

POST GRADUATE DIPLOMA IN COMPUTER APPLICATIONS PGDCA-(NEW)

PGDCA-NEW/ASSIGN/SEMESTER-II

ASSIGNMENTS

(July – 2026 & January – 2027)

MCS-206, MCS-207, MCS-208, MCSL-209, MCSL-210



**SCHOOL OF COMPUTER AND INFORMATION SCIENCES
INDIRA GANDHI NATIONAL OPEN UNIVERSITY
MAIDAN GARHI, NEW DELHI – 110 068**

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Important Notes

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Course Code	:	MCS-206
Course Title	:	Object Oriented Programming Using Java
Assignment Number	:	PGDCA_NEW(II)/206/Assignment/2026-27
Maximum Marks	:	100
Weightage	:	30%
Last Date of Submission	:	31st October, 2026 (for July session) 30th April, 2027 (for January session)

Note: This assignment has eight questions of 80 Marks. Answer all the questions. The remaining 20 marks are for viva voce. You may use Java code, illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Question1:

- (a) Explain different operators available in the Java programming language, providing a brief explanation for each category. **(5 Marks)**
- (b) Define the paradigm of Object-Oriented Programming (OOP) and detail its core architectural features. Additionally, analyze the structural role and significance of the Java Virtual Machine (JVM) in achieving platform independence. **(5 Marks)**

Question2:

- (a) Define a class within the context of Java Programming. Explain how a class is declared, and evaluate the scope and visibility of the access specifiers (public, private, protected, and default) using Java code snippets. **(5 Marks)**
- (b) Explain the uses of *this*, *final* and *super* keywords in Java with the help of example code snippets. **(3 Marks)**
- (c) What is the purpose of the Character wrapper class in Java? Explain the operational utility of any four methods of this class. **(2 Marks)**

Question 3:

- (a) Write a Java program to find the product of two matrices. Define proper class(es) and methods in your program. **(4 Marks)**
- (b) Describe how file handling and I/O operations are managed in Java. Explain the use of the Java File class and its methods using Java code. **(6 Marks)**

Question 4:

- (a) Define the concept of inheritance in object-oriented systems and outline its primary advantages. Discuss the specific types of inheritance supported (and not supported) by Java, and demonstrate its implementation using a clear programming example. **(6 Marks)**

- (b) What is an abstract class? Explain its advantages. Critically compare it with an interface in Java. **(4 Marks)**

Question 5:

- (a) Define polymorphic behavior. Explain the advantages of Polymorphism with example code in Java. **(4 Marks)**
- (b) Define an exception and analyse the primary systemic and logical causes behind exception generation. How are exceptions handled in Java? Design a custom, user-defined exception class to validate human age inputs (e.g., throwing an exception if the input is negative or exceeds a realistic biological threshold). **(6 Marks)**

Question 6:

- (a) Explain the concept of multithreading and differentiate between the two primary mechanisms used to create threads in Java. Write a Java program that demonstrates the practical implementation of thread synchronization. **(7 Marks)**
- (b) Explain the use of the List interface and the Vector class in Java with the help of suitable examples. **(3 Marks)**

Question 7:

- (a) Detail the architectural and package hierarchy of the Java Swing component library. Provide a comprehensive technical comparison between the Abstract Window Toolkit (AWT) and the Swing framework. **(6 Marks)**
- (b) What is FXML? Explain event handling in JavaFX with the help of a code snippet. **(4 Marks)**

Question 8:

- (a) Write a complete Java Database Connectivity (JDBC) program to manage a relational user schema for a library management system. Make necessary design assumptions for the database structure and ensure proper exception handling is implemented. **(8 Marks)**
- (b) Explain the architectural role and lifecycle of the ResultSet interface in JDBC programming. Demonstrate how to traverse and retrieve data from a query outcome, using a short and focused code snippet. **(2 Marks)**

BACHELOR OF COMPUTER APPLICATIONS (BCA_NEW/BCAOL)

**ASSIGNMENTS OF BCA_NEW/BCAOL
PROGRAMME SEMESTER-III**

(July 2026 & January 2027 Session)

MCS-208, MCSL-209, MCS-207, BCS-131, BCSL-135, BCS-040



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Course Code	:	MCS-207
Course Title	:	Database Management Systems
Assignment Number	:	BCA_NEW/BCAOL(III)207/Assign/2026-27
Maximum Marks	:	100
Last Date of Submission	:	31st October, 2026 (For July 2026 Session)
	:	30th April, 2027 (For January 2027 Session)

Note: There are FOUR questions in this assignment, which carry 80 marks. Rest 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanation. Please go through the guidelines regarding assignments given in the Programme Guide for the format of the presentation. The answer to each part of the question should be confined to about 300 words. Make suitable assumptions, if any.

Q1: Foundations of Data-Centric Database Systems

(5 × 4 = 20 Marks)

- a) Data scientists often work with large, evolving datasets. Explain the **limitations of traditional file-based systems** in the context of analytics and machine learning workflows. How does a DBMS address these limitations?
- b) Explain the following concepts with respect to the **relational data model**, giving one data-science-oriented example for each:
 - Candidate Key
 - Functional Dependency
 - Referential Integrity
 - Selection Operation
 - Projection Operation
- c) A **health analytics platform** maintains data about patients, diagnostic tests, doctors, and test results. Analysts want to query trends across diseases, age groups, and regions. Design an **ER diagram** for this system. Clearly identify entities, relationships, key attributes, and constraints. State assumptions made.
- d) Convert the ER diagram designed in part (c) into **normalized relations up to 3NF**, clearly indicating primary and foreign keys.
- e) Explain the importance of **indexes** in analytical databases. Differentiate between primary index, secondary index, and clustering index with suitable examples.

Q2: Data Normalization, Dependencies, and SQL for Analytics

(4+4+4+8= 20 Marks)

- a) Consider a Relation:
 Dataset(DatasetID, DatasetName, Source, CollectionDate, Domain, OwnerName, OwnerEmail, UpdateFrequency)
 - Identify the **primary key**
 - List meaningful **functional dependencies**

- b) Populate the relation with **8–10 sample records** and highlight potential **data redundancy and anomalies**.
- c) Decompose the above relation into **2NF and 3NF**, explaining each step clearly.
- d) Consider the following relations used in a **research publication analytics system**:
 - Researcher(ResearcherID, Name, Email, Affiliation)
 - Publication(PubID, Title, Year, Venue)
 - Authorship(ResearcherID, PubID, AuthorOrder)

Perform the following using SQL:

- Create tables with appropriate primary and foreign keys
- Insert sample data (minimum 5 researchers, 6 publications)
- List publications by a given researcher
- Find researchers who have not authored any publication
- Find the publication with the highest number of authors
- List venues that have more than two publications

Q3: Transactions, Concurrency, and Consistency in Data Systems

(4 + 8 + 8 = 20 Marks)

- a) Explain the **ACID properties** of transactions with the help of an example of banking transaction; “Transfer of an amount of rupees 50,000/- from an account ABC to XYZ”.
- b) Consider the following schedule involving two transactions T1 and T2 operating on a dataset table storing aggregate metrics:

Time	T1	T2
t1	READ(X)	
t2	X = X + 50	
t3		READ(X)
t4		X = X * 1.2
t5		WRITE(X)
t6	WRITE(X)	

- i) Compute the **final value of X** (assume initial X = 100).
 - ii) Determine whether the schedule is **serializable**.
 - iii) Identify the concurrency issue involved and explain its impact on analytics accuracy.
- c) Explain the **Two-Phase Locking (2PL) protocol**. Discuss how it ensures consistency in multi-user analytical environments. Can deadlocks still occur? Explain with a suitable example.

Q4: Advanced Topics and Case-Based Understanding

(5 × 4 = 20 Marks)

Write short notes on the following. Support your answers with examples relevant to data science or analytics.

- a) Centralized vs Distributed Databases in Large-Scale Analytics
- b) Star Schema and Snowflake Schema in Data Warehousing
- c) NoSQL Databases for Data Science (Explain one type with use cases)
- d) Query Optimization Techniques for Analytical Queries
- e) Log-Based Recovery and Checkpointing in Data-Intensive Systems

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Course Code	:	MCS-208
Course Title	:	Data Structures and Algorithms
Assignment Number	:	PGDCA_NEW(II)/208/Assignment/2026-27
Maximum Marks	:	100
Weightage	:	25%
Last Date of Submission	:	31st October, 2026 (for July session) 30th April, 2027 (for January session)

There are four questions in this assignment, which carry 80 marks. Each question carries 20 marks. Rest 20 marks are for viva voce. All algorithms should be written nearer to C programming language. You may use illustrations and diagrams to enhance the explanations, if necessary. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

- Question 1:** Write an algorithm to list the data fields of the nodes of a binary tree by level. (20 Marks)
Within levels , nodes are to be listed left to right.
- Question 2:** Show that every tree is a bipartite graph. (20 Marks)
- Question 3:** Consider a hypothetical data object X1. X1 is a linear list with the restriction that while additions to the list may be made at either end, deletions can be made from one end only. Design a linked list representation for X1. Write addition and deletion algorithms for X1. Specify initial and boundary conditions for your representation. (20 Marks)
- Question 4:** Write an algorithm to list all the identifiers in a hash table in lexicographic order. Assume the hash function f is $f(X) = \text{first character of } X$ and linear probing is used. How much time does your algorithm take? (20 Marks)

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Course Code : **MCSL-209**
Course Title : **Data Structures and Algorithms Lab**
Assignment Number : **BCA_NEW/BCAOL(III)L-209/Assign/2026-27**
Maximum Marks : **100**
Last Dates for Submission : **31st October, 2026 (For July 2026 Session)**
: **30th April, 2027 (For January 2027 Session)**

There are two questions in this assignment carrying a total of 40 marks. Each question carries 20 marks. Your Lab Record will carry 40 Marks. Rest 20 marks are for viva voce. 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:** Write an algorithm and program in 'C' language that accepts a Graph as input and prints its adjacency matrix and adjacency list.
- Q2:** Write an algorithm to list the data fields of the nodes of a Binary tree T by level. Within levels, nodes are to be listed left to right.

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Course Code	:	MCSL-210
Course Title	:	DBMS and Java Lab
Assignment Number	:	PGDCA_NEW(II)/L-210/Assignment/2026-27
Maximum Marks	:	100
Weightage	:	30%
Last Date of Submission	:	31st October, 2026 (for July session) 30th April, 2027 (for January session)

Note: This assignment has two sections. Answer all questions in each section. Each Section is of 20 marks. Also, your Lab Records will carry 40 Marks (20 Marks for each section). The remaining 20 marks are for viva voce (10 marks for each section). You may use illustrations and diagrams to enhance the explanations. You must execute the program and submit the program logic, sample input and output along with the necessary documentation. Assumptions can be made wherever necessary. Please go through the guidelines regarding assignments given in the programme guide for the format of presentation.

Section 1: DBMS Lab

A destination management company provides an online reservation facility for custom tour packages. This system maintains a relational database tracking Tour Packages (including package categories, base pricing, and specialised discounts for premium corporate partners and frequent regular customers), Travellers (classified into *Standard Class* and *Premium Class*), Bookings, and Itinerary Line Items.

To confirm any itinerary, travellers must complete a profile registration by providing their primary dispatch address, contact details, a verified email ID, and a mobile number. To manage corporate premium status and loyalty discounts, an organisational subscription fee is billed to the account. An individual booking can aggregate multiple distinct tour packages as per their choice, and a traveller can manage multiple active bookings simultaneously. The system processes transactions via online payment gateways or deferred Cash-on-Arrival (COA) vouchers at the destination terminal.

Question 1: **(8 Marks)**

List the entities, their attributes and relationships for the description given above and make an ER-diagram for this system. You may use the concept of keys, aggregation, generalisation, cardinality etc. as per need. Design suitable RDBMS tables for the ER-diagram you have created. The database design should include keys, foreign keys, constraints and referential integrity constraints. Your database design should be normalized up to 3rd Normal Form. Make necessary assumptions and list them wherever required.

Question 2: **(5 Marks)**

Implement the database design (create tables) that you have created in Question 1 using an RDBMS with proper integrity constraints. Enter about 8- 10 meaningful records in each of your tables.

Question 3:**(7 Marks)**

Write and run the following queries for your database using SQL commands:

Query 1: List all travellers whose PIN code is "110068" and who possess corporate premium status.

Query 2: List the booking ID and aggregate invoice amount of reservations confirmed during 01-06-2026 to 30-08-2026.

Query 3: Display traveller profiles who finalised the bookings on 10-8-2026 with an aggregate invoice threshold amount exceeding Rs. 25,000.

Query 4: Filter traveller records whose names begin with the alphabetical character 'A' and operate under standard non-corporate accounts.

Query 5: Identify tour package records that have zero booking entries during the initial week of July 2026.

Query 6: Find the total number of packages booked by corporate premium customers between 01-07-2026 and 31-07-2026.

Query 7: Find the average cost of packages booked during July 2026.

Section 2: Java Lab**Question 1:****(3 Marks)**

Write a Java program to demonstrate data access control. Use two separate classes to show/display the visibility levels of private, default, protected, and public data members.

Question 2:**(6 Marks)**

Write a Java program to simulate a hospitality/tourism application scenario to demonstrate constructor overloading, method overloading (compile-time polymorphism), and method overriding (runtime polymorphism). Make necessary assumptions.

Question 3:**(5 Marks)**

Write a Java program to create a custom exception *InvalidAgeException* to validate traveller registration profiles for a hospitality/tourism application scenario. Make necessary assumptions.

Question 4:**(6 Marks)**

Develop a standalone hospitality/tourism application using JDBC. This standalone application implements full *Create, Read, Update, and Delete* operations on database tables created by you. Make necessary assumptions.