ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

Model Syllabus for Computer Science (Minor) in consonance with Curriculum framework w.e.f. AY 2025-26

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
II	III	1	Computer Fundamentals and Office Automation	3	3
			Computer Fundamentals and Office Automation-Practical	2	1
	IV	2	Problem Solving Using C	3	3
			Problem Solving Using C-Practical	2	1
III	V	3	Database Management System	3	3
			Database Management System-Practical	2	1
		4	OOPS Through JAVA	3	3
			OOPS Through JAVA-Practical	2	1
	VI	5	Python Programming	3	3
			Python Programming-Practical	2	1
		6	Web Interface Design Technologies	3	3
			Web Interface Design Technologies-Practical	2	1

SEMESTER-III

COURSE 1: COMPUTER FUNDAMENTALS AND OFFICE AUTOMATION

Theory **Credits: 3** **3 hrs/week**

Course Objectives

1. **Understand foundational computing concepts**, including number systems, the evolution of computers, block diagrams, and generational progress.
2. **Develop knowledge of computer architecture**, focusing on system organization and networking fundamentals.
3. **Acquire practical skills in document creation**, formatting, and digital presentations using word processing tools.
4. **Gain proficiency in spreadsheet operations**, such as data entry, formulas, functions, and charting techniques.
5. **Introduce data visualization and basic modelling principles**, fostering analytical thinking in structuring and interpreting data sets.

Course Outcomes

1. At the End of the Course, The Students will be able to **explain different number systems**, the historical evolution of computers, and identify key components in a block diagram.
2. Learners will demonstrate **basic blocks of a computer and fundamental networking knowledge.**
3. Learners will create professional-level documents and **design visually appealing presentations** using word processing software and presentation software.
4. Learners will manipulate data within spreadsheets, apply formulas, and **generate accurate summaries and visualizations.**
5. Learners will apply data modelling techniques to **analyze, organize, and represent data effectively** in various scenarios.

Unit 1. Number Systems, Evolution , Block Diagram and Generations:
Number Systems: Binary, Decimal, Octal, Hexadecimal; conversions between number systems.

Evolution of Computers: History from early mechanical devices to modern-day systems.

Block Diagram of a Computer: Components like Input Unit, Output Unit, Memory, CPU (ALU + CU).

Generations of Computers: First to Fifth Generation – technologies, characteristics, examples.

Unit 2. Basic organisation and N/W fundamentals:
Computer Organization: Functional components – Input/Output devices, Storage types, Memory hierarchy.

Types of Computers: Micro, Mini, Mainframe, and Supercomputers.

Networking Fundamentals: Definition, need for networks, types (LAN, WAN, MAN), topology (Star, Ring, Bus).

Internet Basics: IP Address, Domain Name, Web Browser, Email, WWW.

Unit 3. Word Processing and presentations:
Word Processing Basics: Using MS Word/Google Docs – formatting, styles, tables, mail merge.

Presentation Tools: Using PowerPoint/Google Slides – slide design, animations, transitions.

Applications: Creating resumes, reports, brochures, and presentations.

Keyboard Shortcuts

Unit 4. Spreadsheet Basics:
Spreadsheet Concepts: Understanding rows, columns, cells in tools like MS Excel/Google Sheets.

Functions and Formulas: SUM, AVERAGE, IF, COUNT.

Charts and Graphs: Creating visual representations

Data Handling: Sorting, filtering, conditional formatting.

Text Functions: LEFT, RIGHT, MID, LEN, TRIM, CONCAT, TEXTJOIN

Advanced Functions: **Logical**: IF, AND, OR, IFERROR, **Lookup**: VLOOKUP, HLOOKUP, XLOOKUP, INDEX, MATCH

Unit 5. Data Modelling:
Conditional Formatting: Custom rules, Color scales, Icon sets, Data bars

Data Analysis Tools: Pivot Tables and Pivot Charts, Data Validation (Drop-downs, Input Messages, Error Alerts), What-If Analysis: Goal Seek, Scenario Manager, Data Tables

Charts and Dashboards: Creating Interactive Dashboards, Using slicers with Pivot Tables,Combo Charts and Sparklines

Productivity Tips: Using Named Ranges, Freeze Panes, Split View

Textbooks:

1. **Fundamentals of Computers,** Reema Thareja, Oxford University Press, 2nd edition
2. **Fundamentals of Computers**, V. Rajaraman – PHI Learning
3. **Introduction to Computers** by Peter Norton – McGraw Hill
4. **Microsoft Office 365 In Practice** by Randy Nordell – McGraw Hill Education

References:

1. **Excel 2021 Bible** by Michael Alexander, Richard Kusleika – Wiley
2. **Networking All-in-One For Dummies** by Doug Lowe – Wiley
3. **Microsoft Official Docs and Training**: https://learn.microsoft.com
4. **Google Workspace Learning Center**: https://support.google.com/a/users/

Activities:

Unit 1: Number Systems & Computer Evolution

Outcome: At the End of the Course, The Students will be able to **explain different number systems**, the historical evolution of computers, and identify key components in a block diagram.

Activity: Create a digital poster or infographic comparing number systems (binary, decimal, octal, hexadecimal) and illustrating the timeline of computer generations with key innovations.

Evaluation Method: Rubric-based assessment of the poster presentation on a 10-point scale focusing on:

- Accuracy of number system conversions
- Correct identification of block diagram components
- Visual organization and creativity

Unit 2: Computer Architecture & Networking Basics

Outcome: Learners will demonstrate **basic blocks of a computer and fundamental networking knowledge.**

Activity: Design a concept map showing the internal architecture of a computer and types of networks (LAN, WAN, MAN), including devices and topologies.

Evaluation Method: Checklist-based peer review and instructor validation:

- Completeness of the map
- Correctness of networking concepts
- Use of appropriate terminology
- Logical flow and structure of the map

Unit 3: Word Processing & Presentation Design

Outcome: Learners will create professional-level documents and **design visually appealing presentations** using word processing software and presentation software.

Activity: Prepare a formal report (e.g., project proposal) in a word processor and present it using a slide deck with transitions, embedded media, and design elements.

Evaluation Method: Performance-based evaluation using a 10-point scoring scale:

- Formatting and structure of the document
- Presentation aesthetics and clarity
- Communication skills during presentation

Unit 4: Spreadsheet Analysis & Visualization

Outcome: Learners will manipulate data within spreadsheets, apply formulas, and **generate accurate summaries and visualizations.**

Activity: Analyze a dataset (e.g., student scores or sales data) using spreadsheet software. Apply formulas (SUM, AVERAGE, IF, VLOOKUP) and create relevant charts.

Evaluation Method: Practical test with a rubric:

- Correct use of formulas
- Accuracy of data summaries

Unit 5: Data Analysis and Visualization:

Outcome: Learners will apply data modelling techniques to **analyze, organize, and represent data effectively** in various scenarios.

Activity: Prepare an interactive dashboard for a given data set using EXCEL.

Evaluation Method: Evaluation of the dashboard on a 10-point scoring scale:

- Presentation aesthetics and clarity
- Interactiveness
- Communication skills during presentation

SEMESTER-III

COURSE 1: COMPUTER FUNDAMENTALS AND OFFICE AUTOMATION

Practical **Credits: 1** **2 hrs/week**

List of Experiments:

1. Demonstration of Assembling and Dessembling of Computer Systems.
2. Identify and prepare notes on the type of Network topology of your institution.
3. Prepare your resume in Word.
4. Using Word, write a letter to your higher official seeking 10-days leave.
5. Prepare a presentation that contains text, audio and video.
6. Using a spreadsheet, prepare your class Time Table.
7. Using a Spreadsheet, calculate the Gross and Net salary of employees(Min 5) considering all the allowances.
8. Generate the class-wise and subject-wise results for a class of 20 students. Also generate the highest and lowest marks in each subject.
9. Using IF, AND, OR, and IFERROR to Automate Grade Evaluation.
    a. Create a table of student scores in different subjects.
    b. Use IF to assign grades (A/B/C/Fail).
    c. Use IFERROR to handle missing scores or invalid data.
10. *Employee Database Search Using VLOOKUP, HLOOKUP, XLOOKUP, INDEX, and MATCH*
    a. Create a database of employees (Name, ID, Department, Salary).
    b. Implement VLOOKUP to search by employee ID.
    c. Use HLOOKUP to extract department heads by role.
    d. Apply XLOOKUP for more flexible searches.
    e. Use INDEX + MATCH as an alternative to VLOOKUP.
11. Sales Report Analysis Using Pivot Tables and Charts
    a. Use a dataset of product sales (Product, Region, Date, Quantity, Revenue).
    b. Create Pivot Tables to summarize data by region/product.
    c. Insert Pivot Charts for visual analysis (e.g., bar, line).
    d. Add slicers to make the dashboard interactive.
12. Designing a Data Entry Form with Drop-downs and Input Rules
    a. Create a student registration form.
    b. Add drop-down lists for course selection using Data Validation.
    c. Add input messages to guide users.
    d. Add error alerts for wrong entries.
13. Monthly Budget Planning using Goal Seek and Scenario Manager
    a. Create a simple personal budget (income, expenses, savings).
    b. Use Goal Seek to determine income needed to save a desired amount.
    c. Use Scenario Manager to compare different budgeting scenarios (best/ worst/ realistic case).
    d. Create a one-variable Data Table to analyze how different expenses affect savings.

14. Dashboard Creation Using Combo Charts, Sparklines & Slicers
    a. Use existing sales or attendance data.
    b. Insert combo charts (e.g., column + line).
    c. Add sparklines to show trends.
    d. Use slicers with Pivot Tables to control dashboard elements.
    e. Finalize and format for interactivity.

SEMESTER-IV

COURSE 2: PROBLEM SOLVING USING C

Theory **Credits: 3** **3 hrs/week**

Course Objectives:

1. Understand the fundamentals of computer programming, Apply structured problem-solving approaches using algorithms, flowcharts, and C programming constructs.
2. Develop efficient logic using decision-making, loop, and jump control statements.
3. Utilize derived data types like arrays and strings for modular program design.
4. Design and implement modular solutions using functions, recursive logic, pointer operations, and dynamic memory management.
5. Handle complex data structures including structures, unions, and text file operations.

Course Outcomes:

At the End of the Course, The Students will be able to:

1. Understand basic computing concepts, programming paradigms and write structured C programs.
2. Apply control flow statements to solve logical and repetitive tasks in C.
3. Implement arrays and string operations to manage and manipulate data efficiently.
4. Design modular code using functions, recursion, and appropriate parameter passing.
5. Utilize pointers and memory operations for effective data handling. Demonstrate competence in dynamic memory allocation and text file processing.

Unit 1. Introduction to computer programming:
Introduction, Types of software, Compiler and interpreter, Concepts of Machine level, Assembly level and high-level programming, Flowcharts and Algorithms, Fundamentals of C: History of C, Features of C, C Tokens-variables and keywords and identifiers, constants and Data types, Rules for constructing variable names, Operators, Structure of C program, Input /output statements in C-Formatted and Unformatted I/O

Unit 2. Control statements:
Decision making statements: if, if else, else if ladder, switch statements. Loop control statements: while loop, for loop and do-while loop. Jump Control statements: break,continue and goto.

Unit 3. Derived data types in C:
Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays -Declaration, Initialization and Memory representation. Strings: Declaring & Initializing string variables; String handling functions, Character handling functions

Unit 4. Functions:
Pointers: Pointer data type, Pointer declaration, initialization, accessing values using pointers. Pointer arithmetic, Pointers and arrays.

Function Prototype, definition and calling. Return statement. Nesting of functions. Categories of functions. Recursion (Basic Concept only). Parameter Passing by address & by value. Local and Global variables. Storage classes: automatic, external, static and register.

Unit 5. Dynamic Memory Management:
Introduction, Functions-malloc, calloc, realloc, free Structures: Basics of structure, structure members, accessing structure members, nested structures, array of structures, structure and functions, structures and pointers. Unions - Union definition; difference between Structures and Unions. Working with text files - modes: opening, reading, writing and closing text files.

Text Books:

1. Programming in ANSI C, E. Balagurusamy, Tata McGraw Hill, 6 th Edn,
2. Computer fundamentals and programming in C, Reema Theraja, Oxford University Press

Reference Books:

1. Let us C, Y Kanetkar, BPB publications
2. Head First C: A Brain-Friendly Guide, David Griffiths, Dawn Griffiths

Activities:

Outcome: Understand basic computing concepts, programming paradigms and write structured C programs.

Activity: Create a concept map of computing fundamentals and programming paradigms (procedural, structured, object-oriented). Then, they write a structured C program (e.g., a calculator or student grade system) using proper syntax, indentation, and modular design.

Evaluation Method: Rubric-based Code Review & Viva to check the

- The correctness of the concept map
- Correct use of structure (main + functions)
- Identification of paradigm used
- Code readability and documentation

Outcome: Apply control flow statements to solve logical and repetitive tasks in C.

Activity: Implement a program that solves a logic puzzle (e.g., number guessing game, pattern generation, or prime number finder) using if, switch, for, while, and do-while.

Evaluation Method: Automated Test Cases + Peer Review to check the

- Correct use of control statements
- Logical correctness of output

- Efficiency and edge case handling
- Peer feedback on clarity and logic

Outcome: Implement arrays and string operations to manage and manipulate data efficiently.

Activity: Build a program that stores and arranges student marks in ascending and descending order using arrays and performs string operations like concatenation, comparing, and formatting names.

Evaluation Method: Functional Demonstration + Code Walkthrough to check the

- Correct array and string usage
- Memory efficiency
- Handling of invalid inputs
- Explanation of sorting/searching logic

Activity:

- **Recursive Problem Solver**
  Students write a modular program to solve a recursive problem (e.g., factorial, Fibonacci, or Tower of Hanoi) using functions with parameters and return values.

Evaluation Method:

- **Code Trace + Written Quiz**
  - Correct function decomposition
  - Proper parameter passing (by value/reference)
  - Recursion depth and base case handling
  - Quiz on tracing recursive calls

Outcome: Utilize pointers and memory operations for effective data handling. Demonstrate competence in dynamic memory allocation and text file processing.

Activity: Create a program that dynamically stores user input (e.g., survey responses) using pointers and writes/reads the data to/from a text file.

Evaluation Method: Memory Debugging + File I/O Assessment to check the

- Proper use of malloc, calloc, realloc, and free
- Pointer arithmetic and dereferencing
- File creation, reading, writing, and error handling
- Use of tools like Valgrind or manual memory trace (Optional for Unix flavours)

SEMESTER-IV

COURSE 2: PROBLEM SOLVING USING C

Practical **Credits: 1** **2 hrs/week**

List of Experiments:

1. Write a program to check whether the given number is Armstrong or not.
2. Write a program to find the sum of individual digits of a positive integer.
3. Write a program to generate the first n terms of the Fibonacci sequence.
4. Write a program to find both the largest and smallest number in a list of integer values
5. Write a program to demonstrate change in parameter values while swapping two integer variables using Call by Value & Call by Address
6. Write a program to perform various string operations.
7. Write a program to search an element in a given list of values.
8. Write a program that uses functions to add two matrices.
9. Write a program to calculate factorial of given integer value using recursive functions
10. Write a program for multiplication of two N X N matrices.
11. Write a program to sort a given list of integers in ascending order.
12. Write a program to calculate the salaries of all employees using Employee (ID, Name, Designation, Basic Pay, DA, HRA, Gross Salary, Deduction, Net Salary) structure.
    a. DA is 30 % of Basic Pay
    b. HRA is 15% of Basic Pay
    c. Deduction is 10% of (Basic Pay + DA)
    d. Gross Salary = Basic Pay + DA+ HRA
    e. Net Salary = Gross Salary - Deduction
13. Write a program to read / write the data from / to a file.
14. Write a program to reverse the contents of a file and store in another file.
15. Write a program to create Book (ISBN,Title, Author, Price, Pages, Publisher)structure and store book details in a file and perform the following operations
    a. Add book details
    b. Search a book details for a given ISBN and display book details, if available
    c. Update a book details using ISBN
    d. Delete book details for a given ISBN and display list of remaining Books

SEMESTER-V

COURSE 3: DATABASE MANAGEMENT SYSTEMS

Theory **Credits: 3** **3 hrs/week**

Course Objectives:

1. To understand the fundamentals of data, information, and the evolution from file-based systems to modern database management systems.
2. To develop the ability to design conceptual data models using Entity-Relationship (ER) and Enhanced ER diagrams.
3. To explore relational model principles, such as keys, integrity constraints, relational algebra and calculus, and normalization.
4. To perform data definition and manipulation using SQL commands including queries, joins, subqueries, views, and set operations.
5. To apply procedural logic using PL/SQL, incorporating control structures, functions, procedures, and database triggers.

Course Outcomes:

At the End of the Course, The Students will be able to:

1. **Describe** the fundamentals of data, database systems, and the differences between file-based and database approaches. **Compare and classify** various DBMS architectures, data models, and their components, including the three-schema architecture.
2. **Design** conceptual data models using Entity-Relationship and Enhanced ER diagrams, applying generalization, specialization, and constraints.
3. **Apply** relational model concepts, including CODD rules, relational algebra, relational calculus, and normalization techniques.
4. **Construct and execute** SQL queries for data definition, manipulation, aggregation, joining, and subqueries, including views and set operations.
5. **Develop** PL/SQL programs incorporating control structures, procedures, functions, and triggers to manage database behavior effectively.

Unit 1. Overview of Database Management System:
Introduction to data, information, database, database management systems, file-based system, Drawbacks of file-Based System, database approach, Classification of Database Management Systems, advantages of database approach, Various Data Models, Components of Database Management System, three schema architecture of data base, costs and risks of database approach.

Unit 2. Entity-Relationship Model:
Introduction, the building blocks of an entity relationship diagram, classification of entity sets, attribute classification, relationship degree, relationship classification, reducing ER diagram to tables, enhanced entity-relationship model (EER model), generalization and specialization, IS A relationship and attribute inheritance, multiple inheritance, constraints on specialization and generalization, advantages of ER modeling.

Unit 3. Relational Model:
Introduction, CODD Rules, relational data model, concept of key, relational integrity, relational algebra, relational algebra operations, advantages of relational algebra, limitations of relational algebra, Functional dependencies and normal forms.

Unit 4. Structured Query Language:
Introduction, Commands in SQL, Data Types in SQL, Data Definition Language, Selection Operation, Projection Operation, Aggregate functions, Data Manipulation Language, Table Modification Commands, Join Operation, Set Operations, View, Sub Query.

Unit 5. PL/SQL:
Introduction, Shortcomings of SQL, Structure of PL/SQL, PL/SQL Language Elements,Data Types, Operators Precedence, Control Structures, Steps to Create a PL/SQL, Program, Iterative Control, Procedures, Functions.

Textbooks:

1. Database System Concepts, Avi Silberschatz, Henry F. Korth,S. Sudarshan, Seventh Edition, McGraw-Hill
2. Database Management Systems by Raghu Ramakrishnan, McGrawhill

Reference Books:

1. Fundamentals of Database Systems, Elmasri Navathe, Pearson Education
2. An Introduction to Database systems, C.J. Date, A.Kannan, S.Swaminadhan, Pearson Education

Activities:

Outcome: Describe the fundamentals of data, database systems, and the differences between file-based and database approaches. Compare and classify various DBMS architectures, data models, and their components, including the three-schema architecture.

Activity: Create a comparative presentation or infographic illustrating:

- File-based vs. DBMS approaches
- Types of DBMS architectures (1-tier, 2-tier, 3-tier)
- Data models and the three-schema architecture

Evaluation Method: Rubric-based assessment of the presentation covering clarity, accuracy, and depth of comparison. Include a short quiz to test conceptual understanding.

Outcome: Design conceptual data models using Entity-Relationship and Enhanced ER diagrams, applying generalization, specialization, and constraints.

Activity: Model a university or hospital database using ER and Enhanced ER diagrams that shows:

- Entity sets, relationships
- Generalization/specialization
- Participation and cardinality constraints

Evaluation Method: Diagram submission with peer review and instructor feedback. Use a checklist to assess completeness, correctness, and notation usage.

Outcome: Apply relational model concepts, including CODD rules, relational algebra, relational calculus, and normalization techniques.

Activity: Normalize a given unstructured dataset up to 3NF. Then, write relational algebra expressions for sample queries.

Evaluation Method: Written assignment graded on:

- Correctness of normalization steps
- Accuracy of relational algebra expressions
- Short-answer questions on CODD rules and relational calculus

Outcome: Construct and execute SQL queries for data definition, manipulation, aggregation, joining, and subqueries, including views and set operations.

Activity: Implement a mini-project (e.g., Library or Inventory DB) using SQL. Include:

- Table creation (DDL)
- Data manipulation (DML)
- Aggregation, joins, subqueries, views, and set operations

Evaluation Method: Lab-based practical test with query execution and output validation. Include a viva to explain logic and optimization.

Outcome: Develop PL/SQL programs incorporating control structures, procedures and functions to manage database behaviour effectively.

Activity: Build a PL/SQL-based payroll or student grading system using:

- Procedures and functions
- Control structures (IF, LOOP)
- Triggers for automated updates

Evaluation Method: Code review and demonstration. Evaluate based on:

- Syntax correctness
- Logical flow

SEMESTER-V

COURSE 3: DATABASE MANAGEMENT SYSTEMS

Practical **Credits: 1** **2 hrs/week**

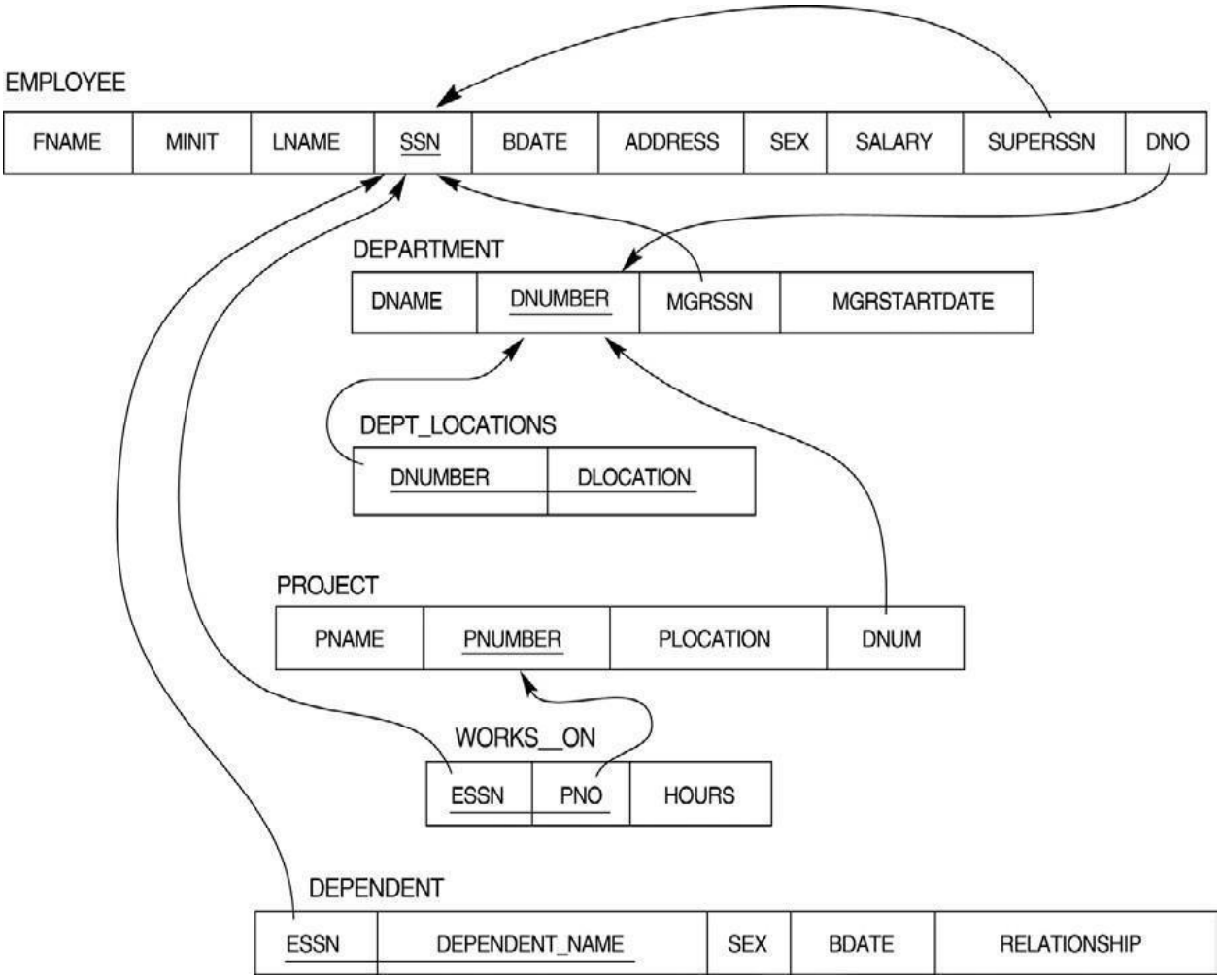
List of Experiments:

1. Draw ER diagram for hospital administration

2. Creation of college database and establish relationships between tables

3. The relational database schema of a company is given in the following figure.

Relational Database Schema - COMPANY



Queries to be performed on the above schema.

A. Create above tables with relevant Primary Key, Foreign Key and other constraints
B. Populate the tables with data
C. Display all the details of all employees working in the company.
D. Display ssn, lname, fname, address of employees who work in department no 7.

E. Retrieve the Birthdate and Address of the employee whose name is 'Franklin T. Wong'
F. Retrieve the name and salary of every employee
G. Retrieve all distinct salary values
H. Retrieve all employee names whose address is in ‘Bellaire’
I. Retrieve all employees who were born during the 1950s
J. Retrieve all employees in department 5 whose salary is between 50,000 and 60,000(inclusive)
K. Retrieve the names of all employees who do not have supervisors
L. Retrieve SSN and department name for all employees
M. Retrieve the name and address of all employees who work for the 'Research' department
N. For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, and birth date.
O. For each employee, retrieve the employee's name, and the name of his or her immediate supervisor.
P. Retrieve all combinations of Employee Name and Department Name
Q. Make a list of all project numbers for projects that involve an employee whose last name is 'Narayan’ either as a worker or as a manager of the department that controls the project.
R. Increase the salary of all employees working on the 'Product X' project by 15%. Retrieve employee names and increase the salary of these employees.
S. Retrieve a list of employees and the project name each works in, ordered by the employee's department, and within each department ordered alphabetically by employee first name.
T. Select the names of employees whose salary does not match with the salary of any employee in department 10.
U. Retrieve the employee numbers of all employees who work on projects located in Bellaire, Houston, or Stafford.
V. Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary. Display with proper headings.
W. Find the sum of the salaries and number of employees of all employees of the ‘Marketing’ department, as well as the maximum salary, the minimum salary, and the average salary in this department.
X. Select the names of employees whose salary is greater than the average salary of all employees in department 10.
Y. Delete all dependents of employees whose ssn is ‘123456789’.
Z. Perform a query using the alter command to drop/add fields and a constraint in the Employee table.

SEMESTER-V

COURSE 4: OOPS THROUGH JAVA

Theory **Credits: 3** **3 hrs/week**

Course Objectives

1. Introduce core OOP principles and contrast procedural and object-oriented paradigms within the Java ecosystem.
2. Equip learners with foundational and advanced Java syntax including variables, control statements, arrays, strings, and classes.
3. Enable the use of inheritance, polymorphism, interfaces, and exception handling to create maintainable and reusable code.
4. Train students in concurrent programming and stream-based I/O operations including file management and serialization.
5. Empower learners to design, build, and manage GUI programs using Swing components, layout managers, and event handling techniques.

Course Outcomes

At the End of the Course, The Students will be able to:

1. Apply OOP principles such as encapsulation, inheritance, and polymorphism in Java applications.
2. Write, compile, and debug Java code using control statements, arrays, classes, and methods effectively.
3. Construct modular code leveraging interfaces, abstract classes, and package hierarchies.
4. Manage thread lifecycles, synchronization, and I/O streams for file handling and console interaction.
5. Design user interfaces using Swing and handle keyboard/mouse input through event-driven programming.

Unit 1. OOPs Concepts and Java Programming:

Introduction to Object-Oriented concepts, procedural and object-oriented programming paradigm

Java programming: An Overview of Java, Java Environment, Data types, Variables, constants, scope and life time of variables, operators, type conversion and casting, Accepting Input from the Keyboard, Reading Input with Java.util.Scanner Class, Displaying Output, Displaying Formatted Output with String.format(), Control Statements

Unit 2. Arrays and OOP Constructs:

Arrays, Command Line Arguments, Strings-String Class Methods

Classes & Objects: Creating Classes, declaring objects, Methods, parameter passing, static fields and methods, Constructors, and ‘this’ keyword, overloading methods and access Inheritance: Inheritance hierarchies, super and subclasses, member access rules, ‘super’ keyword, preventing

inheritance: final classes and methods, the object class and its methods; Polymorphism: Dynamic binding, method overriding, abstract classes and methods;

Unit 3. Interfaces, Packages & Exception Handling:
Interfaces VS Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references, extending interface;

Packages: Defining, creating and accessing a package, importing packages.

Exception Handling: Benefits of exception handling, the classification of exceptions, exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, rethrowing exceptions, exception specification, built in exceptions, creating own exception sub classes.

Unit 4. Multithreading & Stream based I/O:
Differences between multiple processes and multiple threads, thread states, thread life cycle, creating threads, interrupting threads, thread priorities, synchronizing threads, inter thread communication.

Stream based I/O (java.io) – The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and writing Files, The Console class, Serialization

Unit 5. GUI Programming with Swing:
Introduction, MVC architecture, components, containers. Understanding Layout Managers - Flow Layout, Border Layout, Grid Layout, Card Layout, GridBag Layout. Event Handling- The Delegation event model- Events, Event sources, Event Listeners, Event classes, Handling mouse and keyboard events, Adapter classes.

Text Books:

1. Java The complete reference, Herbert Schildt, 9th edition, McGraw Hill.
2. Programming in Java, S. Malhotra, S. Chudhary, 2nd edition, Oxford Univ. Press.

Reference Books:

1. Programming with JAVA - A Primer, E Balaguruswamy, 3rd Edition, McGraw Hill
2. Head First Java: A Brain-Friendly Guide , Katty Sierra, Bert Bates, 2nd Edition, O'Reilly

Activities:

Outcome: Apply OOP principles such as encapsulation, inheritance, and polymorphism in Java applications

Activity: Develop a class hierarchy for a zoo management system using inheritance and polymorphism (e.g., Animal → Mammal → Dog). Implement encapsulation through private fields and public getters/setters.

Evaluation Method: Code review and oral explanation focusing on class relationships, method overriding, and encapsulation practices.

Outcome: Write, compile, and debug Java code using control statements, arrays, classes, and methods effectively

Activity: Create a console-based student grade calculator using loops, conditionals, arrays, and modular methods.

Evaluation Method: Practical test with debugging tasks and output validation across multiple input scenarios.

Outcome: Construct modular code leveraging interfaces, abstract classes, and package hierarchies
Activity:
Design a payment processing system with abstract classes for Payment, interfaces for Taxable, and organize classes into packages (e.g., com.billing, com.tax).

Evaluation Method:

Project submission assessed for modularity, interface implementation, abstraction usage, and package structure.

Outcome: Manage thread lifecycles, synchronization, and I/O streams for file handling and console interaction

Activity: Build a multithreaded logger that reads input from the console and writes to a file using synchronized threads and buffered streams.

Evaluation Method: Lab demonstration with thread state tracing and file output verification under concurrent input.

Outcome: Design user interfaces using Swing and handle keyboard/mouse input through event-driven programming

Activity: Create a GUI-based quiz application using Swing components (JFrame, JButton, JTextField) with event listeners for mouse clicks and key presses.
Evaluation Method: Live demo and rubric-based assessment of UI responsiveness, event handling accuracy, and layout design.

SEMESTER-V

COURSE 4: OOPS THROUGH JAVA

Practical **Credits: 1** **2 hrs/week**

List of Experiments

1. Write a Java program to print Fibonacci series.
2. Write a Java program to calculate multiplication of 2 matrices.
3. Write a Java program for sorting a given list of names in ascending order.
4. Create a class Rectangle. The class has attributes length and width. It should have methods that calculate the perimeter and area of the rectangle. It should have a readAttributes() method to read length and width from the user.
5. Write a Java program that implements method overloading.
6. Write a Java program to implement various types of inheritance
   i. Single ii. Multi-Level iii. Hierarchical iv. Hybrid
7. Write a java program to implement runtime polymorphism.
8. Write a Java program which accepts withdrawal amount from the user and throws an exception In Sufficient Funds when withdrawal amount is more than available amount.
9. Write a Java program to create three threads and that displays good morning, for every one second, hello for every 2 seconds and welcome for every 3 seconds by using extending Thread class.
10. Write a Java program that creates three threads. The first thread displays OOPS, the second thread displays Through and the third thread displays JAVA by using Runnable interface.
11. Write a Java program that displays the number of characters, lines and words in a text file.
12. Implement a Java program for handling mouse events when the mouse entered, exited, clicked, pressed, released, dragged and moved in the client area.
13. Implement a Java program for handling key events when the key board is pressed, released, typed.
14. Write a Java swing program that reads two numbers from two separate text fields and displays the sum of two numbers in the third text field when the button add is pressed.
15. Write a Java program to design student registration form using Swing Controls. The form which having the following fields and button SAVE
    Form Fields are: Name, RNO, Mailid, Gender, Branch, Address.

SEMESTER-VI

COURSE 5: PYTHON PROGRAMMING

Theory	**Credits: 3**	**3 hrs/week**

Course Objectives

1. **Introduce the foundational concepts** of Python programming including its syntax, IDEs, and control structures.
2. **Develop proficiency in modular programming** using functions, lambda expressions, recursion, and Python's built-in modules and packages.
3. **Explore core data structures** like strings, lists, tuples, and dictionaries for effective data manipulation.
4. **Teach exception handling mechanisms** and the use of regular expressions for pattern matching and text processing.
5. **Enable students to interact with files and databases** using Python to build real-world applications involving persistent storage and data retrieval.

Course Outcomes

At the end of the Course, the students will be able to

1. **Write and execute structured Python programs** using variables, expressions, and flow control statements.
2. **Implement modular code** leveraging functions, argument types, recursion, and reusable libraries.
3. **Manipulate and organize data efficiently** using Python's string operations and complex data structures.
4. **Handle runtime errors and apply regular expressions** for robust and flexible program behaviour.
5. **Perform file operations and connect to databases** through Python scripts to store, retrieve, and manage data effectively.

Unit 1. Basics of Python Programming:

Features of python, history of python, Python IDEs, Writing and Executing Python Program, literal constants, variables and identifiers, Data types, input operation- comments, Reserved words, Indentation, Operators and Expressions: Expressions in python, Operations in Strings, Other Data types, Type conversion, Decision control Statements, Iterative Statements, Nested loops, break, Continue, Pass Statements, else statement used with loops.

Unit 2. Strings and Collections:

Strings: Built-in String Methods and Functions

Lists: Access values in List, Updating values in Lists, Nested lists, Basic list operations, List Methods.

Tuple: Creating, Accessing, Updating and Deleting Elements in a tuple,Nested tuples.

Dictionaries: Creating a dictionary, Accessing values, Modifying an Entry, Deleting items, Built-in Dictionary Functions and Methods

Unit 3. Functions and Modules:
Function Definition, Function Call, Variable Scope and lifetime, The return statement, Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments, Lambda Functions, Recursive Functions.

Importing Libraries, Modules, Packages in python, Standard library modules- Globals(), Locals(), and Reload(), Function Redefinition.

Unit 4. Exception Handling:
Errors and Exceptions, Handling Exceptions, Multiple Except blocks, Multiple Exceptions in a single block, Except Block without Exception, The else clause, Built-in and user-defined Exceptions, The finally block, Re-raising Exception, Assertions in python

Unit 5. File Handling & Database Connectivity:
Types of files in Python, Opening and Closing files, Reading and Writing files: write() and writelines() methods- append() method, read() and readlines() methods, Splitting words, File Positions.

Database connectivity using Python, Executing SQL commands using python, Assimilating SQL command results using python.

Textbooks:

1. Python Programming using Problem Solving Approach Reema Thareja Oxford University Press 2020
2. Exploring Python, Budd T A, McGraw-Hill Education, 1st Edition, 2011.

Reference Book:

1. Python: The Complete Reference, Martin C. Brown, Mc Graw Hill, 2018
2. Fundamentals of Python, Kenneth A. Lambert. (2019), First Programs,2nd Edition, CENGAGE Publication.

Activities:

Outcome: Write and execute structured Python programs using variables, expressions, and flow control statements.

Activity: Create a calculator program that uses variables, arithmetic expressions, and flow control (if-else) to perform basic operations (add, subtract, multiply, divide) based on user input.

Evaluation Method: Code walkthrough and output validation. Use a checklist to assess on a 10-point scale to check the:

- Correct use of variables and expressions
- Proper flow control logic

- Accurate results for different inputs

Outcome: Implement modular code leveraging functions, argument types, recursion, and reusable libraries.

Activity: Build a factorial calculator using both iterative and recursive functions. Include parameterized functions and import the math library for comparison.

Evaluation Method: Code review and oral explanation. Assess on 10-point scale based on:

- Function structure and argument usage
- Recursion logic
- Use of reusable libraries

Outcome: Manipulate and organize data efficiently using Python's string operations and complex data structures.

Activity: Develop a contact manager that stores names and phone numbers using dictionaries and lists. Include string formatting and search functionality.

Evaluation Method: Practical demo with test cases. Evaluate based on:

- Use of string methods (split, join, format)
- Data structure selection and manipulation
- Search and retrieval accuracy

Outcome: Handle runtime errors and apply regular expressions for robust and flexible program behaviour.

Activity: Create a form validator that checks email and phone number formats using regular expressions. Include try-except blocks to handle invalid inputs.

Evaluation Method: Scenario-based testing. Assess based on:

- Regex accuracy for pattern matching
- Robust error handling
- Program stability with edge cases

Outcome: Perform file operations and connect to databases through Python scripts to store, retrieve, and manage data effectively.

Activity: Build a student grade logger that reads from a CSV file, stores data in a SQLite database, and allows querying by student name.

Evaluation Method: Lab test with sample data. Evaluate on a 10-point scale:

- File read/write operations
- Database connection and query execution
- Data integrity and retrieval accuracy

SEMESTER-VI

COURSE 5: PYTHON PROGRAMMING

Practical **Credits: 1** **2 hrs/week**

List of Experiments

1. Display a welcome message using print().
2. Declare and use identifiers belonging to strings, integers, floats, and booleans.
3. Accept user input (name, age, height, student status) and display each value with its type using type().
4. Perform operations like .upper(), .find(), .replace() on strings.
5. Write a program to reverse the string, count vowels and words.
6. Write a program for slicing, sorting, and list comprehension.
7. Program to apply list methods: append(), extend(), insert(), remove(), pop(), sort().
8. Create tuples to store student (name, age, course) data and perform
    a. Accessing elements using indexing and slicing.
    b. Demonstrate immutability by attempting to modify a tuple.
    c. Create and navigate nested tuples.
9. Create a dictionary with student roll numbers as keys and names/marks as values.
    a. Accessing, adding, updating, and deleting key-value pairs.
    b. Iterating through keys, values, and items.
10. Write a program to demonstrate variable length arguments.
11. Write a program to illustrate lambda and recursive functions.
12. Write a program to demonstrate Globals(), Locals(), and Reload() functions.
13. Demonstrate exception handling and assertions in Python.
14. Write a Python program to copy the contents of one file into another in reverse order.
15. Write a program to connect to the database and retrieve the required information using SQL commands.

SEMESTER-VI

COURSE 6: WEB INTERFACE DESIGNING TECHNOLOGIES

Theory **Credits: 3** **3 hrs/week**

Course Objectives

1. Understand the principles of web design and distinguish between web and desktop application architectures.Develop static web pages using HTML elements, attributes, and multimedia integration techniques.
2. Style web pages effectively using CSS, including layout control, responsive design, and UI enhancements.
3. Implement dynamic behaviors and form validations using JavaScript and the Document Object Model (DOM).
4. Explore client-side scripting techniques to build responsive, interactive interfaces.
5. Gain foundational knowledge of Content Management Systems (CMS) and apply practical skills in platforms such as WordPress.

Course Outcomes

At the End of the Course, The Students will be able to:

1. Design and structure HTML-based webpages incorporating text, images, tables, forms, and multimedia content.
2. Apply CSS styling rules to manage layout aesthetics, interactivity, and responsiveness across devices.
3. Use JavaScript for string manipulation, event handling, arrays, object operations, and basic validation.
4. Employ client-side scripting to enhance form functionality, create dialog interactions, and add animation via mouse and keyboard events.
5. Analyze different types of CMS and operate WordPress features like posts, pages, themes, plug-ins, and SEO tools to create and deploy basic websites.

Unit 1.HTML:

Introduction to web designing, difference between web applications and desktop applications, introduction to HTML, HTML structure, elements, attributes, headings, paragraphs, images, tables, lists, blocks, symbols, embedding multi-media components in HTML, HTML forms

Unit 2.CSS:

CSS home, introduction, syntax, CSS combinators, colors, background, borders, margins, padding, height/width, text, fonts, tables, lists, position, overflow, float, pseudo class, pseudo elements, opacity, tool tips, image gallery, CSS forms, CSS counters.

Unit 3.Java Script:
What is DHTML, JavaScript, basics, variables, operators, statements, string manipulations, mathematical functions, arrays, functions. objects, regular expressions, exception handling.

Unit 4. Client-Side Scripting:
Accessing HTML form elements using Java Script object model, basic data validations, data format validations, generating responsive messages, opening windows using java script, different kinds of dialog boxes, accessing status bar using java script, embedding basic animative features using different keyboard and mouse events.

Unit 5. Content Management Systems
Introduction to CMS: What is a CMS?, Types: traditional, headless, cloud-based

Popular CMS Platforms: WordPress, Joomla, Drupal, Shopify, When to choose each

Wordpress Basics: Introduction to word press, features, and advantages, wordpress (hosted access and local access), working with posts, managing pages, working with media, working with widgets, working with themes, extending wordpress with plug-ins, SEO and deployment.

Text Book(s)

1. Web Programming Building Internet Applications, Chris Bates, Second Edition, Wiley
2. An Introduction to Web Design plus Programming, Paul S.WangSanda S. Katila, Thomson.

Reference Books

1. Head First HTML and CSS, Elisabeth Robson, Eric Freeman, O'Reilly Media Inc.
2. An Introduction to HTML and JavaScript: for Scientists and Engineers, David R. Brooks. Springer, 2007
3. Schaum's Easy Outline HTML, David Mercer, Mcgraw Hill Professional.
4. Wordpress for Beginners, Dr.Andy Williams

Activities:

Outcome: Design and structure HTML-based webpages incorporating text, images, tables, forms, and multimedia content.

Activity: Create a personal profile webpage using HTML that includes:

- Text (headings, paragraphs)
- Images
- Tables (e.g., contact info or skills)
- Forms (e.g., feedback form)
- Embedded multimedia (e.g., YouTube video or audio clip)

Evaluation Method: Checklist-based review on a 10-point scale:

- Correct use of HTML tags

- Proper structure and nesting
- Functionality of form and media elements
- Visual clarity and completeness

Outcome: Apply CSS styling rules to manage layout aesthetics, interactivity, and responsiveness across devices.

Activity: Style the personal profile page using CSS:

- Apply colors, fonts, spacing
- Use Flexbox or Grid for layout
- Add hover effects and media queries for responsiveness

Evaluation Method: Rubric-based assessment on a 10-point scale:

- Visual appeal and consistency
- Responsive behaviour on different screen sizes
- Use of selectors and layout techniques
- Code cleanliness and organization

Outcome: Use JavaScript for string manipulation, event handling, arrays, object operations, and basic validation.

Activity: Enhance the profile page with JavaScript:

- Validate form inputs (e.g., email format)
- Display a greeting using string manipulation
- Use arrays/objects to store and display hobbies or skills
- Handle click events on button

Evaluation Method: Code demonstration and output testing (10-point scale):

- Correct use of JS syntax and logic
- Functionality of validation and event handling
- Use of arrays/objects
- Console output or alert behaviour

Outcome: Employ client-side scripting to enhance form functionality, create dialog interactions, and add animation via mouse and keyboard events.

Activity: Add interactive features to the form:

- Show/hide sections using mouse events
- Trigger animations on keypress
- Display confirmation dialog on form submission

Evaluation Method: Live demo and observation (10-point scale):

- Smooth interaction and feedback
- Correct use of event listeners
- Animation and dialog behavior
- User experience quality

Outcome: Analyze different types of CMS and operate WordPress features like posts, pages, themes, plug-ins, and SEO tools to create and deploy basic websites.

Activity: Create a basic website using WordPress:

- Add posts and pages
- Apply a theme and customize layout
- Install plug-ins (e.g., contact form, SEO tool)
- Configure basic SEO settings

Evaluation Method: Site walkthrough and checklist (10-point scale):

- Functionality of posts/pages
- Theme customization
- Deployment readiness

SEMESTER-VI

COURSE 6: WEB INTERFACE DESIGNING TECHNOLOGIES

Practical **Credits: 1** **2 hrs/week**

List of Experiments:

1. Create an HTML document with the following formatting options:

   (a) Bold, (b) Italics, (c) Underline, (d) Headings (Using H1 to H6 heading styles), (e) Font (Type, Size and Color), (f) Background (Colored background/Image in background), (g) Paragraph, (h) Line Break, (i) Horizontal Rule, (j) Pre tag

2. Create an HTML document which consists of:

   (a) Ordered List (b) Unordered List (c) Nested List (d) Image

3. Create a Table with four rows and five columns. Place an image in one column.

4. Collect any ten images of your choice. Using table tag, align the images as follows:

5. Create a menu form using HTML.

6. Style the menu buttons using CSS.

7. Create a form using HTML which has the following types of controls:

   (a) Text Box (b) Option/radio buttons (c) Check boxes (d) Reset and Submit buttons

8. Embed a calendar object in your web page.

9. Create a form that accepts the information from the subscriber of a mailing system.

Word press:

10. Installation and configuration of word press

11. Access admin panel and manage posts
12. Access admin panel and manage pages
13. Add widgets and menus
14. Create users and assign roles
15. Create a site and add a theme to it.