BACHELOR OF COMPUTER APPLICATIONS (BCA)

(Revised Syllabus)

BCA(Revised Syllabus)/ASSIGN/SEMESTER-III

ASSIGNMENTS

(July-2025 & January-2026 sessions)

MCS-021,MCS-023,MCS-014,BCS-031,BCSL-032,BCSL-033,BCSL-034

SCHOOLOFCOMPUTERANDINFORMATIONSCIENCES
INDIRA GANDHI NATIONAL OPEN UNIVERSITY
MAIDAN GARHI, NEW DELHI – 110 068

CONTENTS

Important Notes

1. Submit your assignments to the Coordinator of your Study Centre on or before the due date.
2. Assignment submission before due dates is compulsory to become eligible for appearing in corresponding Term End Examinations. For further details, please refer to BCA Programme Guide.
3. To become eligible for appearing the Term End Practical Examination for the lab courses, it is essential to fulfill the minimum attendance requirements as well as submission of assignments (on or before the due date). For further details, please refer to the BCA Programme Guide.

Course Code	**:**	**MCS-021**
Course Title	**:**	**Data and File Structures**
Assignment Number	**:**	**BCA(III)/021/Assignment/2025-26**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Dates for Submission	**:**	**31st October,2025(For July Session)**
	:	**30th April,2026(For January Session)**

This assignment has 16 questions of 5 Marks each, answer all questions. Rest 20 marks are for viva voce. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1. Write a program in C to accepts two polynomials as input and prints the resultant polynomial due to the addition of input polynomials.

Q2. Write a program in 'C' to create a single linked list to store integers and perform the following operations on it:

(i) Find the sum of all even integers and odd integers separately and print them.

(ii) Traverse the linked list and store all the even integers in the beginning nodes and all odd integers in thereafter nodes in a separate linked list.

Q3. Write a program in 'C' to input two matrices and perform the following operations on them.

(i) Multiply both the matrices and display the resultant matrix.

(ii) Find the sum of main diagonal elements of the resultant matrix, computed in (i)

(iii) Find the inverse of the matrix obtained after multiplication in (i)

Q4. Use the appropriate data structures and write a program in C to evaluate the following expressions:
Prefix expression: +, -, *, 3, 2, /, 8, 4, 1
Postfix expression: 10, 5, +, 60, 6, /, *, 8, -

Q5. Draw the binary tree for which the traversal sequences are given as follows:

(i) Post order: D H K E C F M N L G B A
In order: D C H E K A F B M L N G

(ii) Pre order: A B C D E F G H J K
In order: B D C E A G J H K F

Q6. Write a program in 'C' to implement a binary search tree (BST). Traverse and display the binary search tree in the Inorder, Preorder and Post order form.

Q7. Define AVL tree. Create an AVL tree for the following list of data if the data are inserted in the order in an empty AVL tree.

2, 12, 15, 4, 30, 10, 1, 35, 18, 25, 28, 50, 42, 6, 8

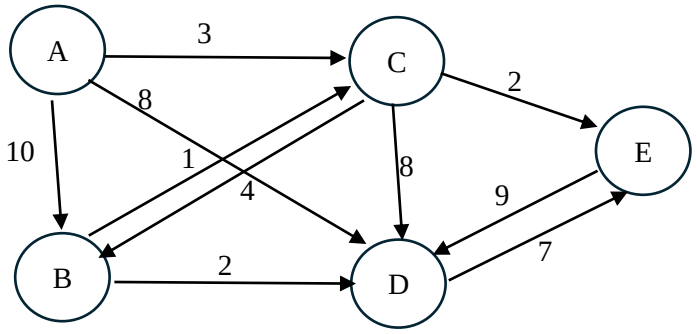
Further delete 1, 4, 8 and 10 from the above AVL tree.

Q8. Define a B-tree and its properties. Create a B-tree of order-4, if the data items are inserted into an empty B-tree in the following sequence:

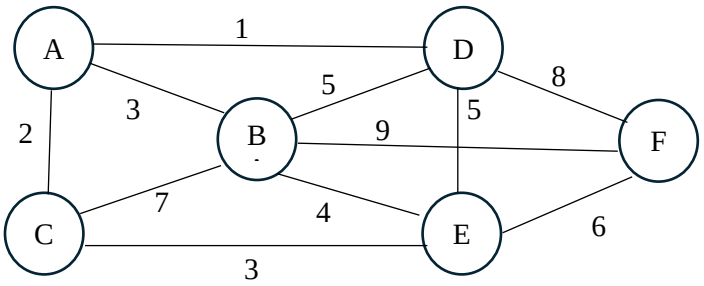
10, 2, 15, 25, 60, 45, 35, 80, 20, 8, 4, 55, 50, 68, 62, 40

Further, delete the items 2, 4, 8, and 10 from the B-tree.

Q9. Apply Dijkstra's algorithm to find the shortest path from the vertex 'S' to all other vertices for the following graph:



Q10. What is minimum spanning tree (MST)? Apply Kruskal's algorithm to find the MST for the following graph.



Q11. Apply Insertion and Bubble sorting algorithms to sort the following list of items. Show, all the intermediate steps. Also, analyze the number of swap and comparison operations performed in both the methods.

5, 20, 10, 12, 30, 35, 40, 50, 45, 55, 7, 8, 2

Q12. What is a heap tree? Create a min heap tree for the following list of items inserted in the order. Also, explain the heap sort with the help of thus created heap tree.

10, 20, 5, 25, 30, 18, 3, 70, 55, 45, 12, 24

Q13. Write a program in 'C' language to perform binary search algorithm.

Q14. What is hashing? Explain the hash functions. Also, discuss the collision resolution methods in hashing.

Q15. What is Red-Black tree? Explain insertion and deletion operations in a Red-Black tree with the help of a suitable example.

Q16. Explain Direct File and Indexed Sequential File Organization.

Course Code	**:**	**MCS-023**
Course Title	**:**	**Introduction to Database Management Systems**
Assignment Number	**:**	**BCA(III)/023/Assignment/2025-26**
Maximum Marks	**:**	**100**
Weightage	**:**	**25%**
Last Date of Submission	**:**	**31st October,2025(For July Session)** **30th April,2026(For January Session)**

Note: This assignment has four questions for a total of 80 marks. Answer all the questions. Rest 20 marks are for viva voce. You may use illustrations and diagrams to enhance explanations. Answer to each part of the question should be confined to about 300 words.

Q1. Answer the following questions:

(a) Differentiate between a File Processing System and a Database Management System (DBMS) based on four key aspects. **(4 Marks)**

(b) Explain the three-level architecture of a DBMS (External, Conceptual, and Internal). How does this architecture support Logical and Physical Data Independence? **(4 Marks)**

(c) What are the ACID properties of a transaction? Explain each property with a suitable example of an airline ticket booking. **(4 Marks)**

(d) Differentiate between DDL (Data Definition Language) and DML (Data Manipulation Language) statements in SQL. Provide two examples for each category. **(4 Marks)**

(e) Explain the difference between 3NF (Third Normal Form) and BCNF (Boyce-Codd Normal Form). Provide an example of a relation that is in 3NF but not in BCNF. **(4 Marks)**

Q2. An online learning platform, "EduSphere," needs a database to manage its operations. The requirements are as follows:

- The platform has many **Students**. Each student is identified by a unique StudentID and has a Name, Email, and RegistrationDate.
- The platform features several **Instructors**. Each instructor has a unique InstructorID, Name, and a short Bio.
- There are multiple **Courses** on offer. Each course has a unique CourseID, a Title, Duration (in hours), and a Fee.
- An instructor can teach multiple courses, but each course is taught by only one instructor.
- A student can enroll in multiple courses, and a course can have many students. When a student enrolls, the EnrollmentDate and the final Grade obtained are recorded.

(a) Design a complete ER (Entity-Relationship) diagram for the "EduSphere" platform. Clearly show all entities, attributes (including primary keys), relationships, and their cardinality constraints. **(12 Marks)**

(b) Convert the ER diagram from part (a) into a set of relational schemas (tables). You must underline the primary key for each table and clearly indicate all foreign keys and the tables they reference. **(8 Marks)**

Q3. Consider the following relational schemas for a company database:

- **Employees** (EmpID, EmpName, Salary, DeptID)
- **Departments** (DeptID, DeptName)
- **Projects** (ProjID, ProjName, Lead_EmpID)

Write and execute SQL queries for the following tasks. Make suitable assumptions where necessary.

(a) Create the Employees table with EmpID as the primary key and DeptID as a foreign key referencing the Departments table. The Salary should not be negative. **(4 Marks)**

(b) List the names and salaries of all employees working in the 'Technology' department, sorted in descending order of their salary. **(4 Marks)**

(c) Find the name of each department and the number of employees working in it. Display only those departments that have more than 10 employees. **(4 Marks)**

(d) Find the names of all employees whose salary is greater than the average salary of all employees in the company. **(4 Marks)**

(e) List the names of all projects along with the name of the employee who is leading the project. **(4 Marks)**

Q4. (a) Consider the relation R(A, B, C, D, E, F) with the following set of Functional Dependencies (FDs): (10 Marks)

$F = \{ A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A \}$

(i) Find all the candidate keys for the relation R.
(ii) Is the relation R in 3NF? Justify your answer.
(iii) Decompose the relation R into a set of relations that are in BCNF.

(b) Consider the following schedule S with two transactions T1 and T2: (10 Marks)

S: R1(X); W1(X); R2(X); W2(X); R1(Y); W1(Y); Commit1; R2(Y); W2(Y); Commit2;

(i) Draw the precedence (serializability) graph for the schedule S.
(ii) Is the schedule S serializable? If yes, provide the equivalent serial schedule(s). If no, explain why.
(iii) Identify any concurrency problems (e.g., Lost Update, Dirty Read) present in this schedule. Explain how the problem occurs.

Course Code	**:**	**MCS-014**
Course Title	**:**	**Systems Analysis and Design**
Assignment Number	**:**	**BCA(III)/014/Assignment/2025-26**
Maximum Marks	**:**	**100**
Weightage	**:**	**25%**
Last Dates for Submission	**:**	**31st October,2025(For July Session)** **30th April,2026(For January Session)**

This assignment has three questions of 80 marks. Rest 20 marks are for viva voce. Answer all questions. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1. Develop SRS for **Student Admission System .** SRS should be as per IEEE standard SRS template. Make necessary assumptions. **(30 Marks)**

Q2. Draw the DFDs upto 3rd level for **Student Admission System.** **(30 Marks)**

Q3. Draw ERD for a **Student Admission System**. Make necessary assumptions. **(20 Marks)**

Course Code	**:**	**BCS-031**
Course Title	**:**	**Programming in C++Assignment**
Number	**:**	**BCA(III)031/Assignment/2025-26**
Maximum Marks	**:**	**100**
Weightage	**:**	**25%**
Last Date of Submission	**:**	**31st October,2025(for July session)**
		30th April,2026(for January session)

This assignment has three questions carrying a total of 80 marks. Answer all the questions. Rest 20 marks are for viva-voce. You may use illustrations and diagrams to enhance explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation. Wherever required, you may write C++ program and take its output as part of solution

Q1. What is a Virtual Destructor? What are its advantages? Explain with examples. **(30 Marks)**

Q2. What do you mean by Exception Handling? What are its advantages and disadvantages? **(30 Marks)**

Q3. What is a Virtual Base Class? When should it be used? Explain with an example. **(20 Marks)**

Course Code	**:**	**BCSL-032**
Course Title	**:**	**C++Programming Lab**
Assignment Number	**:**	**BCA(III)/L-032/Assignment/2025-26**
Maximum Marks	**:**	**50**
Weightage	**:**	**25%**
Last date of Submission	**:**	**31st October,2025(for July session)**
		30th April,2026(for January session)

This assignment has two questions. Answer both the questions. These questions carry 40 marks. Rest 10 marks are for viva-voce. Write C++ program and take its output as part of solution. Please go through the guidelines regarding the assignments given in the Programme Guide for the format of presentation.

Q1. Write a program in C++ to generate a report consisting of the names of employees who are retiring from job on a given specific input date. Make necessary assumptions. **(20 Marks)**

Q2. Write a program in C++ for implementation of a Doubly Linked List using pointers. **(10 Marks)**

Q3. Write a program in C++ for conversion of a Tree into a Binary Tree. **(10 Marks)**

Course Code	**:**	**BCSL-033**
Course Title	**:**	**Data and File Structures Lab**
Assignment Number	**:**	**BCA(III)/L-033/Assignment/2025-26**
Maximum Marks	**:**	**100**
Weightage	**:**	**25%**
Last Dates for Submission	**:**	**31st October,2025(for July Session)** **30th April, 2026(for January Session)**

There are 8 questions of 10 marks each in this assignment carrying a total of 80 marks. Rest 20 marks are for viva voce. Please go through the guidelines regarding assignments given in the Programme Guide for the format of the presentation. Write all the programs in 'C' language.

Q1. Write a program to take input of two matrices from user using arrays. Multiply both the matrices and display the resultant matrix. **(10 Marks)**

Q2. Write a program in `C' Language to accept a string as input and print them in reverse order . Do not use any inbuilt string related functions. **(10 Marks)**

Q3. Write a program to implement singly linked list for integers (user input) and perform the following operations on it:

(i) Count and display the number of even and odd numbers of integer nodes separately.

(ii) Sort the nodes in ascending order and display them. **(10 Marks)**

Q4. Write a program using linked list that accepts two polynomials as input from the user and displays the resultant polynomial after performing the addition and subtraction operations on the user input polynomials. **(10 Marks)**

Q5. Write a program in 'C' language to insert user input integers into an initially empty AVL tree. Make assumptions, if necessary. **(10 Marks)**

Q6. Write a program in C to sort user input data using insertion sort method. Also, print the number of swaps and comparison operations performed for sorting the given data set. **(10 Marks)**

Q7. Write a program to convert an infix expression to a postfix expression. Use appropriate data structure. **(10 Marks)**

Q8. Write a program in 'C' language for the creation of a Binary Search tree. Also, implement insertion deletion operations and traversal operations on it. **(10 Marks)**

Course Code	**:**	**BCSL-034**
Title	**:**	**DBMS Lab**
Assignment Number	**:**	**BCA(III)/L-034/Assignment/2025-26**
Maximum Marks	**:**	**50**
Weightage	**:**	**25%**
Last Date of Submission	**:**	**31st October,2025(for July Session)** **30th April,2026(for January Session)**

This assignment has only one question. Answer the question. This question carries 40 marks. Rest 10 marks are for viva voce. You may use illustrations and diagrams to enhance the explanation. Assumptions can be made wherever required. Please go through the guidelines regarding the assignments given in the programme guide for the format of presentation.

Q1.

Design and implement a database system using any relational DBMS for a **Student Academic Records Management System**, demonstrating fundamental DBMS concepts such as **table creation**, **relationships**, **CRUD operations**, and **SQL queries** for data manipulation and retrieval.

Create Database Schema: **(15 Marks)**

Create the following tables:

Students Table

- student_id (Primary Key, INT, Auto Increment)
- first_name (VARCHAR)
- last_name (VARCHAR)
- date_of_birth (DATE)
- email (VARCHAR, Unique)
- phone (VARCHAR)

Courses Table

- course_id (Primary Key, INT, Auto Increment)
- course_name (VARCHAR)
- credits (INT)
- semester (VARCHAR)

Enrollment Table

- enrollment_id (Primary Key, INT, Auto Increment)
- student_id (Foreign Key, INT)
- course_id (Foreign Key, INT)
- enrollment_date (DATE)
- grade (VARCHAR)

Relationships:

- A student can enroll in multiple courses.
- A course can have multiple students.

Draw an **ER-diagram** for the system. **(5 Marks)**

Perform the following **CRUD operations** on your database: **(7 ½ Marks)**

- Insert new records into all tables.
- Read/display records from each table.
- Update existing records (e.g., grade, contact details).
- Delete a student or a course entry.

SQL Queries **(12½ Marks)**

Write and execute the following SQL queries:

1. List all students with their enrollment details.
2. Retrieve all courses in which a specific student is enrolled.
3. Calculate the number of students enrolled in each course.
4. Find students who have secured grade 'A' in any course.
5. Retrieve the average grade (as alphabet, assuming A=4, B=3...) per course.
6. List all students who have not enrolled in any course.
7. Find courses that have the highest number of enrollments.
8. Retrieve student details sorted by last name.
9. Find all courses offered in a specific semester.
10. Retrieve total number of courses each student has enrolled in.
11. Display enrollment count per semester.
12. List students along with the number of courses they failed (assume F as fail).
13. Find the student who has scored the most A grades.
14. Display all students born before the year 2000.
15. Retrieve course-wise average grade for all enrolled students.

Documentation Checklist:

- Screenshot of table designs and data entry
- SQL query outputs (screenshots or printed result)
- ER-diagram (drawn using any tool or by hand)
- Short explanation of each query
- Summary of observations and learning

Note: You must perform the above said activities and also take prints of screenshots of the layouts, sample input and output along with the necessary documentation for this practical question. Assumptions can be made wherever necessary.