

**S.V.K.P & Dr K.S.RAJU A & S COLLEGE (A) :: PENUGONDA
DEPARTMENT OF COMPUTER SCIENCE (BCA PROGRAMME)**

w.e.f. AB 2025-26

SEMESTER-I

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 modeling 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 modeling 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, Hexa decimal, Conversions between number systems.

Evolution of Computer : 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 Organization and N/W Fundamentals

Computer Organization : Functional Components- Input/Output devices, Storage types, Memory hierarchy.

Types of Computers : Micro, Mini, Mainframe and Super Computers

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

Internet Basics : IP Address, Domain Name, Web Browser, E-Mail, WWW.

UNIT- 3 : Word Processing and Presentations

Word Processing Basics : Using MS Word/ Google Docs – Formatting , Styles, Tables, Mail Merge

Presentation Tools : Using Power Point/ Google Slides – Slide Design, Animations, Transitions.

Applications : Creating resumes, reports, brochures and Presentations.

Keyboard Shortcuts

UNIT-4: Spread sheet basics

Spread sheet 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 Modeling

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 Views.

Text Books :

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.
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

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

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

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

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

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

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SEMESTER-I

COURSE 1: COMPUTER FUNDAMENTALS AND OFFICE AUTOMATION

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Demonstration of Assembling and Desassembling 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.

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**SEMESTER-I
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. Bala guru samy, 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)

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**SEMESTER-I
COURSE 2: PROBLEM SOLVING USING C
Credits: 1**

Practical

2hrs/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.

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w.e.f. AY 2025-26AB

SEMESTER-II

COURSE3: DATA STRUCTURES 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.

Unit1.Basic Concepts:

Algorithm: Definition and characteristics, Complexity analysis: Space Complexity, Time Complexity, Asymptotic Notations.

Introduction to Data structures: Definition, Types of Data structures, Abstract Data Types (ADT), Introduction to Linked Lists, Representation of linked lists in Memory, Comparison between Linked List and Array.

Unit 2.Linked Lists:

Types of Linked Lists - Singly Linked list, Doubly Linked list, Circularly Singly Linked list, Circularly Doubly Linked list; Implementation of Single Linked List ADT: Creating a List, Traversing a linked list, Searching in linked list, Insertion and deletion into linked list (At first Node, Specified Position, Last node).

Unit3. Stacks and Queues:

Introduction to stack ADT, Implementation of stacks using array and Linked List, Application of stacks - Polish Notations - Converting Infix to Post Fix Notation - Evaluation of Post Fix Notation.

Queues: Introduction to Queue ADT, Implementation of Queues using array and Linked List, Application of Queues Types of Queues- Circular Queues, De-queues, Priority Queue, Heaps.

Unit4. Searching and Sorting:

Linear or Sequential Search, Binary Search, Hashing and collision resolution.

Sorting: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort and Merge Sort

Unit5.Treesand Graphs:

Tree Terminology, Binary Tree Representation, Traversal techniques, Expression Tree, Binary Search Tree- Definition, Operations on a Binary Search Tree: Creation, Search, Insertion &deletion.

Graphs: Introduction to Graphs, Terminology, Representation (Adjacency Matrix, Adjacency List),Traversal of Graphs (DFS, BFS), Applications of Graphs, Concept of Shortest Path Problems, Concept of Minimum Cost Spanning Tree

Textbooks:

1. Data Structures Using C, Bala guru samy E.T ata M C Graw Hill
2. Data Structures using C ,ReemaThareja,Third Edition,Oxford University Press

Reference Books:

1. Data Structures, Lipschutz, Schaum'sOutline Series,TataMcgraw-hill
2. Data Structures Using C, Ch. Vijay Kumar, Pen Press International

Activities

Outcome: Explain algorithm characteristics, time and space complexity, and asymptotic notations with clarity

Activity: Create a comparative chart of algorithms with different notations related to time and space complexities.

Evaluation Method: Rubric-based assessment of the chart for correctness, clarity, and depth of explanation on a 10-point scale.

Outcome: Implement and analyze different types of linked lists, including insertion, deletion, and traversal operations

Activity: Code a menu-driven program in C to implement single linked lists with all basic operations.

Evaluation Method: Practical lab assessment with test cases and Viva-style questioning to explain pointer manipulation.

Outcome: Develop stack and queue data structures using arrays and linked lists, and apply them in expression evaluation

Activity: Build a program to convert infix expressions to postfix and evaluate them using stacks; Implement queues using both arrays and linked lists with enqueue/dequeue operations.

Evaluation Method: Code review and execution of programs for sample cases and evaluation based on correctness and efficiency.

Outcome: Apply efficient searching and sorting algorithms to solve computational problems and evaluate performance trade-offs

Activity: Implement and compare sorting algorithms (e.g., selection sort and bubble sort) and searching algorithms (e.g., Linear vs. Binary Search) on datasets of varying sizes. Record number of swaps and iterations for preparing a chart to assimilate the results.

Evaluation Method: Performance report with graphs and analysis. Oral presentation or peer review discussing trade-offs and algorithm selection rationale.

Outcome: Construct and traverse tree and graph structures, using them to solve problems like shortest path and spanning trees

Activity: Implement binary trees and graphs using adjacency lists/matrices.

Evaluation Method: Lab demo with sample inputs and visual output (e.g., tree traversal order, graph paths).

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SEMESTER-II

COURSE3 :DATA STRUCTURES USING C

Practical

Credits: 1

2hrs/week

List of Experiments

1. Write a program to read 'N' numbers of elements into an array and also perform the following operation on an array
 - a. Add an element at the beginning of an array
 - b. Insert an element at given index of array
 - c. Update an element using a values and index
 - d. Delete an existing element
2. WriteaprogramtoimplementSingleLinkedListwithinsertion,deletionandtraversal operations
3. Write a program to implement Doubly Linked List with insertion, deletion and traversal operations
4. Write a program to implement the Stack operations using Arrays and Linked Lists.
5. Write a program to convert a given infix expression to a post fix expression using stacks.
6. Write a program to implement the Queue operations using Arrays and Linked Lists.
7. Write a program to implement the Circular Queue operations using Arrays.
8. Write a program for Binary Search Tree Traversals
9. Write a program to search an item in a given list using the following Searching Algorithms
 - a. Linear Search
 - b. Binary Search.
10. Write a program for implementation of the following Sorting Algorithms
 - a. Bubble Sort
 - b. Insertion Sort
 - c. Quick Sort
 - d. Merge Sort

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w.e.f. AY 2025-26AB

SEMESTER-II

COURSE4:DATA BASE 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, sub queries, 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.

Unit1.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.

Unit2.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.

Unit3.RelationalModel:

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.

Unit4.StructuredQueryLanguage:

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.

Unit5.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, [AviSilberschatz](#), [HenryF.Korth](#), [S.Sudarshan](#), Seventh Edition, McGraw-Hill
2. Database Management Systems by Raghu Rama krishnan, Mc Grawhill

Reference Books:

1. Fundamentals of Database Systems, Elmasri Nava the Pearson Education
2. An Introduction to Database systems, C.J. Date ,A. Kannan, S.Swami Nadhan, Pearson

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 info graphic 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

EvaluationMethod: Diagram submission with peer review and instructor feedback. Use a check list 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 data set 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 sub queries, including views and set operations.

Activity:

- Create tables using DDL (CREATE TABLE) for Students, Courses, Enrollments, Faculty.
- Fetch aggregated data (e.g., average marks, total students).
- Perform joins (e.g., list students enrolled in each course).
- Execute sub queries (e.g., students scoring above average).
- Create and use views (e.g., Student Course Summary).
- Use set operations (UNION, INTERSECT) for combined results.

EvaluationMethod:

- Appropriate use of data types, primary & foreign keys, normalization.
- Correct syntax and execution of table creation and data insertion.
- Use of GROUP BY, JOIN, and multi-table queries with accurate output.
- Correct implementation of UNION, INTERSECT, EXCEPT.
- Writing correlated/un-correlated sub queries and reusable views.

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w.e.f. AY 2025-26AB

SEMESTER-II

COURSE4:DATABASE MANAGEMENT SYSTEMS

Practical

Credits:1

2 hrs/week

Experiment1:Data base: Inventory Management Table

1: Products

Structure:

Column Name	DataType	Constraints
product_id	INT	PRIMARYKEY
product_name	VARCHAR(50)	NOTNULL
price	DECIMAL(10,2)	CHECK(price>0)
stock_qty	INT	CHECK(stock_qty>=0)

Sample Data:

product_id	product_name	price	stock_qty
1	Pen	10.00	100
2	Notebook	50.00	200
3	Stapler	120.00	50
4	Marker	25.00	80
5	FileFolder	60.00	150

Table2:Suppliers Structure:

Column Name	Data Type	Constraints
supplier_id	INT	PRIMARYKEY
supplier_name	VARCHAR(50)	NOTNULL
contact_no	VARCHAR(20)	UNIQUE
product_id	INT	FOREIGNKEY REFERENCES Products(product_id)

Sample Data:

supplier_id	supplier_name	contact_no	product_id
101	Stationery Mart	9876543210	1
102	Paper World	9876500000	2
103	Office Supplies	9876512345	3
104	Marker Hub	9876522222	4
105	File Depot	9876533333	5

Section A: DDL (Data Definition Language)

1. Create a database called Inventory DB.
2. Create a table Products and table Suppliers with the specified columns and constraints:

Section B:DML(Data Manipulation Language)

4. Insert at least 5 rows into the Products table.
5. Insert at least 5 rows into the Suppliers table.
6. Update the stock quantity of product 'Pen' to 120.
7. Delete a supplier with a specific supplier_id.
8. Write a query to rename 'Notebook' to 'Note Book A4'

Section C: DQL(SELECT Queries)

9. Display all records from the Products table.
10. Display only product_ name and price of all products.
11. List all products that have a stock quantity less than 100.
12. Show all products between 20and100pricerange.
13. Find all suppliers whose contact number startswith‘98765’.
14. Find the average price of products.
15. Display the total number of products in the inventory.
16. Show the maximum and minimum stock quantities.
17. Count how many suppliers supply each product.
18. Show all products where price>50AND stock _qty>100.
19. Show all products where price<20ORstock_qty<80.
20. Display suppliers whose supplier _name contains the word ‘Mart’
21. List all suppliers along with the product they supply (useINNER JOIN).
22. Display suppliers whose names tarts with ‘S’.
23. Find products whose name has exactly5 characters
24. Find suppliers who supply products costing morethan100.

Experiment2:ONLINE BOOKSTORE DB

An online book store wants to implement a BOOK STORE DB for managing their online transactions by using the following tables.

Authors Table

Column Name	Data Type	Constraints
Author _id	INTEGER	PRIMARYKEY
First _name	VARCHAR	NOTNULL
last_ name	VARCHAR	NOTNULL
nationality	VARCHAR	NULL allowed

Books Table

Column Name	Data Type	Constraints
book_id	INTEGER	PRIMARYKEY
Title	VARCHAR	NOTNULL

author_id	INTEGER	FOREIGN KEY REFERENCES Authors
publication_year	INTEGER	
Price	DECIMAL	

Customers Table

Column Name	Data Type	Constraints
customer_id	INTEGER	PRIMARYKEY
first_name	VARCHAR	NOTNULL
last_name	VARCHAR	NOTNULL
Email	VARCHAR	UNIQUE,NOT NULL
Address	VARCHAR	NOTNULL

Orders Table

Column Name	Data Type	Constraints
order_id	INTEGER	PRIMARYKEY
customer_id	INTEGER	FOREIGN KEY REFERENCES Customers
book_id	INTEGER	FOREIGN KEY REFERENCES Books
order_date	DATE	NOTNULL
quantity	INTEGER	NOTNULL

SAMPLE DATA SET for BOOK STORE DB

Authors Table

author_id	first_name	last_name	nationality
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1	Jane	Austen	British
2	George	Orwell	British
3	Gabriel	Garcia Marquez	Colombian
4	Toni	Morrison	American
5	Mark	Twain	American
6	Harper	Lee	American
7	Fyodor	Dostoevsky	Russian

Books Table

book_id	Title	author_id	publication_year	price
101	Pride and Prejudice	1	1813	12.99
102	1984	2	1949	9.50
103	One Hundred Years f Solitude	3	1967	15.00
104	Beloved	4	1987	11.25
105	Animal Farm	2	1945	8.75
106	Adventures of Huckleberry Finn	5	1884	10.50
107	To Kill a Mockingbird	6	1960	14.00

Customers Table

customer_id	first_name	last_name	Email	address
201	Alice	Smith	alice.s@example.com	12OakSt,London
202	Bob	Johnson	bob.j@example.com	45PineAve, Oxford
203	Charlie	Brown	charlie.b@example.com	78Maple Rd, Bristol

204	Diana	Prince	diana.p@example.com	34QueenSt, York
205	Edward	Norton	edward.n@example.com	22RiverLn, Leeds
206	Fiona	Hall	fiona.h@example.com	56LakeDr, Bath
207	Greg	Miller	greg.m@example.com	89ParkAve, Glasgow

Orders Table

order_id	customer_id	book_id	order_date	Quantity
301	201	101	2025-07-20	1
302	202	102	2025-07-21	2
303	201	105	2025-07-22	1
304	203	103	2025-07-23	1
305	204	106	2025-07-24	1
306	205	107	2025-07-25	3
307	206	104	2025-07-26	2

Section A: DDL (Schema Design & Constraints)

- Write SQL statements to create all 4 tables (Authors, Books, Customers, Orders) with:
 - Primary Keys
 - Foreign Keys
 - Appropriate data types
 - NOT NULL constraints where necessary.
- Alter the Book stable to add a constraint that price must be greater than 0.
- Add anew column phone_ number to the Customers table(VARCHAR(15))and ensure it is unique.
- Drop the phone_ number column from the Customers table.

Section B: DML (Data Manipulation)

- Insert at least 7 records for each table(use sample data set above).
- Update the price of the book titled *Animal Farm* by increasing it by 10%.
- Delete all orders madebefore2025-07-21.
- Change the nationality of Gabriel Garcia Marquezto “Latino-American”.

Section C: SELECT Queries (Data Querying)

9. List all books published between 1900 and 2000.
10. Find all customers whose email contains "example.com".
11. Retrieve books whose price is between 10 and 15 and published before 1950.
12. Show authors who are either 'British' or 'American'.
13. Find books that have a price less than 10 or a republished after 1980.
14. Display all orders placed after 2025-07-22.
15. List all books written by author with author _id=2.
16. Find customers whose last name starts with B.
17. Show all books with a price NOT between 9 and 13.
18. Display books whose publication _year is in (1813, 1945, 1987).
19. Find authors whose nationality is NOT 'British'.
20. List customers whose address contains the word Park.
21. Show all books sorted by price in descending order.
22. List authors in alphabetical order by last _name.
23. Display orders sorted by order _date(latest first).

Use of Date Functions

24. Show all orders placed in July 2025.
25. Show all orders with an estimated delivery date (5 days after order date).
26. Show customers who placed an order on a weekend.
27. Calculate how many days have passed since the last order was placed.

Aggregate Functions (COUNT, SUM, AVG, MIN, MAX)

28. Count the total number of books in the database.
29. Find the average price of all books.
30. Show the highest-priced book.
31. Count how many orders each customer has placed.
32. Calculate the total sales (price × quantity) for each customer.

GROUP BY and HAVING

33. Count how many books are written by each author.
34. Group orders by customer_id and display total quantity ordered.
35. Show customers who have ordered more than 2 books in total (use HAVING).
36. Find the total number of books sold per author (GROUP BY author).

Experiment 3: EMPLOYEE DB

An enterprise wants to automate its employee management process by implementing an Employee Database. The goal is to replace manual record-keeping with a centralized system that stores employee, department, and project details. Use the following table structures and data set to implement Employee DB.

Employee DB–Table Structures

1. Departments Table

Column	Type	Constraints
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dept_id	INT	PRIMARYKEY
dept_name	VARCHAR	UNIQUE,NOTNULL
location	VARCHAR	NOTNULL

2. Employees Table

Column	Type	Constraints
emp_id	INT	PRIMARYKEY
first_name	VARCHAR	NOTNULL
last_name	VARCHAR	NOTNULL
email	VARCHAR	UNIQUE,NOTNULL
phone	VARCHAR	CHECK(phoneLIKE'--_____')
hire_date	DATE	NOTNULL
job_title	VARCHAR	NOTNULL
salary	DECIMAL	CHECK(salary>0)
dept_id	INT	FOREIGN KEY REFERENCES Departments(dept_id)
manager_id	INT	FOREIGN KEY REFERENCES Employees(emp_id)(self-referential)

3. Projects Table

Column	Type	Constraints
project_id	INT	PRIMARYKEY
project_name	VARCHAR	NOTNULL
start_date	DATE	NOTNULL
end_date	DATE	NULL

dept_id	INT	FOREIGNKEY REFERENCES Departments(dept_id)
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4. Employee_Project Table(Many-to-Many)

Column	Type	Constraints
emp_id	INT	FOREIGN KEY REFERENCES Employees(emp_id), PRIMARY KEY(emp_id, project_id)
project_id	INT	FOREIGN KEY REFERENCES Projects(project_id)
hours_allocated	INT	CHECK(hours_allocated>0)

Sample Data Set

Departments Table

dept_id	dept_name	Location
1	HR	New York
2	IT	San Francisco
3	Finance	Chicago
4	Marketing	Boston
5	Operations	Seattle
6	Legal	Washing to n D.C.
7	Sales	Dallas
8	R&D	Austin
9	Procurement	Denver
10	CustomerCare	Miami

2. Employees Table

emp_id	first_name	last_name	Email	phone	hire_date	job_title	salary	dept_id	manager_id
101	Alice	Johnson	alice.j@corp.com	123-456-7890	2020-03-15	HR Manager	75000	1	NULL
102	Bob	Smith	bob.s@corp.com	234-567-8901	2019-05-20	IT Analyst	65000	2	104
103	Charlie	Brown	charlie.b@corp.com	345-678-9012	2021-01-10	Finance Executive	58000	3	106
104	Diana	Prince	diana.p@corp.com	456-789-0123	2018-07-12	IT Manager	90000	2	NULL
105	Ethan	Hunt	ethan.h@corp.com	567-890-1234	2022-02-25	Marketing Lead	62000	4	NULL
106	Fiona	Hall	fiona.h@corp.com	678-901-2345	2017-11-01	Finance Manager	85000	3	NULL
107	Greg	Miles	greg.m@corp.com	789-012-3456	2023-04-15	IT Support	45000	2	104
108	Hannah	White	hannah.w@corp.com	890-123-	2021-	HR	50000	1	101

			orp.com	4567	09-05	Executive			
109	Ian	Scott	ian.s@corp.com	901-234-5678	2020-11-20	Operations Analyst	56000	5	NULL
110	Julia	Adams	julia.a@corp.com	012-345-6789	2019-12-18	Legal Advisor	70000	6	NULL

3. Projects Table

project_id	project_name	start_date	end_date	dept_id
201	Payroll System	2023-01-01	NULL	3
202	Website Upgrade	2023-02-10	NULL	2
203	Recruitment Drive	2023-03-05	NULL	1
204	Ad Campaign	2023-05-20	NULL	4
205	New CRM Tool	2023-04-15	NULL	7
206	Compliance Portal	2023-06-10	NULL	6
207	Inventory System	2023-07-01	NULL	5
208	AI Research	2023-08-05	NULL	8
209	Customer Feedback	2023-09-10	NULL	10
210	Procurement System	2023-10-01	NULL	9

4. Employee_Project Table

emp_id	project_id	hours_allocated
--------	------------	-----------------

102	202	120
104	202	80
103	201	100
106	201	150
101	203	50
105	204	70
107	202	60
109	207	90
110	206	110
108	203	40

Section A:DDL(Schema Creation &Modification)

1. Write SQL statements to create the above tables with the specified constraints
2. Alter the Employees table to add a column bonus DECIMAL(8,2)with default value0.
3. Drop the column bonus from Employees.

Section B:DML(Insert, Update, Delete)

4. Insert at least 10 rows into Departments ,Employees ,Projects, and Employee_ Project.(use the above data set)
5. Try inserting an employee with a negative salary(should fail due to CHECK constraint).
6. Update the salary of the employee with emp_ id =103 by15%.
7. Delete an employee record who has resigned(choose any emp_ id).
8. Increase all employees' salaries in the IT department by 5%.
9. Change the department of an employee to "Research".(should fail due to FK constraint)

Section C: DQL(Select Queries)

10. List all employees and their details.

11. Show all employees in the "HR" department.
12. Find employees with salaries between 50,000 and 80,000.
13. Retrieve employees hired after 2020.
14. Show employees who are in either the IT or Finance department.
15. Find employees whose email ends with "@corp.com".
16. List all employees with salary >60,000 AND located in "New York".
17. Display employees in descending order of salary.
18. Count the number of employees in each department.
19. Show the average salary of employees department-wise.
20. Display departments where the average salary is greater than 70,000.
21. Find the number of employees in each project.
22. Display departments with more than 3 employees.
23. Show the sum of all salaries department-wise.
24. List all distinct department IDs from the Employees table.
25. Show employee names with the year they were hired.
26. Show employees grouped by the year of hire.
27. List employees hired in the last 90 days.
28. List the number of years of experience of all the employees.

Section D: Joins

29. List all employees with their department names (INNER JOIN).
30. Display all departments along with employees, including those departments without employees (LEFT JOIN).
31. Show employees and the projects they are working on (JOIN 3 tables: Employees, Employee_Project, Projects).
32. List projects along with total hours allocated by employees.
33. Write a query to find employees who are working on more than one project.
34. Show all projects handled by the 'Finance' department.

Section E: PL/SQL Programming

1. Write a procedure Get Emp Info that takes emp_id as input and displays name, salary, and department.
2. Write a PL/SQL block that checks if an employee's salary is above 50,000. If yes, print "High Salary"; Otherwise print "Standard Salary".
3. Write a PL/SQL program to display the top 10 rows in the Emp table based on their job and salary.
4. Write a stored procedure Give Bonus that takes department ID and a designation as input, along with a bonus amount, and updates the salary of all employees in that department who have the specified designation by adding the bonus amount to their current salary.
5. Create a trigger to prevent inserting employees with a salary less than 30,000.
6. Create a trigger to avoid any transactions (insert, update, delete) on EMP table on Saturday & Sunday.