technology (Degree)	Vth & VIth semester
12.	Bachelor of Computer Application (Optional)	Vth & VIth semester
13.	Bachelor of Computer Application (Degree)	Vth & VIth semester

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar.
-431 004.
REF.NO.SU/2024/1786-94
Date:- 21.06.2024.

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Deputy Registrar,
Academic Section

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Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] **The Director, Board of Examinations & Evaluation,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar

Dr. Babasaheb Ambedkar Marathwada University

Chhatrapati Sambhajinagar- 431004(MS) India

Three Year Undergraduate Bachelor Degree Program In Science and Technology

B.C.A. (Science) (Degree)

III Year

Curriculum Structure and Scheme of Examination

Choice Based Credit System

(Effective from Academic Year 2024-25)

Question Paper Pattern for Theory

B. C.A. (Science) Semester ----------
Course Code ----------
Paper Number ----------
Title of Paper ----------

Time : 1.30 Hrs. **Max Marks: 40**

N.B.

1. Attempt All Questions.
2. All questions carry equal marks.
3. Illustrate your answer with suitable labelled diagram.

Q.1. Multiple choice questions / Fill In the Blanks / Terms / Definition / One Line Answer questions. (10 Marks)

1)
2)
3)
4)
5)
6)
7)
8)
9)
10)

Q.2. Long answer question. (10 Marks)
OR
Long Answer question

Q.3. Long answer question (10 Marks)
OR
Short answer questions
a)
b)

Q.4. Short Notes on any TWO of the following:- (10 Marks)
a)
b)
c)
d)

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar

Choice Based Credit System (CBCS) Curriculum
For
Faculty of Science and Technology
Course Structure (Third Year)

B.C.A. (Science) Three Year Under Graduate Degree Program

Third Year

Course Type	Semester – V		Course Type	Semester - VI	
	Name of Paper	Credit		Name of Paper	Credit
Discipline Specific Elective–I (DSE–1A) 7 Credits	**DSE-1A (1)** Select any one Paper from (A1/B1) A1: Java Database Connectivity (JDBC) B1: Database Programming using Python	2	Discipline Specific Elective–IV (DSE–1B) 7 Credits	**DSE-1B (1)** Select any one Paper from (A1/B1) A1: Java Serve Pages (JSP) B1: Machine Learning Using Python	2
	DSE-1A (2) Select any one Paper from (A2/B2) A2: Data Mining B2: Distributed Database Management System	2		**DSE-1B (2)** Select any one Paper from (A2/B2) A2: Data Visualisation B2: Blockchain	2
	Lab based On DSE-1A(1)	1.5		Lab based On DSE-1B(1)	1.5
	Lab based On DSE-1A(2)	1.5		Lab based On DSE-1B(2)	1.5
Discipline Specific Elective–II (DSE–2A) 7 Credits	**DSE-2A (1)** Select any one Paper from (A1/B1) A1: Software Quality Assurance & Testing B1: Modelling & Simulation	2	Discipline Specific Elective–V (DSE–2B) 7 Credits	**DSE-2B (1)** Select any one Paper from (A1/B1) A1: Software Project Management (SPM) B1: GIS and Remote Sensing	2
	DSE-2A (2) Select any one Paper from (A2/B2) A2: Shell Programming B2: Foundational Data Science	2		**DSE-2B (2)** Select any one Paper from (A2/B2) A2: Linux Administration B2: Advance Data Science	2
	Lab based On DSE-2A(1)	1.5		Lab based On DSE-2B(1)	1.5
	Lab based On DSE-2A(2)	1.5		Lab based On DSE-2B(2)	1.5

Discipline Specific Elective–III (DSE–3A) 7 Credits	**DSE-3A (1)** Select any one Paper from (A1/B1) A1: Cybersecurity B1: Introduction to Big Data	**2**	Discipline Specific Elective–VI (DSE–3B) 7 Credits	**DSE-3B (1)** Select any one Paper from (A1/B1) A1: Natural language Processing B1: Cloud Computing	**2**
	DSE-3A (2) Select any one Paper from (A2/B2) A2: IoT (Internet of Things) B2: Power BI	**2**		**DSE-3B (2)** Major Project	**2**
	Lab based On DSE-3A(1)	**1.5**		Lab based On DSE-3B(1)	**1.5**
	Lab based On DSE-3A(2)	**1.5**		Seminar	**1.5**
Skill Enhancement Course (SEC-3) 2 Credits	**SEC-3** (Any one skill to be chosen out of two) (E) Android Programing (F) Problem Solving & Decision Making	**2**	Skill Enhancement Course (SEC-4) 2 Credits	**SEC-4** (Any one skill to be chosen out of two) (G): Digital Marketing (H): Leadership Skill Development	**2**
	Total Credit 23			**Total Credit 23**	

Structure and Curriculum for
Bachelor of Computer Application (Science)

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar

Choice Based Credit System (CBCS) Curriculum
For
Faculty of Science and Technology
Course Structure and Scheme of Examination
B.C.A. (Science) Three Year Under Graduate Degree Program

Semester-V

Course Type	Course Code	Course Title	Total Periods (Teaching Periods / Week)	Credits	Scheme of Examination			
					UA	IA	Max Marks	Min Marks
Discipline Specific Elective – I (DSE – 1A) 7 Credits	CA-511T	**DSE-1A (1)** Select any one Paper from(A1/B1) A1: Java Database Connectivity (JDBC) B1: Database Programming using Python	45 (3/per week)	2	40	10	50	20
	CA-512T	**DSE-1A (2)** Select any one Paper from(A2/B2) A2: Data Mining B2: Distributed Database Management System	45 (3/per week)	2	40	10	50	20
	CA-513P	Lab Course (based on CA-511T)	45 (3/per week)	1.5	40	10	50	20
	CA-514P	Lab Course (based on CA-512T)	45 (3/per week)	1.5	40	10	50	20
Discipline Specific Elective – II (DSE – 2A) 7 Credits	CA-521T	**DSE-2A (1)** Select any one Paper from(A1/B1) A1: Software Quality Assurance & Testing B1: Modelling & Simulation	45 (3/per week)	2	40	10	50	20
	CA-522T	**DSE-2A (2)** Select any one Paper from(A2/B2) A2: Shell Programming B2: Foundational Data Science	45 (3/per week)	2	40	10	50	20
	CA-523P	Lab Course (based on CA-521T)	45 (3/per week)	1.5	40	10	50	20

	CA-524P	Lab Course (based on CA-522T)	45 (3/per week)	**1.5**	**40**	**10**	**50**	**20**
Discipline Specific Elective – III (DSE – 3A) 7 Credits	CA-531T	**DSE-3A (1)** Select any one Paper from(A1/B1) A1: Cybersecurity B1: Introduction to Big Data	45 (3/per week)	**2**	**40**	**10**	**50**	**20**
	CA-532T	**DSE-3A (2)** Select any one Paper from(A2/B2) A2: IoT (Internet of Things) B2: Power BI	45 (3/per week)	**2**	**40**	**10**	**50**	**20**
	CA-533P	Lab Course (based on CA-531 T)	45 (3/per week)	**1.5**	**40**	**10**	**50**	**20**
	CA-534P	Lab Course (based on CA-532 T)	45 (3/per week)	**1.5**	**40**	**10**	**50**	**20**
Skill Enhancement Course (SEC-3) 2 Credits	CA-541P*	**SEC-3** (Any one skill to be chosen out of two) **(E):** Android Programming **(F):** Problem Solving & Decision Making	45 (3/per week)	**2**	**-**	**50**	**50**	**20**
		39 Periods/week		**23**	**520**	**130**	**650**	**260**
Total Credit for Semester V: 23 (Theory: 14 & Laboratory: 9)								

* See note on Page 9

Structure and Curriculum for
Bachelor of Science in (Computer Science)

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar

Choice Based Credit System (CBCS) Curriculum

For

Faculty of Science and Technology

Course Structure and Scheme of Examination

B. Sc. (Computer Science)Three Year Under Graduate Degree Program

Semester-VI								
Course Type	Course Code	Course Title	Total Periods (Teaching Periods / Week)	Credits	Scheme of Examination			
					UA	IA	Max Marks	Min Marks
Discipline Specific Elective–IV (DSE – 1B) 7 Credits	CA- 611T	**DSE-1B (1)** Select any one Paper from(A1/B1) A1: Java Server Pages (JSP) B1: Machin Learning Using Python	45 (3/per week)	2	40	10	50	20
	CA-612T	**DSE-1B (2)** Select any one Paper from(A2/B2) A2: Data Visualisation B2: Blockchain	45 (3/per week)	2	40	10	50	20
	CA-613P	Lab Course (based on CA-611T)	45 (3/per week)	1.5	40	10	50	20
	CA-614P	Lab Course (based on CA-612T)	45 (3/per week)	1.5	40	10	50	20
Discipline Specific Elective–IV (DSE – 2B) 7 Credits	CA-621T	**DSE-2B (1)** Select any one Paper from(A1/B1) A1: Software Project Management B1: GIS and Remote Sensing	45 (3/per week)	2	40	10	50	20
	CA-622T	**DSE-2B (2)** Select any one Paper from(A2/B2) A2: Linux Administration B2: Advance Data Science	45 (3/per week)	2	40	10	50	20
	CA-623P	Lab Course (based on CA-621T)	45 (3/per week)	1.5	40	10	50	20
	CA-624P	Lab Course (based on CA-622T)	45 (3/per week)	1.5	40	10	50	20

Discipline Specific Elective–IV (DSE – 3B) 7 Credits	CA-631T	**DSE-3B (1)** Select any one Paper from(A1/B1) A1: Natural Language Processing B1: Cloud Computing	45 (3/per week)	**2**	**40**	**10**	**50**	**20**
	CA-632T	**DSE-3B(2) Major Project**	45 (3/per week)	**2**	**40**	**10**	**50**	**20**
	CA-633P	Lab Course (based on CA-631T)	45 (3/per week)	**1.5**	**40**	**10**	**50**	**20**
	CA-634P	**Seminar**	45 (3/per week)	**1.5**	**40**	**10**	**50**	**20**
Skill Enhancement Course (SEC-4) 2 Credits	CA-641P*	**SEC-4** (Any one skill to be chosen out of two) **(G):** Digital Marketing **(H):** Leadership Skill Development	45 (3/per week)	**2**	**-**	**50**	**50**	**20**
		39 Periods/ week		**23**	**520**	**130**	**650**	**260**
Total Credit for Semester VI: 23 (Theory: 14 & Laboratory: 9)								

* See note of page 9

Important Note Regarding Skill Enhancement Courses

1. Skill Enhancement Courses have a significant theoretical component therefore theory workload is assigned to the course but the teaching of these courses should focus on practical application, with the goal of developing practical skills and knowledge as the final outcome.
2. There shall be no theory examination for Skill Enhancement Courses (SEC-1, SEC-2).
3. The evaluation of Skill Enhancement Courses should be entirely based on college internal assessment, meaning that the assessment will be carried out by the college's respective course in-charge, rather than by an external entity.
4. To assess the students' understanding and skills in Skill Enhancement Courses, they should demonstrate their acquired skill through hands-on experience, practical work, projects, and case studies. There should be one assessment for each unit and an additional assessment at the end of the semester.
5. Records of each assessment should be maintained by the college's respective course incharge and should be readily made available upon request.
6. At the end of the semester, the consolidated marks should be submitted to the University for Inclusion in the student's mark sheet, which will contribute towards their final grade.
7. The university should generate the mark list for Skill Enhancement Courses, similar to the internal assessment mark list. The mark list should be downloaded, filled with the consolidated marks of all assessments, and submit along with the internal marks list.



B.C.A. (Science)

Semester - V

Course Code: CA-511T[A1]	Course Title: - Java Database Connectivity (JDBC)
Total Credit: 2	Marks: 50 (UA:40 & IA: 10)
Periods: 3 per week (50 Minutes each)	

Prerequisites:
Core Java Programming Course CA-411T

Learning Objectives

1. To be able understand Database and SQL Basics:
2. To be able master JDBC Architecture and Connectivity.
3. To be able execute SQL Operations Using JDBC.
4. To be able implement Advanced JDBC Features and Best Practices.

Learning Outcomes

After Completion of the Course students will be able to

1. Explain database types and execute basic SQL commands for data manipulation.
2. Outline JDBC architecture and establish database connections using JDBC drivers.
3. Perform SQL operations using Statement, PreparedStatement, and CallableStatement interfaces, and process data with ResultSet.
4. Manage transactions and batch processing, optimize performance, and apply best practices in JDBC applications.

Unit -I: Database Fundamentals and SQL Basics (10 Periods)

Introduction to Databases: Definition and purpose of databases, differentiate between relational and non-relational databases, and gain an overview of Database Management Systems (DBMS).
Introduction to SQL: Learn basic SQL commands such as SELECT, INSERT, UPDATE, DELETE, acquire skills in creating and managing tables, and develop proficiency in basic query writing.

Unit -II: DBC Fundamentals (10 Periods)

Overview of JDBC: JDBC Definition, architecture, API, and different types of drivers available.
Establishing Database Connections: Types of JDBC drivers, loading and registering drivers, connecting to databases such as MySQL or Oracle, and utilizing the Connection Interface and DriverManager Class for connection management.

Unit -III: Executing SQL Operations using JDBC (10 Periods)

SQL queries using the Statement, PreparedStatement, and CallableStatement interfaces, navigate and process ResultSet data, including its metadata.

Unit -IV: Advanced JDBC Features and Best Practices (10 Periods)

Transaction Management: Gain insights into transactions, including understanding, committing, and rolling back changes.
Batch Processing: Learn how to perform batch updates efficiently.
Performance Optimization and Best Practices: Implement strategies such as using PreparedStatements to prevent SQL injection, employing connection pooling, and ensuring effective error handling and logging for enhanced performance and security.

Unit-V: Test and Tutorials
In addition to CIA, tutorials, seminars, assignments, and case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same).

Textbook

1. "Java: The Complete Reference" by Herbert Schildt
2. "JDBC API Tutorial and Reference" by Maydene Fisher, Jon Ellis, Jonathan Bruce

E-Resources

- Oracle JDBC Documentation
- TutorialsPoint JDBC Guide
- JavaTpoint JDBC Tutorial



Course Code: CA-513P	Course Title: Lab Course (based on CA-511T [A1])
Total Credit: 1.5	Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)	

Sample List of experiments to be carried out based on the course **CA-511T [A1]**

(The teacher can make use of any IDE and Database server and can add few more practical based on each unit)

Practical No	Details
1	Write a note on setting up the JDBC environment?
2	Write and explain each step o establish a database connection using Java?
3	Write and execute basic SQL commands like (SELECT, INSERT, UPDATE AND DELETE) in any database server.
4	Write a program in Java to create and manage database tables programmatically.
5	Write a program in Java to use PreparedStatements and parameterized queries.
6	Write a program in Java to navigate and process ResultSet objects.
7	Write a program in Java to manage transactions in JDBC applications.
8	Write a program in Java to implement batch processing in JDBC.
9	Write a program in Java to handle SQL exceptions.
10	Write a program in Java to configure and use connection pooling.
11	Write a program in Java to use savepoints in JDBC transactions.
12	Write a program in Java to execute stored procedures using CallableStatement.
13	Write a program in Java to work with metadata in JDBC.
14	Write a program in Java to optimize JDBC performance.
15	Write a program in Java to develop a real-world JDBC application incorporating various JDBC features.

Course Code: CA-511T[B1]	Course Title: - Database Programming Using Python
Total Credit: 2	Marks: 50 (UA:40 & IA: 10)
Periods: 3 per week (50 Minutes each)	

Prerequisites:
Basic Python Programming Course CA-441T (C)

Learning Objectives

1. Understand databases and SQL fundamentals, including sqlite3 usage in Python.
2. Master database connectivity and management using Python's sqlite3 module.
3. Execute CRUD operations, manage transactions, and ensure data integrity in sqlite3 databases with Python.
4. Design efficient database schemas and integrate sqlite3 functionalities into Python applications.

Learning Outcomes

After Completion of the Course students will be able to

1. Demonstrate proficiency in fundamental database concepts and SQL usage with sqlite3 in Python.
2. Effectively establish and manage database connections using Python's sqlite3 module.
3. Execute CRUD operations, handle transactions, and ensure data integrity with sqlite3 in Python.
4. Design optimized database schemas and integrate sqlite3 functionalities into Python applications.

Unit -I: Introduction to Databases and SQL Basics (10 Periods)

Introduction to Databases in Python:

- Understanding the Purpose and Types of Databases, including data storage, management, retrieval, integrity, and security, and exploring relational, NoSQL, in-memory, NewSQL, time-series, object-oriented, hierarchical, and network databases.
- Overview of sqlite3 and Its Usage in Python, encompassing the features of sqlite3 such as serverless, self-contained, and zero-configuration nature, common use cases, and the process of installing and setting up sqlite3.

Basic SQL Commands with sqlite3:

- Creating and Managing Databases and Tables, involving tasks like creating a new sqlite3 database, defining schema, and altering table structure.

Unit -II: Establishing Database Connections with Python (10 Periods)

Connecting to sqlite3 Database:

- **Establishing Connections to sqlite3 Databases Using Python:**
  - Importing sqlite3 module.
  - Connecting to a sqlite3 database file.
  - Handling connection errors.
- **Creating Database Connections and Cursors:**
  - Creating a cursor object.
  - Using the cursor to execute SQL commands.
  - Closing connections and cursors properly.

Unit -III: CRUD Operations and Advanced Database Handling with Python and sqlite3 (10 Periods)

CRUD Operations with Python and sqlite3:

- **Implementing CRUD (Create, Read, Update, Delete) Operations on sqlite3 Databases Using Python:**
  - Writing Python functions for each CRUD operation.
  - Executing CRUD operations through Python scripts.
  - Handling exceptions and ensuring data integrity.
- **Executing Basic SQL Commands (CREATE, INSERT, SELECT, UPDATE, DELETE) Using sqlite3:**
  - Writing and executing SQL commands in Python.
  - Inserting data into tables.
  - Selecting and querying data.
  - Updating and deleting data from tables.

Unit -IV: Advanced Database Operations and Practical Applications (10 Periods)

Transactions and Error Handling:

- **Managing Transactions and Implementing Error Handling in sqlite3 Database Operations:**
  - Understanding transactions and their importance.
  - Using `BEGIN`, `COMMIT`, and `ROLLBACK`.
  - Implementing try-except blocks for error handling.
  - Ensuring atomicity, consistency, isolation, and durability (ACID properties).

Query Execution and Data Retrieval:

- **Executing SQL Queries with Parameters:**
  - Preventing SQL injection using parameterized queries.
  - Using placeholders and binding parameters.
- **Fetching and Processing Query Results:**
  - Retrieving data using `fetchall()`, `fetchone()`, and `fetchmany()`.
  - Iterating over result sets.
  - Converting result sets to dictionaries or other data structures.

Unit-V: Test and Tutorials

In addition to CIA, tutorials, seminars, assignments, and case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same).

- **Reading Materials:**
  - "Python SQLite3 Documentation"
  - "SQL Fundamentals" by Joe Celko
- **Online Resources:**
  - SQLite Tutorial at SQLite.org
  - Real Python SQLite Tutorial

Course Code: CA-513P	Course Title: Lab Course (based on CA-511T [B1])
Total Credit: 1.5	Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)	

Sample List of experiments to be carried out based on the course **CA-511T [B1]**

(The teacher can make use of any IDE for python and SQLite3 and can add few more practical based on each unit)

Practical No	Details
1	Set up the sqlite3 environment in Python and verify the installation.
2	Create a new sqlite3 database file and establish a connection to it using Python.
3	Write and execute basic SQL commands (CREATE TABLE, INSERT INTO, SELECT, UPDATE, DELETE) using sqlite3 in Python.
4	Design and create a schema for a sample database using sqlite3 in Python.
5	Establish a database connection to an existing sqlite3 database file and verify the connection in Python.
6	Create and execute a Python script to retrieve data from a sqlite3 database using SELECT queries.
7	Implement error handling in Python scripts for database connection errors and SQL query execution errors.
8	Develop Python functions to perform CRUD operations (Create, Read, Update, Delete) on sqlite3 databases.
9	Implement transactions in Python scripts using sqlite3 to ensure data consistency and integrity.
10	Write a Python program to execute batch processing operations on sqlite3 databases.
11	Handle SQL exceptions in Python scripts using try-except blocks with sqlite3 operations.
12	Configure and utilize connection pooling in Python programs to optimize database connection management.
13	Develop a Python application using sqlite3 to manage a real-world dataset, including database creation, data insertion, and retrieval.

Course Code: CA-512T[A2]	Course Title: - Data Mining
Total Credit: 2	Marks: 50 (UA:40 & IA: 10)
Periods: 3 per week (50 Minutes each)	

Prerequisites:

There are no prerequisites for this course

Learning Objectives

1. Understand the fundamental concepts and motivations behind data mining.
2. Learn and apply basic data pre-processing techniques.
3. Gain the ability to describe, mine, and analyze data patterns and associations.
4. Develop skills to classify and predict data using various algorithms and evaluate their accuracy.

Learning Outcomes

After Completion of the Course students will be able to

1. Explain the key concepts and importance of data mining.
2. Perform basic data pre-processing tasks proficiently.
3. Identify and analyze frequent patterns and associations in data effectively.
4. Classify data, make predictions, and evaluate the performance of different algorithms with confidence.

Unit -I: Introduction to Data Mining (10 Periods)

Motivation for Data Mining (Importance and Applications), **Data Mining Definition and Functionalities** (Key Concepts and Goals), **Classification of Data Mining Systems** (Types and Examples), **Data Mining Task Primitives** (Basic Tasks and Operations), **KDD Process Overview** (Steps in Knowledge Discovery in Databases).

Unit -II: Data Pre-processing (10 Periods)

Data Summarization (Descriptive Statistics (Mean, Median, Mode)), **Data Cleaning** (Handling Missing Values (Mean/Median Imputation)), Handling Noise (Binning), **Data Integration and Transformation** (Combining Data (Concatenation, Join Operations), Transforming Data (Normalization, Standardization), **Data Reduction** (Reducing Data Volume (Sampling, Aggregation)), **Introduction to Feature Extraction and Selection** (Feature Extraction (Principal Component Analysis - PCA), Feature Selection (Chi-Square Test, Correlation Coefficient)).

Unit -III: Concept Description and Mining Patterns (10 Periods)

What is Concept Description? (Understanding Concept Description), **Data Generalization and Summarization-Based Characterization** (Simple Data Summarization (Roll-up, Drill-down)), **Basic Concepts of Frequent Pattern Mining** (Finding Frequent Patterns (Apriori Algorithm)), **Mining Association Rules** (Basic Techniques (Apriori Algorithm)), **Introduction to Correlation Analysis** (Simple Methods (Pearson Correlation, Spearman's Rank Correlation)).

Unit -IV: Classification and Prediction (10 Periods)

Classification vs. Prediction (Differences and Applications), **Basic Classification Algorithms** (Statistical Methods (Naive Bayes)), Distance-Based Methods (k-Nearest Neighbours - k-NN)), **Introduction to**

Neural Networks (Basic Concepts (Perceptron), **Logistic Regression** Explanation and Uses, **Evaluating Classifier and Predictor Accuracy** (Accuracy Metrics (Confusion Matrix, Precision, Recall)).
Unit-V: Test and Tutorials In addition to CIA, tutorials, seminars, assignments, and case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same).

Reference Books:-

1. J. Han, M. Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann
2. M. Kantardzic, "Data mining: Concepts, models, methods and algorithms, John Wiley &Sons Inc.
3. M. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education.
4. Ning Tan, Vipin Kumar, Michael Steinbanch Pang, "Introduction to Data Mining", Pearson Education

Course Code: CA-514P	Course Title: Lab Course (based on CA-512T [A2])
Total Credit: 1.5	Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)	

Sample List of experiments to be carried out based on the course **CA-512T [A2]**

(The teacher can make use of either of Python and R language or WEKA tool for lab sessions and can add few more practical based on each unit)

Practical No	Details
1	How would you handle missing values in a dataset? Provide an example and explain your approach.
2	Implement a basic data summarization technique using Python or R.
3	Apply data cleaning techniques to a dataset to handle noise. Explain the steps you took.
4	Use a dataset to demonstrate data integration and transformation methods.
5	Implement data reduction techniques to reduce the volume of a dataset. Evaluate the effectiveness of your approach.
6	Perform feature extraction on a dataset using Principal Component Analysis (PCA). Interpret the results.
7	Select relevant features from a dataset using the Chi-Square Test. Discuss the significance of the selected features.
8	Use the Apriori algorithm to find frequent itemsets in a transaction dataset. Interpret the results.
9	Mine association rules from a dataset and discuss the implications of the discovered rules.
10	Apply correlation analysis to a dataset and interpret the correlation coefficients.
11	Implement a basic classification algorithm (e.g., Naive Bayes) on a dataset. Evaluate its performance using appropriate metrics.
12	Use k-Nearest Neighbors (k-NN) algorithm for classification. Compare the results with the previous classification algorithm.
13	Train a simple neural network model (e.g., perceptron) for classification tasks. Discuss the advantages and limitations of neural networks.
14	Evaluate the accuracy of different classification models using confusion matrix, precision, and recall metrics. Compare the performance of the models.

Course Code: CA-512T[B2]	Course Title: - Distributed Database Management System
Total Credit: 2	Marks: 50 (UA:40 & IA: 10)
Periods: 3 per week (50 Minutes each)	
Prerequisites: Database Management Systems & Networking	

Learning Objectives

1. Understand the fundamentals of distributed database systems and their architecture.
2. Explore data distribution strategies and their impact on query processing.
3. Learn access control mechanisms and semantic integrity in distributed environments.
4. Master distributed transaction management and concurrency control techniques.

Learning Outcomes

After Completion of the Course students will be able to

1. Analyze and design distributed database systems based on their understanding of distributed data processing and architecture.
2. Implement effective data distribution strategies and optimize queries for distributed environments.
3. Demonstrate proficiency in managing access control and ensuring semantic integrity in distributed databases.
4. Apply various techniques for distributed transaction management and concurrency control to ensure data consistency and reliability.

Unit -I: Introduction to Distributed Databases (10 Periods)

Basics of Distributed Data Processing, understanding processing in distributed environments, Overview of Distributed Database Systems, Exploring structure and functionality, Benefits and Challenges of DDBSs, Discussing advantages and obstacles, Distributed DBMS Architecture, Models (Autonomy, Distribution, Heterogeneity), Architectural Approaches (Client/Server, Peer to Peer, MDBS)

Unit -II: Data Distribution Strategies (10 Periods)

Localized vs. Distributed Data, Comparing storage methods, Data Fragmentation Techniques, Vertical, Horizontal (Primary & Derived), Hybrid, Distribution Transparency and its Impact, Location, Fragmentation, Replication Transparency

Unit -III: Query Processing and Access Control (10 Periods)

Basics of Query Processing, Parsing, Optimization, Code Generation, Centralized Query Processing, Understanding centralized systems, View Management, Authentication Methods (Database vs. OS), Access Rights, Semantic Integrity Control

Unit -IV: Distributed Transactions and Concurrency (10 Periods)

Overview of Transactions and ACID Properties, Understanding Transaction properties, Handling Concurrency Issues, Control Anomalies, Basic Methods (Serializability, Recoverability, Locking, Timestamping)

Unit-V: Test and Tutorials

In addition to CIA, tutorials, seminars, assignments, and case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same).

Reference Books:-

1. Principles of Distributed Database Systems, Ozsu, Pearson Publication
2. Distributed Database Management Systems, Rahimi & Haug, Wiley
3. Distributed Database Systems, Chanda Ray, Pearson Publication
4. Distributed Databases, Sachin Deshpande, Dreamtech

Course Code: CA-514P	Course Title: Lab Course (based on CA-512T [B2])
Total Credit: 1.5	Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)	

Sample List of experiments to be carried out based on the course **CA-512T [B2]**

(The teacher can add few more practical based on each unit)

Practical No	Details
1	How does data processing differ in a distributed environment compared to a centralized one?
2	Explore the structure and functionality of a distributed database system of your choice.
3	Discuss the advantages and challenges of implementing a distributed database system.
4	Explain the autonomy, distribution, and heterogeneity models in distributed DBMS architecture.
5	Compare and contrast different architectural approaches to distributed databases, such as client/server and peer-to-peer.
6	Demonstrate the process of data fragmentation using vertical, horizontal, and hybrid techniques.
7	Investigate the impact of distribution transparency on location, fragmentation, and replication.
8	Implement basic query processing tasks including parsing, optimization, and code generation.
9	Design and execute a centralized query processing task for a given dataset.
10	Manage access control by implementing view management and authentication methods.
11	Discuss the differences between database and operating system authentication for access control.
12	Evaluate access rights management strategies for maintaining data security in distributed databases.
13	Implement semantic integrity control measures for ensuring data consistency across distributed systems.
14	Explore transaction management principles and analyze the ACID properties.
15	Solve concurrency issues by applying basic methods like serializability, recoverability, locking, and timestamping.

Course Code: CA-521T[A1]	Course Title: - Software Quality Assurance & Testing
Total Credit: 2	Marks: 50 (UA:40 & IA: 10)
Periods: 3 per week (50 Minutes each)	
Prerequisites: Software Engineering	
Learning Objectives 1. To understand the basic view of software quality and quality factors. 2. To understand the Software Quality Assurance (SQA) architecture and the details of its components. 3. To understand how the SQA components can be integrated into the project life cycle. 4. To be familiar with the software quality infrastructure	
Learning Outcomes After Completion of the Course students will be able to 1. Utilize the concepts in software development life cycle. 2. Demonstrate their capability to adopt quality standards. 3. Assess the quality of software product. 4. Apply the concepts in preparing the quality plan & documents	
Unit -I: (10 Periods) Introduction to software Quality and Assurance, The software quality challenge, Software quality, Software quality factors, Management and its role in software quality assurance, Components of SQA, The components of the software quality assurance system – overview, Pre-project Software Quality Components, Contract review, Development and quality plans.	
Unit -II: (10 Periods) SQA Components in the Project Life Cycle and Strategies, Integrating quality activities in the project life cycle, Reviews, Software testing – strategies	
Unit -III: (10 Periods) Software Testing – Implementation: Software Quality Implementation, Assuring the quality of software maintenance components, Assuring the quality of external participants' contributions, CASE tools and their effect on software quality	
Unit -IV: (10 Periods) Software Quality Infrastructure Components Procedures and work instructions, Staff training and certification, Corrective and preventive actions, Documentation control, Software Quality Metrics, Software Quality metrics, Cost of Quality	
Unit-V: Test and Tutorials In addition to CIA, tutorials, seminars, assignments, and case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same).	

Reference Books:-

1) Quality and Management Standards (ISO, CMMi, ISO/IEC, IEEE, EIA).
2) KshirsagarNaik and PriyadarshiTripathy, Software Testing & Quality Assurance-Theory and Practice, Wiley Student edition
3) William E. Perry, Effective Methods for Software Testing, WILLEY, . 3rd Edition
4) Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 1997.
5) M G Limaye, Software Testing, Tata McGraw-Hill Education, 2009

Course Code: CA-523P	Course Title: Lab Course (based on CA-521T [A1])
Total Credit: 1.5	Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)	

Sample List of experiments to be carried out based on the course **CA-521T [A1]**

(The teacher can make use of any software testing tool and can add few more practical based on each unit)

Part 1: Test Planning

a) Prepare Quality Plan for any Application like online shopping etc.
b) Prepare Test Plan for any Application like Railway Reservation System etc.
Output: Test plan and Quality Plan

Part 2: Software Testing

a) Create Test cases (Unit, Integration, System and Acceptance Test Cases) for Application
b) Perform manual testing using test case created and prepare test Metrics.

Part 3: Software Testing

Test automation – script creation and execution.
Tools: Selenium

1. Open URL in different browsers (Chrome, Firefox, IE)
2. Perform mouse hovers and other events
3. To take snapshots.
4. Getting current time-stamp
5. To Handle a drop-down.
6. Handling 2 3 steps at a time like Website Registration+login+logout at a time in single run.
7. To Upload File.
8. Storing and fetching data from excel (E.g Registration data)
9. Radio button selection.
10. Checkbox Selection

Course Code: CA-521T[B1]	Course Title: - Modelling & Simulation
Total Credit: 2	Marks: 50 (UA:40 & IA: 10)
Periods: 3 per week (50 Minutes each)	

Prerequisites:

Basic mathematics (algebra and calculus), introductory programming skills, and basic knowledge of statistics and probability.

Learning Objectives

1. Develop and analyze mathematical models.
2. Implement and run simulations using appropriate software.
3. Apply simulation techniques to solve real-world problems.
4. Understand the ethical considerations and limitations of modeling and simulation.

Learning Outcomes

After Completion of the Course students will be able to

1. Formulate and analyze mathematical models for various applications.
2. Implement simulations using appropriate software tools.
3. Apply simulation techniques to address and solve real-world problems.
4. Evaluate the ethical implications and limitations of modeling and simulation.

Unit -I: Introduction to Modelling and Simulation (10 Periods)

Overview of modeling and simulation, importance and applications of modeling and simulation in different domains, types of models: deterministic vs. stochastic, discrete vs. continuous, introduction to simulation: simulation models, simulation languages, simulation environments

Unit -II: Mathematical Foundations of Modelling (10 Periods)

Mathematical modelling: formulation of mathematical models, basic mathematical techniques for modelling: differential equations, difference equations, algebraic equations, model validation and verification techniques, sensitivity analysis and uncertainty quantification in modelling

Unit -III: Simulation Techniques (10 Periods)

Discrete-event simulation: basic concepts and components, simulation process: model development, experimentation, output analysis, simulation languages and tools: overview and comparison, hands-on simulation exercises using simulation software

Unit -IV: Applications of Modelling and Simulation (10 Periods)

Applications in various fields: engineering, healthcare, business, etc., case studies demonstrating the use of modeling and simulation to solve real-world problems, ethical considerations and limitations of modeling and simulation, future trends and advancements in modeling and simulation

Unit-V: Test and Tutorials

In addition to CIA, tutorials, seminars, assignments, and case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same).

Reference Books:-

1. "Simulation Modeling and Analysis" by Averill M. Law
2. "System Modeling and Simulation: An Introduction" by Frank L. Severance
3. "Introduction to Computational Science: Modeling and Simulation for the Sciences" by Angela B. Shiflet and George W. Shiflet

Course Code: CA-523P	Course Title: Lab Course (based on CA-521T [B1])
Total Credit: 1.5	Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)	

Sample List of experiments to be carried out based on the course **CA-521T [B1]**

(The teacher can make use of free tool like Python with libraries such as SimPy for discrete-event simulation or NumPy and Matplotlib for mathematical modelling and analysis and can add few more practical based on each unit)

1. Create a simple deterministic model to simulate the growth of a population over time using a differential equation.
2. Implement a Monte Carlo simulation to estimate the value of π.
3. Simulate a basic queuing system (e.g., a single-server queue) and analyze the average wait time and queue length.
4. Model and simulate the spread of a disease using the SIR (Susceptible-Infected-Recovered) model.
5. Develop a discrete-event simulation of a bank with multiple tellers and analyze customer wait times.
6. Implement a random walk simulation in 1D and 2D and visualize the paths taken.
7. Simulate a basic predator-prey model (Lotka-Volterra equations) and analyze the population dynamics.
8. Create a traffic flow simulation at a single intersection and evaluate the average delay for vehicles.
9. Develop a simple supply chain model and simulate the inventory levels over time.
10. Simulate a manufacturing process with multiple stages and analyze the throughput and bottlenecks.
11. Implement a stochastic model to simulate stock price movements using the Geometric Brownian Motion model.
12. Simulate a Markov chain to model weather patterns (e.g., transitions between sunny, cloudy, and rainy days).
13. Create an agent-based model to simulate the behavior of pedestrians in a confined space.
14. Simulate the performance of a simple caching system and analyze hit rates and response times.
15. Develop a simulation of a basic epidemic scenario and evaluate the impact of different intervention strategies (e.g., vaccination, quarantine).

Course Code: CA-522T[A2]	Course Title: - Shell Programming
Total Credit: 2	Marks: 50 (UA:40 & IA: 10)
Periods: 3 per week (50 Minutes each)	

Prerequisites:

Basic computer literacy, familiarity with the command line, proficiency with a text editor, understanding of basic programming concepts

Learning Objectives

1. Understand the fundamental concepts of shell scripting, including variables, control structures, and input/output operations.
2. Develop proficiency in navigating and managing files and directories using shell commands.
3. Learn how to automate repetitive tasks and system administration operations using shell scripts.
4. Gain practical experience in writing efficient and effective shell scripts through hands-on practice and experimentation.

Learning Outcomes

After Completion of the Course students will be able to

1. Create and execute shell scripts to automate routine tasks and system administration operations effectively.
2. Navigate and manipulate the file system using advanced shell commands and techniques.
3. Demonstrate proficiency in utilizing variables, loops, conditionals, and functions within shell scripts to solve complex problems.
4. Apply best practices for writing clear, maintainable, and efficient shell scripts in diverse computing environments.

Unit -I: Introduction to Shell Scripting (10 Periods)

Understanding the basics of shell scripting, Introduction to shell commands and syntax, Writing and executing simple shell scripts, Basic file management operations using shell commands.

Unit -II: Variables, Conditionals, and Loops (10 Periods)

Declaring and using variables in shell scripts, Implementing conditional statements (if-else) in shell scripts, Using loop structures (for, while) for repetitive tasks, Practice exercises integrating variables, conditionals, and loops.

Unit -III: File Management and Text Processing (10 Periods)

Advanced file management operations using shell commands (e.g., find, grep, sed), Understanding input/output redirection and piping, Processing text files using shell scripts, Practical exercises on text manipulation and file processing.

Unit -IV: : Shell Scripting Best Practices and Automation (10 Periods)

Writing modular and reusable shell scripts, Error handling and debugging techniques in shell scripting, Introduction to shell scripting for automation purposes, Final project: Designing and implementing a practical automation script.

Unit-V: Test and Tutorials

In addition to CIA, tutorials, seminars, assignments, and case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same).

Reference Books:-

1. "Learning the bash Shell" by Cameron Newham and Bill Rosenblatt, O'Reilly Media
2. "UNIX and Linux System Administration Handbook" by Evi Nemeth, Garth Snyder, Trent R. Hein, and Ben Whaley, Addison-Wesley Professional
3. "Shell Scripting: Expert Recipes for Linux, Bash, and More" by Steve Parker, Wiley

Course Code: CA-524P	Course Title: Lab Course (based on CA-522T [A2])
Total Credit: 1.5	Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)	

Sample List of experiments to be carried out based on the course **CA-522T [A2]**

(The teacher can make use of free tool like VS code Studio Bash debug or Atom or any other freeware for implementing the following shell programming and can add few more practical based on each unit)

1. Write a shell script to display "Hello, World!" on the terminal.
2. Create a script that prompts the user for their name and then greets them.
3. Write a script to check if a file exists in the current directory and print a message accordingly.
4. Implement a script to calculate the sum of two numbers entered by the user.
5. Create a script to list all files and directories in the current directory.
6. Write a script to rename files with a specific extension in a directory.
7. Implement a script to count the number of lines, words, and characters in a file.
8. Write a script to find and display the largest number in an array of integers.
9. Create a script to automate the backup of a specified directory.
10. Implement a script to search for a specific string in a file and print the line numbers where it occurs.
11. Write a script to generate a random password of a specified length.
12. Create a script to monitor CPU usage and send an email alert if it exceeds a certain threshold.
13. Implement a script to download a file from a specified URL using curl or wget.
14. Write a script to automate the installation of a list of software packages on a Linux system.
15. Create a script to calculate the factorial of a given number using recursion.

Course Code: CA-522T[B2]	Course Title: - Foundational Data Science
Total Credit: 2	Marks: 50 (UA:40 & IA: 10)
Periods: 3 per week (50 Minutes each)	

Prerequisites:

There are no prerequisites for this course

Learning Objectives

1. Develop a comprehensive understanding of the data science lifecycle, including data collection, cleaning, analysis, and visualization.
2. Acquire practical skills in data manipulation and preprocessing using Python libraries such as NumPy and Pandas.
3. Gain proficiency in exploratory data analysis techniques, including descriptive statistics and data visualization methods for uncovering patterns and insights in datasets.
4. Master fundamental statistical analysis concepts and methods, including probability theory, hypothesis testing, and inferential statistics, for making data-driven decisions.

Learning Outcomes

After Completion of the Course students will be able to

1. Apply the principles of the data science lifecycle to effectively collect, clean, analyze, and visualize datasets for various applications.
2. Utilize Python programming and relevant libraries to manipulate and preprocess data efficiently.
3. Conduct thorough exploratory data analysis, including descriptive statistics and data visualization, to extract meaningful insights from complex datasets.
4. Apply statistical analysis techniques to interpret data, make informed decisions, and communicate findings effectively to stakeholders.

Unit -I: Introduction to Data Science (10 Periods)

Understanding Data Science: Definition, scope, and importance, Overview of data lifecycle: Collection, cleaning, analysis, and visualization, Role of data scientists and interdisciplinary nature of data science

Unit -II: Data Collection and Cleaning (10 Periods)

Data Collection: Sources of data: Structured vs. unstructured, APIs, web scraping, Ethics and legality in data collection, Hands-on exercises on collecting data from various sources

Data Cleaning and Preprocessing: Data cleaning techniques: Handling missing values, outliers, and inconsistencies, Data preprocessing: Normalization, scaling, and feature engineering, Practical examples and tools for data cleaning

Unit -III: Exploratory Data Analysis (EDA) (10 Periods)

Descriptive statistics: Mean, median, mode, variance, standard deviation, Data visualization techniques for EDA: Histograms, box plots, scatter plots, Correlation analysis and identifying patterns in data

Unit -IV: Statistical Analysis (10 Periods)

Probability basics: Probability distributions, Bayes' theorem, Inferential statistics: Hypothesis testing, confidence intervals, Application of statistical methods in data analysis

Unit-V: Test and Tutorials

In addition to CIA, tutorials, seminars, assignments, and case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same).

Reference Books:-

1. "Python for Data Analysis" by Wes McKinney, published by O'Reilly Media.
2. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett, published by O'Reilly Media.
3. "Introduction to Statistical Learning: with Applications in R" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, published by Springer.

Course Code: CA-524P	Course Title: Lab Course (based on CA-522T [B2])
Total Credit: 1.5	Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)	

Sample List of experiments to be carried out based on the course **CA-522T [B2]**

(The teacher can make use of free tools like python or R for implementing the following and can add few more practical based on each unit)

1. Load a dataset into the software and display basic information about its structure and variables.
2. Explore the distribution of a numerical variable in the dataset using a histogram.
3. Create summary statistics (mean, median, standard deviation) for numerical features in the dataset.
4. Visualize the relationship between two numerical variables using a scatter plot.
5. Perform basic data cleaning tasks such as handling missing values and outliers.
6. Encode categorical variables using appropriate techniques such as one-hot encoding or label encoding.
7. Implement web scraping to collect data from a website and store it in a structured format.
8. Preprocess the collected data by cleaning and formatting it for further analysis.
9. Apply techniques to handle missing data, such as imputation or deletion, based on the dataset characteristics.
10. Visualize the distribution of missing values in the dataset and its impact on analysis.
11. Conduct exploratory data analysis by generating descriptive statistics for numerical features.
12. Visualize the distribution of numerical features using box plots and identify outliers.
13. Explore relationships between variables using correlation analysis and visualizations such as heatmaps.
14. Perform dimensionality reduction using techniques like PCA and visualize high-dimensional data in lower dimensions.
15. Implement basic hypothesis testing procedures to compare two groups in the dataset.

Course Code: CA-531T[A1]	Course Title: - Cybersecurity
Total Credit: 2	Marks: 50 (UA:40 & IA: 10)
Periods: 3 per week (50 Minutes each)	
Prerequisites: Networking & Operating System	

Learning Objectives

1. Understand the importance and basic concepts of cybersecurity.
2. Identify and analyze various types of cyber threats.
3. Apply network and operating system security principles.
4. Implement cryptographic techniques and address ethical issues in cybersecurity.

Learning Outcomes

After Completion of the Course students will be able to

1. Grasp and articulate the importance and fundamental concepts of cybersecurity.
2. Recognize and evaluate various types of cyber threats.
3. Effectively implement network and operating system security principles.
4. Utilize cryptographic techniques and navigate ethical issues in cybersecurity.

Unit -I: Foundations of Cybersecurity (10 Periods)

Overview of Cybersecurity, Importance of Cybersecurity, History of Cyber Attacks, Basic Concepts and Terminology (Threats, Vulnerabilities, Risk).

Unit -II: Types of Cyber Threats (10 Periods)

Malware: Viruses, Worms, Trojans, Phishing and Social Engineering, Ransomware and Advanced Persistent Threats (APTs)

Unit -III: Network and Operating System Security (10 Periods)

Fundamentals of Network Security, Firewalls, VPNs, and IDS/IPS, Secure Network Design, OS Security Principles (Windows, Linux),User and File System Security

Unit -IV: Cryptography and Ethical Considerations (10 Periods)

Introduction to Cryptography, Symmetric vs. Asymmetric Encryption, Hash Functions and Digital Signatures, Ethical Hacking and Legal Implications, Privacy and Data Protection Laws

Unit-V: Test and Tutorials

In addition to CIA, tutorials, seminars, assignments, and case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same).

Reference Material: -

1. "Cybersecurity for Beginners" by Raef Meeuwisse (Chapters 1-2)
2. "The Art of Deception" by Kevin Mitnick (Chapters 1-3)
3. "Network Security Essentials" by William Stallings (Chapters 1-3)
4. "Practical UNIX and Internet Security" by Simson Garfinkel and Gene Spafford (Chapters 2-4)
5. "Cryptography and Network Security" by William Stallings (Chapters 2-4)
6. "Hacking Exposed" by Stuart McClure, Joel Scambray, and George Kurtz (Chapters 1-2)

Course Code: CA-533P	Course Title: Lab Course (based on CA-531T [A1])
Total Credit: 1.5	Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)	

Sample List of experiments to be carried out based on the course **CA-531T [A1]**

(The teacher can add few more practical based on each unit)

1. **Virtual Environment Setup:**
   - Set up a virtual machine using VirtualBox or VMware. Install a Linux-based operating system (e.g., Ubuntu) on it. Document the steps and configurations you used.
2. **Basic Security Configuration:**
   - Implement basic security measures on your virtual machine (e.g., updating the system, configuring a firewall, disabling unnecessary services). Provide screenshots and a brief explanation of each step.
3. **Malware Analysis:**
   - Download a benign sample malware (provided by the instructor) and analyze its behavior using tools like Process Monitor and Wireshark. Document your findings.
4. **Phishing Simulation:**
   - Create a phishing email using an email spoofing tool. Ensure it looks legitimate but does not send it. Describe the elements that make it convincing and the potential signs of phishing.
5. **Social Engineering:**
   - Develop a simple social engineering scenario. Role-play with a partner and identify the psychological principles used. Reflect on the experience and discuss ways to mitigate such attacks.
6. **Firewall Configuration:**
   - Configure a firewall on your virtual machine. Write rules to allow HTTP/HTTPS traffic and block all other inbound traffic. Provide screenshots of the configuration and explain the rules.
7. **VPN Setup:**
   - Set up a basic VPN on your virtual machine. Connect to the VPN and verify the connection. Document the setup process and the benefits of using a VPN.
8. **IDS/IPS Configuration:**
   - Install and configure an Intrusion Detection System (IDS) like Snort on your virtual machine. Test it with known attack signatures and document the alerts generated.
9. **Secure Network Design:**
   - Design a small network for a hypothetical organization. Include security measures such as firewalls, DMZ, and network segmentation. Explain your design choices.
10. **User and File System Security:**
    - Create multiple user accounts with different permission levels on your virtual machine. Implement file system permissions and verify the access control. Provide examples and screenshots.
11. **Symmetric Encryption:**
    - Write a Python script to encrypt and decrypt a message using symmetric encryption (e.g., AES). Provide the code and explain how it works.
12. **Asymmetric Encryption:**

- Generate a pair of RSA keys using OpenSSL. Encrypt a message with the public key and decrypt it with the private key. Document the commands and the process.

13. **Hash Functions:**
    - Calculate the hash of a file using different algorithms (e.g., MD5, SHA-256) and compare the results. Explain the importance of hash functions in cybersecurity.
14. **Digital Signatures:**
    - Create a digital signature for a document using OpenSSL. Verify the signature with the corresponding public key. Provide the commands used and explain the process.
15. **Ethical Hacking Case Study:**
    - Analyze a case study of an ethical hacking scenario. Identify the steps taken by the ethical hacker, the vulnerabilities exploited, and the legal and ethical implications. Reflect on how ethical hacking helps improve security.

Course code: CA-531T[B1]
Total Credit: 2
Periods: 3 per week (50 Minutes each)

Course Title: Introduction to Big Data
Marks: 50 (UA: 40 + IA: 10)

Prerequisites

- None

Learning Objectives

- To provide an overview of an exciting growing field of big data analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSqlapReduce.
- To teach the fundamental techniques and Principles in achieving big data analytics with scalability and streaming capability.
- To enable students to have skills that will help them to solve complex real- world problems in for decision support.

Learning Outcomes

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

- Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
- Acquire fundamental enabling techniques and scalable.
- algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
- Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
- Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

Course Outline

Unit -1 Introduction to Big Data, Characteristics of Data, and Big Data Evolution of Big Data, Definition of Big Data, Challenges with big data, Why Big data? Data Warehouse environment, Traditional Business Intelligence versus Big Data. State of Practice in Analytics, Key roles for New Big Data Ecosystems, Examples of big Data Analytics.

Unit -2 Analytical Theory and Methods: Clustering and Associated Algorithms, Association Rules, Apriori Algorithm.

Unit -3 Applications of Association Rules, Validation and Testing, Diagnostics,

Unit -4 Regression, Linear Regression, Logistic Regression, Additional Regression Models.

Unit -4 Test and Tutorial

Reference Books

1. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
2 Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.
3. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
4 Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
5 Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
6 Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press,2012.

Course Code: CS-533P **Course Title:** Practical based on CA-531T[B1]

Total Credit: 1.5 Marks: 50 (UA: 40 + IA: 10)

Periods: 3 per week (50 Minutes each)

Sample List of Experiments and Tutorials to be carried out based on the course.CA-531T[B1]. (Introduction to Big Data)

Course code: CA-532T[A2]
Total Credit: 2
Periods: 3 per week (50 Minutes each)

Course Title: IoT (Internet of Things)
Marks: 50 (UA: 40 + IA: 10)

Prerequisites

- Fundamentals of computer network, web technology etc

Learning Objectives

- IoT market is growing rapidly from installed base of about 30 billion devices in the year 2020and expected to grow up to 75 billion devices by 2025.
- IoT is useful in many sectors like consumer, commercial, infrastructure, health, industry and military. Industry 4.0 is based on IoT.
- It provide opportunity to the students for contribution in IoT applications.

Learning Outcomes

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

- Understand the vision of IoT from a global context.
- Understand the application of IoT.
- Determine the Market perspective of IoT.
- Use of Devices, Gateways and Data Management in IoT.
- Building state of the art architecture in IoT.
- Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

Course Outline

Unit -1 IoT & Web Technology : The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Unit -2 M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.
M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit -3 IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, **IoT Reference Architecture**- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit -4 IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects,

Unit -5 Test and Tutorial

Reference Books

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1 st Edition, VPT, 2014
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013
3. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1

Course Code: CA-534P **Course Title :** Practical based on CA-532-T

Total Credit: 1.5 Marks: 50 (UA: 40 + IA: 10)

Periods: 3 per week (50 Minutes each)

Sample List of Experiments and Tutorials to be carried out based on the course CA-532-T. (IoT (Internet of Things))

1. Define and Explain Eclipse IoT Project.
2. List and summarize few Eclipse IoT Projects.
3. Sketch the architecture of IoT Toolkit and explain each entity in brief.
4. Demonstrate a smart object API gateway service reference implementation in IoT toolkit.5.
5. Write and explain working of an HTTP- to-CoAP semantic mapping proxy in IoT toolkit.
6. Describe gateway-as-a-service deployment in IoT toolkit.
7. Explain application framework and embedded software agents for IoT toolkit.
8. Explain working of Raspberry Pi.
9. Connect Raspberry Pi with your existing system components.
10. Give overview of Zetta.

Course code: CA-532T[B2]
Total Credit: 2
Periods: 3 per week (50 Minutes each)

Course Title: POWER BI
Marks: 50 (UA: 40 + IA: 10)

Prerequisites

- None

Learning Objectives

- To learn about Data Analysis Expressions (DAX) and Data Visualization with Power BI Desktop.
- To discover, explore and visualize enterprise data using Natural Language.

Learning Outcomes

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

- It provides interactive visualizations with self-service business intelligence capabilities.
- end users can create reports and dashboards by themselves, without having to depend on any information technology staff or database administrator.
- It offers Data modelling capabilities including data preparation, data discovery, and interactive dashboards.

Course Outline

Unit -1 Introduction to Power BI, Get Started with Power BI, Overview: Power BI concepts, Sign up for Power BI, Overview: Power BI data sources, Connect to a SaaS solution, Upload a local CSV file, Connect to Excel data that can be refreshed, Connect to a sample, Create a Report with Visualizations, Explore the Power BI portal, Overview: Visualizations , Using visualizations Create a new repor, Create and arrange visualizations, Format a visualization, Create chart visualizations, Use text, map, and gauge visualizations and save a report.

Unit -2 Reports and Dashboards - Modify and Print a Report, Rename and delete report pages , Add a filter to a page or report, Set visualization interactions, Print a report page, Send a report to PowerPoint, Create a Dashboard, Create and manage dashboards, Publishing Workbooks and Workspace, Share Data with Colleagues and Others, Publish a report to the web, Manage published reports, Share a dashboard, Create an app workspace and add users, Use an app workspace, Publish an app

Unit -3 Other Power BI Components and Table Relationship, Use Power BI Mobile Apps, Get Power BI for mobile. View reports and dashboards in the iPad app, Use workspaces in the mobile app, Sharing from Power BI Mobile, Use Power BI Desktop, Install and launch Power BI Desktop, Get data, Reduce data, Transform data

Unit -4DAX functions New Dax functions, Date and time functions, Time intelligence functions, Filter functions, Information functions, Logical functions, Math & trig functions, Parent and child functions, Text functions

Unit -5 Test and Tutorial

Reference Books

1. Introducing Microsoft Power BI by Alberto Ferrari and Marco Russo PUBLISHED BY Microsoft Press A division of Microsoft Corporation One Microsoft Way Redmond, Washington 98052-6399

Course Code: CA-534P **Course Title :** Practical based on CA-532T [B2]

Total Credit: 1.5 Marks: 50 (UA: 40 + IA: 10)

Periods: 3 per week (50 Minutes each)

Sample List of Experiments and Tutorials to be carried out based on the course CA-532T[B2].

(POWER BI)

Course Code: CA-541(E)	Course Title: Android Programming
Total Credits: 2	Marks: 50 (IA: 50)
Periods: 3 per week (50 Minutes each)	
Prerequisites: Student must have a thorough knowledge about Java Programming	
Learning Objectives To provide the comprehensive insight into developing applications running on smart mobile devices and demonstrate programming skills for managing task on mobile. To provide systematic approach for studying definition, methods, and its applications for Mobile-App development.	
Learning Outcomes 1) Understand the requirements of Mobile programming environment. 2) Learn about basic methods, tools and techniques for developing Apps 3) Explore and practice App development on Android Platform 4) Develop working prototypes of working systems for various uses in daily lives.	
Unit 1: Introduction to Android Development What is Android OS, Android Architecture, History of Android, Android System Architecture, Advantages and Disadvantages of Android Development, Android Fundamentals, Introduction to Android Studio	
Unit 2: Android Activity, UI, Intent & Notification Creating first android app, understanding the components of screen, adapting display orientation, action bar, Activities and Intents, Activity Lifecycle and Saving State, Layouts in Android UI Design- Linear, Relative, Frame, Grid. Intent- Implicit & Explicit, Notification- Broadcast receivers, Services & Notification, Toast.	
Unit 3: Android View And Buttons Basic Views: Text View, Button, Image Button, Edit Text, Checkbox, Toggle Button, Radio Button, and Radio Group Views, Progress Bar View, AutoCompleteTextView, Time Picker View, Date Picker View, List View, Spinner View	
Unit 4: Android Database Connectivity Data - saving, retrieving, and loading: Overview to storing data, Shared preferences, SQLite primer, store data using SQLite database, Content Providers, loaders to load and display data, Permissions, performance, and security.	
Unit 5: Test & Tutorials In addition to CIA, Tutorials, Seminars, Assignments & Case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same.)	

Course Assessment (Full 50 Marks Internal Assessment)

Here are some potential assessments that could be used to evaluate understanding and practical skills for this course.

1. Implement Activity Life Cycle in Android with all its phases
2. Implement different layout in Android
3. Implement TextView widget in Android
4. Implement Radio Button in Android

5 Write a program to implement Toggle Button
6 Write a program to implement Checkbox
7 Write a program in Android to implement Intent
8 Write a program to implement Date and Time picker in Android
9 Write a program in Android to implement TextToSpeech
10 Write a program in Android to create a Login Page

Course Code: CA-541T(F)	Course Title:- Problem Solving and Decision Making
Total Credit: 2	Marks: 50 (IA: 50)
Periods: 3 per week (50 Minutes each)	

Prerequisites:
There are no prerequisites for this course

Learning Objectives

5. To understand the concepts of problem solving and decision making and their significance in personal and professional life.
6. To develop problem-solving skills, including defining problems, generating alternatives, evaluating options, and implementing solutions.
7. To cultivate decision-making abilities, including analyzing information, considering consequences, and choosing the best course of action.
8. To apply problem-solving and decision-making techniques to real-life scenarios.

Learning Outcomes
After Completion of the Course students will be able to

5. Identify and define problems effectively.
6. Generate and evaluate multiple solutions to a given problem.
7. Make informed decisions by considering various factors and potential outcomes.
8. Apply problem-solving and decision-making techniques in personal and professional contexts.

Unit -I: Introduction to Problem Solving and Decision Making (10 Periods)
- Understanding the concepts of problem solving and decision making
- Significance of effective problem solving and decision making in different contexts
- Historical perspectives on problem-solving methodologies

Unit -II: Developing Problem-Solving Skills (10 Periods)
- Steps in the problem-solving process: defining the problem, generating alternatives, evaluating options, implementing solutions
- Problem-solving techniques and tools
- Creative problem-solving methods
- Overcoming obstacles in problem solving

Unit -III: Enhancing Decision-Making Abilities (10 Periods)
- Rational decision making vs. intuitive decision making
- Decision-making models and frameworks
- Factors influencing decision making: cognitive biases, emotions, risk perception
- Ethical considerations in decision making

Unit -IV: Applying Problem Solving and Decision Making (10 Periods)
- Real-life case studies and scenarios for application of problem-solving and decision-making skills

- Group decision-making processes
- Strategies for effective implementation of decisions
- Evaluating the outcomes of decisions and adjusting strategies accordingly

Unit-V: Test and Tutorials

In addition to CIA, tutorials, seminars, assignments, and case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same).

Textbook

1. "Problem Solving 101: A Simple Book for Smart People" by Ken Watanabe

References:

1. "Decision Making For Dummies" by Dawna Jones and Pat Swanson
2. "Think Smarter: Critical Thinking to Improve Problem-Solving and Decision-Making Skills" by Michael Kallet
3. "Smart Choices: A Practical Guide to Making Better Decisions" by John S. Hammond, Ralph L. Keeney, and Howard Raiffa

E-Resources

1. https://www.mindtools.com/pages/main/newMN_TMC.htm
2. https://www.coursera.org/courses?query=problem%20solving%20and%20decision%20making

Course Assessment (Full 50 Marks Internal Assessment): To assess the skills acquired in a problem-solving and decision-making course, a combination of formative and summative assessment methods can be used:

1. Written Assignments
2. Discussions
3. Group Activities
4. Quizzes and Tests
5. Self-assessment
6. Peer Assessment
7. In-class Activities

Sample questions for assessment methods could include:

1. Written Assignments: Analyze a real-world problem and propose a solution, considering various alternatives and potential consequences.

2. Discussions: Debate the ethical implications of a decision made by a fictional character in a case study.

3. Group Activities: Work as a team to develop a strategy for resolving a complex business problem, considering different perspectives and potential risks.

4. Quizzes and Tests: True/False question: A rational decision-making process always leads to the best outcome.

5. Self-assessment: Reflect on your decision-making process in a recent personal or professional situation. What factors influenced your decision, and how could you improve your approach in the future?

6. Peer Assessment: Provide feedback on a classmate's proposed solution to a problem, evaluating the feasibility and effectiveness of their approach.

7. In-class Activities: Participate in a role-playing exercise where students take on different decision-making roles in a simulated scenario, and observe each other's strategies and outcomes.

By using a variety of assessment methods, students' problem-solving and decision-making skills can be effectively evaluated, ensuring they have the competencies required for success in both academic and professional settings.



B.Sc. (Computer Science)

Semester - VI

Course Code: CA-611T[A1]	Course Title: JAVA SERVER PAGES
Total Credits: 2	Marks: 50(UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)	

Prerequisites:
A rudimentary familiarity of HTML, CSS, or any programming language would be helpful.

Learning Objectives

- Explore the fundamentals of exception handling in Java.
- Create and use exception handling through classes and objects.
- Understand the concept of Threads in Java.
- To learn event handling in Swings, JFrames and Components.

Learning Outcomes

- Use the Java language for writing well-organized, complex computer programs with both command line and graphical user interfaces.
- Develop web application using Java Servlet and Java Server Pages technology.
- Learn how to work with ODBC, JSP and Servlets.
- Gathering the JDBC database connectivity, Java beans importance and services.
- Exploring advance JSTL libraries.
- Come across the applications of java events and their approaches.

Unit 1:
Introduction to JSP, Architecture of JSP page, Life cycle of JSP page, scripting tags –(Script let,Declarative, Expression)

Unit 2:
• Implicit objects (all 9 objects) , Directive tags (Page, Include Tag lib)
•ActionTags:<include>,<forward>,<param>,<usebean>,<setproperty>,<getproperty>,<Plugin>, <params>,<fallback>,<attribute>,<body>,<element>,<text>
• JSP & Java Beans

Unit 3:
• Database Access to JSP page, Session Tracking, Session API in JSP.
• Introduction to JSTL, Core tag library, XML tag library, Internationalization tag library, SQL tag library, Functions tag library.

Unit 4: Test & Tutorials
In addition to CIA, Tutorials, Seminars, Assignments & Case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same.)

Reference Books:

1. JSP: The Complete Reference - Phil Hanna (Tata Mcgraw Hill)
2. Java Server Programming Java EE6 (J2EE 1.6) – Black Book (Dreamtech Publication)

Course Code: CA-613P	Course Title: Lab Course based on CA-611T[A1]
Total Credits: 1.5	**Marks: 50(UA: 40 + IA: 10)**
Periods: 3 per week (50 Minutes each)	

Sample List of Practicals
(The teacher can conduct three Practicals based on each unit as per their choice and feasibility)

1. Create a simple JSP page that displays "Hello, World!" in the browser.
2. Practice embedding Java code within JSP using scriptlets to perform basic operations like arithmetic, string manipulation, or displaying the current date/time.
3. Create JSP pages that demonstrate the use of if-else statements and switch-case statements to control the flow of execution.
4. Practice using loops such as for, while, and do-while loops within JSP to iterate over data structures or perform repetitive tasks.
5. Create JSP pages that handle form submissions. Retrieve form data using request parameters and display them back to the user.
6. Learn and practice using JSTL tags for common tasks such as iteration, conditionals, formatting, and internationalization.
7. Create and use custom tags in JSP for reusable components or functionality. Practice both simple and complex custom tag implementations.
8. Explore techniques for managing external resources such as files, databases, or web services within JSP pages.
9. Implement common design patterns within JSP applications, such as MVC (Model-View-Controller), to improve code organization and maintainability.
10. Experiment with error handling in JSP by using try-catch blocks, error pages, and handling different types of exceptions gracefully.

Course Code: CA-611T[B1]	Course Title: Machine Learning Using Python
Total Credits: 2	**Marks: 50(UA: 40 + IA: 10)**
Periods: 3 per week (50 Minutes each)	
Prerequisites: Student must know basics of Python.	
Learning Objectives: To Learn various Testing Techniques. Learn to Develop Simple Algorithms. Learn About The ML with Python Programming And Well-Structured Algorithms/ Programs. Develop the Skills for python programming with Solutions to a Problem.	
Learning Outcomes: Learn the History and Machine learning with Python Programming. Learn Various Approach of Writing Better Program. Learn to Develop Simple Algorithms, Tools and Techniques.	
Unit 1. Introduction to Machine Learning: **Introduction:** Introduction to Machine Learning, Application of Machine Learning, Why Machine Learning?, Types of Machine Learning, Uses of Machine Learning, Why Python. **Essential Libraries:** NumPy, SciPy, MatPlotLib, Pandas, how to Install and Use of Libraries.	
Unit 2: Handling Data: Qualitative Data And Quantitative Data, Nominal Data, Ordinal Data, Discrete Continuous, Understanding Data Types In Pandas, Data Splitting, Data Scaling, Array Dimension. Finding Mean, Median, Mode, standard deviation and Variance.	
Unit 3: Exploratory Data Analysis (EDA): Goals of Exploratory Data Analysis, Types of Exploratory Data Analysis, Bivariate Analysis, multivariate analysis, time series analysis, Getting Insights About Data Set, Handling Missing Data, Exploratory Data Analysis Using Python Libraries, Data Visualization Tools: Graph and Maps, Plots.	
Unit 4: Introduction to Supervised Learning and Unsupervised Learning: Supervised Learning: Classification, Regression, Decision Trees, Unsupervised Learning: Clustering, Clustering with Advantages & Disadvantages, Introduction Reinforcement Learning, Introduction to Semi Supervised Learning.	
Unit 5: Test & Tutorials In addition to CIA, Tutorials, Seminars, Assignments & Case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same.)	

Reference Books:

1. Introduction of Machine Learning Using Python, A GUIDE FOR DATA SCIENTISTS, By Andreas C. Müller & Sarah Guido.
2. Machine Learning Engineering with Python. by Andrew P. McMahon.
3. Machine Learning, Data Science and Generative AI with Python. by Frank Kane.
4. Machine Learning with Python Cookbook, 2nd Edition. by Kyle Gallatin, Chris Albon.

Sample List of Practicals

Course Code: CA-613P	**Course Title: Lab Course based on CA-611T[B1]**
Total Credits: 1.5	**Marks: 50(UA: 40 + IA: 10)**
Periods: 3 per week (50 Minutes each)	

(The teacher can conduct three Practicals based on each unit as per their choice and feasibility)

1. Implement the python program to Calculate the Mean, Medium and Mode.
2. Implement the python program to calculate the Standard Deviation and Variance.
3. Implement the python program to draw a histogram.
4. Implement the python program to draw Scatter Plot.
5. Implement the python program for data visualize distribution using ` Matplotlib` library.
6. Implement the python program to retrieve data using pandas.
7. Implement the python program to plot data using Matplotlib library.
8. Implement the python program to read dataset from CSV. File.
9. Implement the python program to Analyzing the Data using shape (), info (), describe ().
10. Implement the python program to Check Columns, and Check Missing Values.
11. Implement the python program to Check for the duplicate values
12. Case study for Exploratory Data Analysis (EDA) on sales dataset.

Course Code: CA-612T[A2]	Course Title: - Data Visualization
Total Credit: 2	Marks: 50 (UA:40 & IA: 10)
Periods: 3 per week (50 Minutes each)	

Prerequisites:

1. Basic programming knowledge in Python and R
2. Introductory statistics understanding
3. Experience with data handling and manipulation

Learning Objectives

9. Create effective and visually appealing data visualizations using Python and R.
10. Efficiently clean, transform, and prepare datasets for visualization.
11. Develop interactive and dynamic visualizations using Plotly.
12. Apply principles of color theory and visual aesthetics to enhance data visualizations.

Learning Outcomes

After Completion of the Course students will be able to

5. Create diverse and effective data visualizations using Matplotlib, Seaborn, and ggplot2.
6. Perform data wrangling tasks, including cleaning, transforming, and preparing datasets, using Pandas and tidyr/dplyr.
7. Develop and customize interactive visualizations with Plotly to enhance data exploration and presentation.
8. Apply principles of color theory and visual aesthetics to design clear and engaging data visualizations.

Unit -I: Introduction to Data Visualization (10 Periods)

Definition and Scope: What is Data Visualization? History and Evolution of Data Visualization.
Importance of Data Visualization: Benefits in Data Analysis and Communication. Real-World Applications and Case Studies.
Types of Data Visualizations: Charts, Graphs, and Plots: An Overview. Infographics and Dashboards.
Data Visualization in Different Fields (Business, Science, etc.).
Fundamentals of Visual Encoding: Visual Variables: Position, Size, Shape, Color, and Texture. Principles of Color Theory and Effective Use of Colors.

Unit -II: Data Wrangling and Visualization with Python (10 Periods)

Introduction to Python Visualization Libraries: Overview of Matplotlib and Seaborn, Setting Up the Python Environment.
Creating Basic Visualizations: Line Plots, Bar Charts, Histograms, and Scatter Plots, Customizing Plots: Titles, Labels, Legends, and Annotations.
Data Wrangling with Pandas: Data Cleaning and Transformation Techniques, Handling Missing Data and Outliers, Merging, Grouping, and Aggregating Data.
Advanced Plotting Techniques: Complex Visualizations: Heatmaps, Pair Plots, and Violin Plots, Subplots and Multiple Plots in a Single Figure, Theming and Styling Advanced Visualizations.

Unit -III: Data Wrangling and Visualization with R (10 Periods)

Introduction to R Visualization Libraries: Overview of ggplot2, Setting Up the R Environment.
Creating Basic Visualizations with ggplot2: Grammar of Graphics: Concepts and Implementation, Basic Plots: Line, Bar, Histogram, and Scatter Plots, Customizing Aesthetics: Colors, Themes, and Facets.
Data Wrangling with tidyr and dplyr: Data Cleaning and Preparation, Reshaping and Pivoting Data, Summarizing and Filtering Data.
Advanced Plotting Techniques with ggplot2: Complex Visualizations: Geoms, Stats, and Layers, Combining Multiple Plots with Patchwork.

Unit -IV: Interactive Visualizations with Plotly (10 Periods)

Introduction to Plotly: Overview of Plotly for Python and R, Comparison with Static Visualization Tools.
Creating Static and Interactive Visualizations: Basic Interactive Plots: Line, Bar, and Scatter Plots,
Enhancing Interactivity: Hover, Zoom, and Select.
Customizing Interactivity and Appearance: Layout and Styling: Titles, Axes, and Legends, Adding Annotations, Shapes, and Images.
Advanced Topics in Interactive Visualizations: 3D Plots and Geo-Spatial Visualizations.

Unit-V: Test and Tutorials

In addition to CIA, tutorials, seminars, assignments, and case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same).

Reference Book: -

4. "Essentials of Data Visualisation" ISBN 978-93-5543-406-8 by Dr. Nazneen Akhter and Dr. Bharti Gawali, Shrof Publications 2024

Reference Material: -

1. Matplotlib Gallery: Matplotlib's official website provides a gallery showcasing a wide range of visualizations along with the code used to create them. It's a great resource for learning and inspiration.
2. Seaborn Gallery: Seaborn's official website also features a gallery with examples of different types of visualizations created using Seaborn.
3. "Fundamentals of Data Visualization" by Claus O. Wilke: This book is freely available online and covers fundamental principles of data visualization using R and ggplot2.
4. "Interactive Data Visualization for the Web" by Scott Murray: While not completely free, the online version of this book is available on GitHub, covering interactive visualization techniques using web technologies like D3.js.

Course Code: CA-614P	Course Title: Lab Course (based on CA-612T [A2])
Total Credit: 1.5	Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)	

Sample List of experiments to be carried out based on the course **CA-612T [A2]**

(The teacher should make use of visualization libraries of python and r can add few more practical based on each unit)

1. Define data visualization and discuss its significance in data analysis and communication. Provide examples of real-world applications.
2. Describe the evolution of data visualization throughout history and its impact on modern data analysis.
3. Explain the different types of data visualizations and provide examples of when each type is most appropriate.
4. Discuss the fundamental principles of visual encoding, including visual variables and color theory. How can these principles be effectively applied in data visualization?
5. Demonstrate the process of setting up the Python environment for data visualization using Matplotlib and Seaborn.
6. Create a line plot, bar chart, histogram, and scatter plot using Matplotlib. Customize these plots by adding titles, labels, legends, and annotations.
7. Utilize Pandas to clean and transform a dataset, handle missing data and outliers, and perform data aggregation.
8. Implement advanced plotting techniques in Python, such as heatmaps, pair plots, and violin plots. Create subplots and multiple plots within a single figure.
9. Install and set up the R environment for data visualization using ggplot2.
10. Use ggplot2 to create basic plots including line, bar, histogram, and scatter plots. Customize the aesthetics of these plots, including colors, themes, and facets.
11. Employ tidyr and dplyr to clean and prepare a dataset, reshape and pivot data, and summarize and filter data.
12. Explore advanced plotting techniques in R using ggplot2, including complex visualizations with geoms, stats, and layers. Combine multiple plots using Patchwork.
13. Introduce Plotly and compare its features with static visualization tools. How does Plotly enhance interactivity in data visualization?
14. Develop static and interactive visualizations using Plotly for Python and R, including basic line, bar, and scatter plots. Enhance interactivity through hover, zoom, and select functionalities.
15. Customize the interactivity and appearance of Plotly visualizations by adjusting layout, titles, axes, legends, and adding annotations, shapes, and images. Experiment with 3D plots and geo-spatial visualizations.

Course code: CA-612T[B2] **Course Title: Blockchain**

Total Credit: 2 Marks: 50 (UA: 40 + IA: 10)

Periods: 3 per week (50 Minutes each)

Prerequisites :- Networking security, Database management system etc

Learning Objectives

- To make the students aware about creation of strong cryptographic distributed and replicated ledger of events, transactions, and data generated through various IT processes.
- To make the students familiar with crypto currencies.

Learning Outcomes

After learning the course the students should be able to:

- familiarise the functional/operational aspects of cryptocurrency.
- understand emerging abstract models for Blockchain Technology.
- identify major research challenges and technical gaps existing between theory and practice in cryptocurrency domain.

Course Outline

Unit–1 Introduction - Basic ideas behind blockchain, How it is changing the landscape of digitalization, Cryptographic basics for cryptocurrency, A short overview of hashing, Signature schemes, Encryption schemes and elliptic curve cryptography

Unit - 2 Models for Blockchain - The Consensus problem, Asynchronous Byzantine Agreement, AAP protocol and its analysis, Nakamoto Consensus on permission-less, nameless, peer- to-peer network, Abstract Models for Blockchain, GARAY model, RLA Model, Proof of Work (PoW) as random oracle, formal treatment of consistency, liveness and fairness, Proof of Stake (PoS) based Chains, Hybrid models (PoW + PoS)

Unit - 3 Mechanics of Bitcoin Bitcoin, Wallet, Blocks, Merkley Tree, Bitcoin transactions, Transaction verifiability, Anonymity, Forks, Double spending, Mathematical analysis of properties of Bitcoin, Bitcoin scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements, How to store and use Bitcoins, Simple local storage, Hot and cold storage, Splitting and sharing keys, Online wallets and exchanges, Payment services, Transaction fees, Currency exchange markets

Unit - 4 Alternative coin and Recent Trends Ethereum, Ethereum Virtual Machine (EVM), Wallets for Ethereum, Solidity, Smart Contracts, some attacks on smart contracts, Zero Knowledge proofs and protocols in Blockchain, Succinct non interactive argument forKnowledge (SNARK), pairing on Elliptic curves, Zcash

Unit - 5 Test and Tutorial/Case Studies

Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems and others.

Reference Books:-

1. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction
by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder Princeton University Press, 2016
2. SoK: Research Perspectives and Challenges for Bitcoin and Cryptocurrency
by Joseph Bonneau et al IEEE Symposium on Security and Privacy, 2015
3. The bitcoin backbone protocol - analysis and applications by J.A.Garay et al
EUROCRYPT 2015 LNCS VOl 9057, (VOLII), pp 281-310

Course Code: CA-614P **Course Title : Practical based on CA-612T[B2]**

Total Credit: 1.5 Marks: 50 (UA: 40 + IA: 10)

Periods: 3 per week (50 Minutes each)

Sample List of experiments to be carried out based on the course CA-612T[B2]

1. Create different types of Blockchain bitcoin wallet.
2. Do the Bitcoin Transaction from bitcoin wallet.
3. Implement Merkley tree hash algorithm.
4. Set up an environment for Ethereum on Windows and Linux.
5. Install & setup Ethereum wallet and send/receive ether.
6. Create smart contracts using solidity.
7. Create smart contract for connect with the front end (web page).
8. Implement smart contract to send ether to another contract/address.
9. Implement smart contract for deposit and withdrawals money from digital bank.
10. Implement zero knowledge proof protocol using blockchain.

Course Code: CA-621T [A1]	Course Title: Software Project Management
Total Credits: 2	**Marks: 50(UA: 40 + IA: 10)**
Periods: 3 per week (50 Minutes each)	
Prerequisites: Student must know basics of Software Project Management.	
Learning Objectives To learn various techniques or models for manage the development time span.	
Learning Outcomes • Apply project management concepts and techniques to an IT project. • Identify issues that could lead to IT project success or failure. • Explain project management in terms of the software development process. • Describe the responsibilities of IT project managers. • Apply project management concepts through working in a group as team leader • Be an active team member on an IT project.	
Unit 1: Software Efforts estimation and Software Project Introduction, Problems over and under estimates basics of software estimation, Estimation techniques, function point analysis and COCOMO model.	
Unit 2: Activity Planning Introduction, Objectives of Activity Planning, Project Schedule, Projects and Activities, Sequence and schedule, Adding time dimension, Identifying the critical path.	
Unit 3: Risk management, Risk category of risk, framework for dealing with risk, risk identification, risk assessment, risk planning, PERT technique, Resource allocation, Nature of resources, identifying resources, scheduling resources.	
Unit 4: Monitoring and control, Framework creation, Data collection, Visualizing progress, Software quality importance, defining software quality, quality management.	
Unit 5: Test & Tutorials In addition to CIA, Tutorials, Seminars, Assignments & Case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same.)	

Reference Books:

1. Bob Hughes and Mike Cotterell - Software project management – fourth edition - McGraw Hill
2. Walker Royce - Software Project Management - Addison Wesley.

Course Code: CA-623P	Course Title: Lab Course based on CA-621T[A1]
Total Credits: 1.5	Marks: 50(UA: 40 + IA: 10)
Periods:	

Sample List of Practicals
(The teacher can conduct three Practicals based on each unit as per their choice and feasibility)

Following steps of Software Project management can be studied on the basis of some project topics allotted to students.

1. REQUIREMENT GATHERING AND ANALYSIS.
2. DEVELOPMENT ENVIRONMENT.
3. SRS
4. ERD
5. DFD
6. USECASE DIAGRAM
7. ACTIVITY DIAGRAM
8. SEQUENCE DIAGRAM
9. CLASS DIAGRAM
10. FEASIBILITY STUDY

Course code: CA-621T[B1] **Course Title: GIS and Remote Sensing**
Total Credit: 2 Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)

Prerequisites :- Nil

Learning Objectives

- To develop a basic understanding about Geo-Spatial techniques and its applications.
- To enable the students to apply the tools to solve various problems.

Learning Outcomes

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

- Observe, Identify and define simple/ complex problems of day to day lives
- present in Industry/ Society where GIS and Remote Sensing applications can be useful.
- Apply knowledge of basic image interpretation and data image processing.
- Integrate the existing data through various observations from various angles and layer creation.
- Apply problem-solving methodologies to generate, evaluate and justify
- innovative solutions by designing and conducting/ analyzing and interpreting the data.

Course Outline

Unit – 1: FUNDAMENTAL OF REMOTE SENSING: Definition –Components of Remote Sensing –Active and Passive Remote Sensing – Electro Magnetic Spectrum – Interaction of EMR With the Earth's Surface – Interactions with the Atmosphere Energy Sources and Radiation. Active and Passive Remote Sensting. Energy Interaction in the Atmosphere. Energy Interaction with the Earth Surface Features. Data Acquisition and Recording. Remote Sensing Data Products.

Unit – 2 : IMAGE INTERPRETATION AND DIGITAL IMAGE PROCESSING - Introduction to Digital Image and Imaging Sensors- Data Formats of Digital Image- Display of Digital Image - Image Processing Systems – Strategies – Keys – Equipments – Digital Image Processing – Rectification and Restoration – Enhancement of Image – Image Transformation, Classification and Analysis.

Unit – 3: GEOGRAPHIC INFORMATION SYSTEM - Introduction to GIS- Definitions of GISand related terminology - Components of GIS – GIS Data – Georeferenced data – Components of GIS- Data input and output –Data quality and Management – GIS analysis functions – Retrieval – Reclassification –- Buffering and Neighbourhood – Overlaying – Data Output – Implementation of GIS- GIS Analysis functions.

Unit – 4 : SOFTWARE - GIS and Image interpretation Software – Salient features – Capabilities and Limitations. Data management in different GIS software- Spatial Data Models- Attribute Data Management APPLICATIONS - Application of Remote Sensing / GIS– Case studies. GIS and Remote Sensing – Usefulness in Civil Engineering.

Unit– 5: Test and Tutorial

Reference Books :

1. Lilliesand T.M. and Kiefer R.W., Remote Sensing and image Interpretation , John Wiley and Sons, New York, 2004.
2. Burrrough P.A and McDonnel R.A., Principles of Geographic Information Systems, Oxford university press, 1998
3. A.M. Chandra and S.K. Ghosh,Remote Sensing and Geographical information System, Narosa Publishing House, New Delhi, 2006
4. BhattaB.,Remote Sensing and GIS, Oxford University Press, New Delhi, 2008
5. Stan Aronoff, "Geographical Information Systems", WDL Publications, Ottawa, Canada, 1989.

6. Agrawal N.K., Essentials of GPS, Spatial Network Pvt. Ltd., Hydrabad, 2004.
7. Bhatta B., Remote Sensing and GIS, Oxford University Press, New Delhi, 2008
8. Manual of Remote Sensing (Edited), Series of volumes.
9. Lo C.P. and Yeung Albert K.W., Concepts and Techniques of Geographical Information Systems, Prentice-Hall of India Pvt. Ltd. New Delhi, 2006

Course Code: CA-623P
Total Credit: 1.5
Periods: 3 per week (50 Minutes each)

Course Title : Practical based on CA-621T[B1]
Marks: 50 (UA: 40 + IA: 10)

List of Experiments: GIS and Remote Sensing

Minimum 10 Experiments are to be designed.

Course code: CA-622T[A2] **Course Title: Linux Administration**
Total Credit: 2 Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)

Prerequisites :- Linux O.S.

Learning Objectives

- Demonstrate proficiency with the Linux command line interface, directory & file management techniques, file system organization, and tools commonly found on most Linux distributions.
- Effectively operate a Linux system inside of a network environment to integrate with existing service solutions.
- Demonstrate the ability to troubleshoot challenging technical problems typically encountered when operating and administering Linux systems.

Learning Outcomes
On completion of the course, the students will be able to:

- Learner will be able to develop Linux based systems and maintain.
- Learner will be able to install appropriate service on Linux server as per requirement.
- Learner will have proficiency in Linux server administration.

Course Outline

Unit – 1: Introduction: Technical Summary of Linux Distributions, Managing Software Single-Host Administration: Managing Users and Groups, Booting and shutting down processes, File Systems, Core System Services, Process of configuring, compiling, Linux Kernel.

Unit – 2 : Networking and Security: TCP/IP for System Administrators, basic network Configuration, Linux Firewall (Netfilter), System and network security.

Unit – 3: Internet Services: Domain Name System (DNS), File Transfer Protocol (FTP), Apache web server, Simple Mail Transfer Protocol (SMTP), Post Office Protocol and Internet Mail Access Protocol (POP and IMAP), Secure Shell (SSH), Network Authentication, OpenLDAP Server, Samba and LDAP, Network authentication system (Kerberos), Domain Name Service (DNS), Security

Unit – 4 : Intranet Services: Network File System (NFS), Samba, Distributed File Systems (DFS), Network Information Service (NIS), Lightweight Directory Access Protocol (LDAP), Dynamic Host Configuration Protocol (DHCP), MySQL, LAMP Applications File Servers, Email Services, Chat Applications, Virtual Private Networking.

Unit– 5: Test and Tutorial

Reference Books :
1. Beginning Linux by Neil Mathew 4 th Edition
2. Red hat Linux Networking and System Administration by Terry Collings
3. UNIX: Concepts and techniques, S. Das, Tata McGraw-Hill,
4. Linux Administration: A Beginner's Guide, Fifth Edition, Wale Soyinka, Tata McGraw-Hill
5. Linux: Complete Reference, 6 th Edition, Richard Petersen, Tata McGraw-Hill

Course Code: CA-624P **Course Title :** Practical based on CA-622T[A2]
Total Credit: 1.5 Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)

List of Experiments:

1. Installation of Fedora/Ubuntu Linux operating system.
a. Partitioning drives
b. Configuring boot loader (GRUB/LILO)
c. Network configuration
d. Setting time zones
e. Creating password and user accounts
f. Shutting down
2. Software selection and installation
3. Programming Shell scripts for Linux administration
4. Linux system administration
a. Becoming super user
b. Temporarily changing user identity with su command
c. Using graphical administrative tools
d. Administrative commands
e. Administrative configuration files
5. Connecting to the internet and configuring samba
a. Setting up dial-up PPP
b. Creating a dial- up connection with the internet configuration wizard
c. Launching PPP connection
d. Setting up linux as a proxy server
e. Configuring mozilla or firefox to use as a proxy
6. Setting up local area network
a. LAN topologies
b. LAN equipment
c. Networking with TCP/IP
d. Configuring TCP/IP
e. Adding windows computer's to user LAN
f. IP address classes
7. Server setup and configuration
a. Setting up NFS file server
b. Setting up Samba file server
c. The Apache web server
d. Setting up FTP server
e. Setting up proxy server
8. Understanding COMPUTER SECURITY: Firewall and security configurations
a. LINUX security checklist
b. Securing linux with IP table firewalls
c. Configuring an IP table firewall
d. Securing Linux features
9. Programming using C.
10. Implementing Socket programs.
11. Setting up hardware devices including sound card and printers and others (USB devices etc).
12. Working with X-windows: a. Switching between text and graphical consoles
b. set up my video card, monitor and mouse for the X-server.
c. Install KDE, change default desktop to KDE (or Gnome)
d. Installing TrueType fonts from my MS Windows partition.
e. Display and Control a Remote Desktop using VNC.

DSE-2B(2)

Course code: CA-622T[B2]
Total Credit: 2
Periods: 3 per week (50 Minutes each)

Course Title: Advance Data Science
Marks: 50 (UA: 40 + IA: 10)

Prerequisites : Basic data Science

Learning Objectives

.Data Science is a fast-growing interdisciplinary field, focusing on the analysis of data to extract knowledge and insight.
.To introduce students to the collection, Preparation, analysis, modelling and visualization of data, covering both conceptual and practical issues.
.Examples and case studies from diverse fields will be presented, and hands-on use of statistical and data manipulation software will be included

Learning Outcomes

After learning the course the students should be able to:
.Recognize various disciplines that contribute to a successful data science effort.
.Identify the data types, relation between data and visualization technique for data.
.Explain probability, distribution, sampling, Estimation
.Solve regression and classification problem.
.Develop and appreciate various techniques for data modelling and mining.

Course Outline :

Unit – 1 Introduction to Probability, Introduction to Probability Theory, Probability Theory – Terminology, Fundamental Concepts in Probability – Axioms of Probability, Application of Simple Probability Rules – Association Rule Learning, Bayes' Theorem, Random Variables Probability Density Function (PDF) and Cumulative Distribution Function (CDF) of a Continuous Random Variable, Binomial Distribution, Poisson Distribution, Geometric Distribution, Parameters of Continuous Distributions, Uniform Distribution, Exponential Distribution, Chi-Square Distribution, Student's t-Distribution, F-Distribution.

Unit – 2 Sampling and Estimation, Introduction to Sampling, Population Parameters and Sample Statistic, Sampling, Probabilistic Sampling, Non-Probability Sampling, Sampling Distribution, Central Limit Theorem (CLT), Sample Size Estimation for Mean of the Population, Estimation of Population Parameters, Method of Moments, Estimation of Parameters Using Method of Moments, Estimation of Parameters Using Maximum Likelihood Estimation,

Unit – 3 simple Linear Regression, Introduction to Simple Linear Regression, History of Regression–Francis Galton's Regression Model, Simple Linear Regression Model Building, Estimation of Parameters Using Ordinary Least Squares, Interpretation of Simple Linear Regression Coefficients, Validation of the Simple Linear Regression Model,Outlier Analysis, Confidence Interval for Regression Coefficients b0 and b, Confidence Interval for the Expected Value of Y for a Given X, Prediction Interval for the Value of Y for a Given X.

Unit – 4 Logistic Regression, Introduction – Classification Problems, Introduction to Binary Logistic Regression, Estimation of Parameters in Logistic Regression, Interpretation of Logistic Regression Parameters, Logistic Regression Model, Diagnostics, Classification Table, Sensitivity, and Specificity, Optimal Cut-Off Probability, Variable Selection in Logistic Regression, Application of Logistic Regression in Credit Rating, Gain Chart and Lift Chart

Unit - 5 Test and Tutorial

Reference Books:-

1. Dinesh Kumar, Business Analytics, Wiley IndiaBusinenalytics: The Science
2. V.K. Jain, Data Science & Analytics, Khanna Book Publishing, New Delhi of Dat

3. Data Science For Dummies by Lillian Pierson , Jake Porway
4) Doing Data Science by Rachel Schutt, Cathy O'Neil, O'Reilly publication
5) Data Science with Jupyter Author: Prateek Gupta, BPB publication

Course Code: CA-624P **Course Title :** Practical based on CA-622T[B2]
Total Credit: 1.5 Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)
Sample List of Experiments and Tutorials to be carried out based on the course B1.**CS-622-T.**

(Advance Data Science)

1. Perform descriptive analysis and identify the data type.
2. Implement a method to find out variation in data. For example the difference between highest and lowest marks in each subject semester wise.
3. Plot the graph showing result of student in each semester.
4. Plot the graph showing the geographical location of students.
5. Plot the graph showing number of male and female students.
6. Implement a method to treat missing value for gender and missing value for marks.
7. Implement linear regression to predict the 5 th semester result of student.
8. Implement logistic regression and decision tree to classify the student as average or clever.

Course code: CS-631T[A1] **Course Title: Natural Language Processing**
Total Credit: 2 Marks: 50 (UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)

Prerequisites : NA

Learning Objectives

- NLP is about getting computers to perform useful and interesting tasks involving spoken and written human language.
- NLP is sometimes referred to as Computational Linguistics to emphasize the fact that this subject involves the combination of CS methods with research insights from Linguistics.

Learning Outcomes
After learning the course the students should be able to:

- Develop an understanding of the general problems that people who work on NLP study and the strategies they use to solve them.
- Understand the role of data, machine learning, and neural networks in NLP systems.
- Understand the ethical considerations and potentials for bias in NLP systems.
- Be able to implement models to solve some "standard" NLP problems.
- Be able to formulate potential starting points given a new problem with NLP elements.
- Understand some of the motivating linguistic phenomena that make NLP problems hard and why these can be hard phenomena for computers to approach.

Course Outline :
Unit – 1 **Introduction:** History of NLP, Generic NLP system, levels of NLP , Knowledge in language processing, Ambiguity in Natural language, stages in NLP, challenges of NLP, Applications of NLP

Unit – 2 Word Level Analysis: Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST) ,Morphological parsing with FST, Lexicon free FST Porter stemmer. N –Grams- N-gram, language model,

Unit – 3 Syntax analysis Part-Of-Speech tagging(POS)- Tag set for English (Penn Treebank) , Rule based POS tagging, Stochastic POS tagging, Issues –Multiple tags & words, Unknown words. Introduction to CFG, Sequence labeling: Hidden Markov Model (HMM),Maximum Entropy

Unit – 4 Text Summarization, Text Classification Text summarization- LEXRANK , Optimization based, approaches for summarization , Summarization evaluation, Text classification

Unit - 5 Test and Tutorial

Reference Books:-
1. Jurafsky, D. and J. H. Martin, Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition (2nd Edition). Prentice-Hall, 2008.
2. Charniak, E.: Statistical Language Learning. The MIT Press. 1996.
3. J. Allen: Natural Language Understanding. Benjamin/Cummins.1995.
4. https://archive.nptel.ac.in/courses/106/101/106101007/

Course Code: CA-633P **Course Title :** Practical based on CA-631T[A1]

Total Credit: 1.5 Marks: 50 (UA: 40 + IA: 10)

Periods: 3 per week (50 Minutes each)

Sample List of Experiments and Tutorials to be carried out based on the course **CA-631T[A1]** Laboratory work will be based on the above syllabus D1.CS-521-T. (**Natural Language Processing**) with minimum 10 experiments to be incorporated.

Course Code: CA-631T[B1]	Course Title: Cloud Computing
Total Credits: 2	Marks: 50(UA: 40 + IA: 10)
Periods: 3 per week (50 Minutes each)	
Prerequisites: Student must know basics of Computer Network and Parallel & Distributed Computing	
Learning Objectives: To provide students with the fundamentals and essentials of Cloud Computing.	
Learning Outcomes: • To learn and understand basic concepts of Cloud Computing & its Models. • To learn and understand Cloud Technologies • To design, develop and deploy Cloud applications • To get acquainted with the challenges and security aspects of Cloud Computing.	
Unit 1: UNIT I: - Introduction to Cloud Computing **Cloud Computing Fundamentals:** Introduction, Layers of Cloud Computing, Types of Cloud Computing: Public, Private, Hybrid cloud. **Cloud Services:** Infrastructure as a Service(IAAS), Platform As a Service(PAAS), Software As a Service (SAAS). Enabling Technologies, Cloud Computing Features, Cloud Computing Security, Cloud Computing Challenges, Benefits, and Limitations.	
Unit 2: Cloud Computing Technologies and Applications: Cloud Computing: IT as a Service, Cloud Computing Security, Cloud Computing Model Application Methodology, Cloud Computing in Development/Test, **Key Enabling Technologies for Virtual Private Clouds:** Virtual Private Clouds,Virtual Data Centers and Applications.	
Unit 3: Cloud Infrastructure: Historical Perspective of Data Centers, **Datacenter Components:** IT Equipment and Facilities **Design Considerations:** Requirements, Power, Efficiency, & Redundancy, Power and Challenges in Cloud Data Centers.	
Unit 4: Virtualization & Security in the Cloud **Virtualization:** Introduction to virtualization, Hypervisor: Type-I & Type II, Types of Virtualization, Pros and cons of virtualization, **Security:** Cloud Security, cloud Security Challenges.	
Unit 5: Test & Tutorials In addition to CIA, Tutorials, Seminars, Assignments & Case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same.)	

Reference Books

1. Cloud Computing Bible by Barrie Sosinsky
2. Cloud Computing Handbook
3. Mastering Cloud Computing Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi

Course Code: CA-633P	Course Title: Lab Course based on CA-631T[B1]
Total Credits: 1.5	Marks: 50(UA: 40 + IA: 10)
Periods:	

Sample List of Practicals
(The teacher can conduct three Practicals based on each unit as per their choice and feasibility)

1. Comparative study of traditional data center and virtual data center.
2. Understanding layers of cloud computing.
3. Installation and configuration of own Cloud
4. Find procedure to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time.
5. Practical implementation of Storage as a Service: Create online Google forms
6. Create a Cloud Storage Account: Sign up for a cloud storage service like Google Drive, Dropbox, or OneDrive. Upload and organize some files in the cloud.
7. Creating windows virtual machine using VMWare workstation under IaaS.
8. Creating Linux virtual machine using VMWare workstation under IaaS.
9. Install a C/Java compiler in the virtual machine created using virtual box and execute Simple Programs
10. Clone virtual machines (VMs) in VMWare

Course Code: CA-641(SEC-4 G)	Course Title: Digital Marketing
Total Credits: 2	**Marks: 50(UA: 40 + IA: 10)**
Periods: 3 per week (50 Minutes each)	
Prerequisites: Student must know basics of concept of Digital marketing and SEO.	
Learning Objectives To understand the basic Concepts of Digital marketing and the road map for successful Digital marketing strategies.	
Learning Outcomes **Understand the concept of digital marketing and its real-word implementations** **2. Articulate innovative insights of digital marketing enabling a competitive edge** **3. Understand how to create and run digital media-based campaigns** **4. Identify and utilise various tools such as social media etc.**	
Unit 1: Fundamentals of Digital marketing & Its Significance, Traditional marketing Vs Digital Marketing, Evolution of Digital Marketing, Digital Marketing Landscape, Key Drivers, Digital Consumer & Communities	
Unit 2: The Digital users in India, Digital marketing Strategy- Consumer Decision journey, POEM Framework, Segmenting & Customizing messages, Digital advertising Market in India, Skills in Digital Marketing, Digital marketing Plan.	
Unit 3: Terminology used in Digital Marketing, PPC and online marketing through social media, Social Media Marketing, Keyword advertising, Google web-master and analytics overview, Affiliate Marketing, Email Marketing, Mobile Marketing	
Unit 4: Introduction to SEO, How Search engine works, SEO Phases, History Of SEO, How SEO Works, What is Googlebot (Google Crawler), Types Of SEO technique, Keywords, Keyword Planner tools.	
Unit 5: Test & Tutorials In addition to CIA, Tutorials, Seminars, Assignments & Case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same.)	

Reference books:

1. Digital Marketing, S.Gupta, McGraw-Hill
2. Digital Marketing –Kamat and Kamat-Himalaya
3. Marketing Strategies for Engaging the Digital Generation, D. Ryan

Course Assessment (Full 50 Marks Internal Assessment)

Here are some potential assessments that could be used to evaluate understanding and practical skills for this course.

1. Introduction to Digital Marketing and its significance
2. Compare and Contrast between Traditional and Digital Marketing
3. Understanding the POEM Framework in Digital Marketing
4. Understanding the skills required in Digital Marketing
5. Introduction to PPC and Online Marketing through Social Media
6. Understanding Social Media Marketing in Digital Marketing
7. Email and Mobile Marketing in Digital Marketing
8. Introduction to SEO and its Phases in detail
9. Understanding types of SEO in Digital Marketing
10. Understanding SEO using Keyword Planner tool

Course Code: CA-641P (SEC-4 H)	Course Title: - Leadership Skill Development
Total Credit: 2	Marks: 50 (IA: 50)
Periods: 3 per week (50 Minutes each)	

Prerequisites:

There are no prerequisites for this course

Learning Objectives

5. To understand the concepts and theories of leadership.
6. To develop essential leadership skills, including communication, decision making, motivation, and conflict resolution.
7. To explore different leadership styles and their applications in various contexts.
8. To cultivate self-awareness and emotional intelligence as foundations for effective leadership.

Learning Outcomes

After Completion of the Course students will be able to

5. Demonstrate an understanding of leadership concepts, theories, and models.
6. Apply effective communication techniques in leadership roles.
7. Make informed decisions and solve problems as a leader.
8. Motivate and inspire individuals and teams towards shared goals.
9. Manage conflicts and navigate challenges in leadership positions.
10. Reflect on personal leadership strengths and areas for development.

Unit -I: Introduction to Leadership (10 Periods)

- Definition of leadership and its significance in personal and professional contexts
- Historical perspectives on leadership theories and models
- Traits vs. behaviors vs. situational approaches to leadership

Unit -II: Leadership Skills Development (10 Periods)

- Effective communication in leadership roles: listening, speaking, nonverbal communication
- Decision making and problem-solving techniques for leaders
- Motivation theories and strategies for inspiring individuals and teams
- Conflict resolution and negotiation skills for leaders

Unit -III: Leadership Styles and Applications (10 Periods)

- Different leadership styles: autocratic, democratic, transformational, servant leadership, etc.
- Situational leadership: adapting leadership styles to different contexts and followers
- Leading diverse teams and managing inclusivity in leadership

Unit -IV: Emotional Intelligence and Self-Awareness in Leadership (10 Periods)

- Understanding emotional intelligence and its role in effective leadership
- Self-awareness: assessing personal strengths, weaknesses, values, and leadership philosophy
- Managing emotions and building resilience as a leader
- Developing empathy and social skills in leadership roles

Unit-V: Test and Tutorials
In addition to CIA, tutorials, seminars, assignments, and case studies are to be given for building proficiency in the course. (Respective course in-charge should maintain the records for the same).

Textbook

1. "Leadership: Theory and Practice" by Peter G. Northouse

References:

4. "The Leadership Challenge" by James M. Kouzes and Barry Z. Posner
5. "Primal Leadership: Realizing the Power of Emotional Intelligence" by Daniel Goleman, Richard Boyatzis, and Annie McKee
6. "Dare to Lead: Brave Work. Tough Conversations. Whole Hearts." by Brené Brown
7. "The 21 Irrefutable Laws of Leadership: Follow Them and People Will Follow You" by John C. Maxwell

E-Resources

3. https://www.ccl.org/leadership/education-resources/
4. https://www.ted.com/topics/leadership

Course Assessment (Full 50 Marks Internal Assessment): To assess the skills acquired in a leadership development course, a combination of formative and summative assessment methods can be used:

1. Written Assignments
2. Discussions
3. Leadership Case Studies
4. Quizzes and Tests
5. Leadership Reflection Papers
6. Peer Feedback and Assessment
7. Leadership Projects and Presentations

Sample questions for assessment methods could include:

1. Written Assignments: Analyze a case study of a successful leader and identify key leadership principles demonstrated.
2. Discussions: Debate the advantages and disadvantages of different leadership styles in a given organizational context.
3. Leadership Case Studies: Evaluate a real-world leadership challenge and propose strategies for resolution.
4. Quizzes and Tests: Multiple-choice question: Which leadership style is characterized by high consideration for followers' needs and low directive behavior? a) Autocratic b) Transformational c) Laissez-faire d) Transactional

5. Leadership Reflection Papers: Reflect on a personal leadership experience, discussing successes, challenges, and lessons learned.

6. Peer Feedback and Assessment: Provide constructive feedback on a peer's leadership presentation, focusing on strengths and areas for improvement.

7. Leadership Projects and Presentations: Develop a leadership development plan for a hypothetical organization, outlining strategies for enhancing leadership effectiveness and fostering a positive organizational culture.