POST GRADUATE DIPLOMA IN COMPUTER APPLICATIONS PGDCA-(NEW)

PGDCA-NEW/ASSIGN/SEMESTER-II

ASSIGNMENTS

(July – 2025 & January – 2026)

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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Course Code	**:**	**MCS-206**
Course Title	**:**	**Object Oriented Programming Using Java**
Assignment Number	**:**	**PGDCA_NEW(II)/206/Assignment/2025-26**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Date of Submission	**:**	**31st October, 2025 (for July session)** **30th April, 2026 (for January session)**

Note: This assignment has eight questions of 80 Marks. Answer all questions. 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.

Question1:

(a) Explain different operators available in java. **(5 Marks)**

(b) What is object-oriented programming? What are its advantages? Explain Java is platform independent. **(5 Marks)**

Question2:

(a) What is a class? How a class is different from object? Explain need of private access specifiers in java with example program. **(4 Marks)**

(b) Explain use of abstract class in Java programming. What is abstract method? Explain with example. **(4 Marks)**

(c) What is String class? Explain use of any four methods of String class. **(2 Marks)**

Question 3:

(a) Write a java program to find simple interest and compound interest. Define proper class and methods in your program. **(4 Marks)**

(b) Explain use of InputSteam and OutputStream classes with the help of examples. **(6 Marks)**

Question 4:

(a) What is inheritance? What are advantages of it? Explain how multilevel inheritance is implemented in java with the help of an example. **(7 Marks)**

(b) Explain use of interface in Java with example program. **(3 Marks)**

Question 5:

(a) What is polymorphism? What are different types of polymorphism supported by Java? Explain in detail. **(5 Marks)**

(b) What is an exception? Explain various causes of exceptions. **(5 Marks)**
How exceptions are handled in java? Explain concept of exception hierarchy.

Question 6:

(a) What is multithreading? How threads are created in Java? **(5 Marks)**
Write a java program to demonstrate advantage of multithreading.

(b) Explain use of Map interface in Java. **(2 Marks)**

(c) Explain Autoboxing and Unboxing with example. **(3 Marks)**

Question 7:

(a) Explain Swing package/class hierarchy. What are different Swing components? **(4 Marks)**

(b) What is FXML? Explain features of JavaFX. Also, explain differ layouts used in Java GUI development **(6 Marks)**

Question 8:

(a) Write a Java program using JDBC to manage issue and return of Books in a Library. **(8 Marks)**
Make Necessary assumptions. Make provisions of exception handling in your program.

(b) Explain different types of JDBC drivers. **(2 Marks)**

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Course Code	**:**	**MCS-207**
Course Title	**:**	**Database Management Systems**
Assignment Number	**:**	**PGDCA_NEW(II)/207/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 four questions in this assignment, which carries 80 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 the presentation. The answer to each part of the question should be confined to about 300 words. Make suitable assumption, if any.

Question 1: (Covers Block 1) (4+4+4+4+4=20 Marks)

(a) What are the limitations of file-based systems? How does a database approach resolve those limitations? Also, explain the physical architecture of a database management system (DBMS).

(b) Explain the following terms in the context of a relational model with the help of one example of each:

(i) Key constraints
(ii) Domain constraints
(iii) Candidate key
(iv) Select operation
(v) Project Operation
(vi) Equijoin Operation
(vii) Set Difference operation
(viii) Referential Integrity constraint

(c) A departmental store maintains the inventory of all the items that it sells using a database system. In addition, this system is used for keeping a record of the sales of items to its registered customers. This database is used to find the following details by the staff of the departmental store:

- List of the items that are out of stock.
- List of customers and the items purchased by them.
- List of all the items in the store.

Draw an ER diagram for the departmental store. Specify key attributes and constraints on each entity type and on each relationship type. Note any unspecified requirement and make appropriate assumptions to make the specification complete.

(d) Design normalised tables in 3NF for the ER diagram drawn in part (c), with the required integrity constraints.

(e) Explain the role of the primary index in a database system. Also, compare the primary indexes with the secondary indexes. What are clustering Indexes? Explain with the help of an example.

Question 2: (Covers Block 2) **(4+4+2+10=20 Marks)**

(a) Consider a Relation:**Course(CourseCode, CourseName, ProgrammeCode, ProgrammeName, CourseCredit, CourseDuration, ProgrammeDuration, ProgrammeCredit).** Some of the constraints on the relation **Course**are:

- CourseCode uniquely identifies a course.
- ProgrammeCode is a unique code of a programme. A programme consists of many courses. A course can be part of multiple programmes.
- A Programme consists of compulsory courses and optional courses. To complete a Programme, a student must complete all the compulsory courses and optional courses, as per the total credit requirements of a Programme.

Perform the following tasks for the relation given above:

(i) What is the key to the relation?
(ii) Identify and list the functional dependencies in the relation.
(iii) Make an instance of this relation consisting of at least 8 to 10 records, showing possible redundancies.
(iv) Decompose the relation **Course**into 2NF and 3NF relations.

(b) What is multi-valued dependency? Explain with the help of an example. How can it be used to decompose a relation into the 4th Normal Form? Explain with the help of an example. Also, explain the concept of the Join dependency with the help of an example.

(c) Explain the following terms with the help of an example of each:Views, Embedded SQL, Triggers and Dynamic SQL.

(d) Consider the following relational database:

Member (memberId,memberName, memberAddress, memberPhone)
BookIssued(memberID, BookID, IssueDate,returnDate)
Book(BookId, BookTitle, FirstAuthor)

The underlined attribute(s) in the relations given aboveform the primary key. In relation Member the attribute memberId is the unique identifier of a member. The purposes of other attributes in the Member relation are self-explanatory. You may define the domain of different attributes. Pleasenote that the BookIssued relation has two foreign keys,namely memberID and BookID, which reference the Member and Book relations, respectively. Write and run the following SQL queries on the database:

(i) Create the tables with the primary and foreign key constraints.
(ii) Insert at least 5 records each in the Member and Book tables and about 10 records in the BookIssuedtable.
(iii) List the name and phone number of all the members in lexicographical order.
(iv) Find all the Books issued to the member whose memberID is “0001”.
(v) Find the list of those members who have not returned more than one book. (Assume that a book is not returned if returnDate is NULL)
(vi) Find the number of books whose first author’s name is “XYZ”.
(vii) Find the pair of members who have the same memberPhone.
(viii) Find the list of Books whose title includes the term “Database”.

(ix) Find the title of the book that has been issued the most.
(x) Find the list of members who have not issued any books.

Question 3:

(a) What are the ACID (Atomicity, Consistency, Isolation, Durability) properties of a transaction? Explain each property with a suitable example related to an online banking fund transfer. **(4 Marks)**

(b) Consider the following schedule involving two transactions, T1 and T2, where A and B are data items with initial values A=1000, B=2000.

Time	T1	T2
t1	READ(A)	
t2	A = A - 100	
t3		READ(A)
t4		A = A * 1.1
t5		WRITE(A)
t6		READ(B)
t7	WRITE(A)	
t8	READ(B)	
t9	B = B + 100	
t10	WRITE(B)	

(i) What is the final value of A and B after this schedule? **(4 Marks)**
(ii) Is this schedule serializable? Justify your answer. Identify the specific concurrency problem (e.g., Lost Update, Dirty Read) that occurs here. **(4 Marks)**

(c) Explain the Two-Phase Locking (2PL) protocol. How does it ensure serializability? Does 2PL prevent deadlocks? Explain with an example of how a deadlock can occur even when 2PL is used. **(8 Marks)**

Question 4:

Write short notes on any **four** of the following, explaining their purpose and key features. Provide an example where applicable. **(4 x 5 = 20 Marks)**

(i) Distributed Databases vs. Centralized Databases
(ii) The Star Schema in Data Warehousing
(iii) NoSQL Databases (Explain one type, e.g., Document, Key-Value, or Graph)
(iv) Query Optimization in RDBMS
(v) Log-Based Recovery and the role of Checkpoints

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Course Code	**:**	**MCS-208**
Course Title	**:**	**Data Structures and Algorithms**
Assignment Number	**:**	**PGDCA_NEW(II)/208/Assignment/2025-26**
Maximum Marks	**:**	**100**
Weightage	**:**	**25%**
Last Date of Submission	**:**	**31st October, 2025 (for July session)** **30th April, 2026 (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: For each of the Singly Linked List, Circularly Singly Linked List, Doubly Linked List, Circularly Doubly Linked List, write one application that is exclusively suitable for that list. For example, X may be an application for whose implementation, only Circularly Singly Linked List is suitable and others are not suitable. Justify your answer. **(20 Marks)**

Question 2: We can test whether a node ' m' is a proper ancestor of a node ' n' by testing whether ' m' precedes ' n' in X-order but follows ' n' in Y-order , where X and Y are chosen from {pre, post, in}. Determine all those pairs X and Y for which this statement holds. **(20 Marks)**

Question 3: Explain Left Leaning Red Black Trees. What are their advantages and disadvantages? **(20 Marks)**

Question 4: Write a short note on the recent developments in the area of finding minimum cost spanning trees. **(20 Marks)**

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Course Code	**:**	**MCSL-209**
Course Title	**:**	**Data Structures and Algorithms Lab**
Assignment Number	**:**	**PGDCA-NEW(II)/L-209/Assignment/2025-26**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Dates for Submission	**:**	**31st October, 2025 (for July session)** **30th April, 2026 (for January 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.

Question 1: Write an algorithm and program in 'C' language to merge two sorted linked lists. The resultant linked list should be sorted. **(20 Marks)**

Question 2: Write an algorithm and a program in 'C' language to insert and delete edges in an adjacency list representation of an undirected graph. Make assumptions, if necessary. **(20 Marks)**

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Course Code	**:**	**MCSL-210**
Course Title	**:**	**DBMS and Java Lab**
Assignment Number	**:**	**PGDCA_NEW(II)/L-210/Assignment/2025-26**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Date of Submission	**:**	**31st October, 2025 (for July session)** **30th April, 2026 (for January session)**

Note: This assignment has two sections. Answer all questions in each section. Each Section is of 20 marks. Your Lab Records will carry 40 Marks (20 Marks for each section). Rest 20 marks are for viva voce. 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 Payroll management is a critical component, ensuring timely and accurate payment of salaries, benefits, and allowances to the employees of an orgenization. A construction company which undertakes various infrastructure projects such as buildings, roads, and bridges wants to develop payroll management system for covering various employee categories and associated payroll details. The company employs a diverse workforce consisting of both technical and non-technical staff. The database records manage **details of Employees and their associations with Departments, Basic Salary, Attendance, Allowances/Incentives and Deductions, Leave Records, Employee type** (Contract Details /Permanent/Part time etc.)

Question 1: List the entities, their attributes and relationships for the description given above and make an ER-diagram for this Payroll Management System. You may use the concept of keys, aggregation, generalization, cardinality etc. as per need. Design the 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 wherever require. **(10 Marks)**

Question 2: Implement the database design (create tables) that you have created in question 1 using a RDBMS with proper integrity constraints. Enter about 8- 10 meaningful records in each of your table. **(4 Marks)**

Question 3: **(6 Marks)**

1. List all permanent employees with their department name
2. Show the June 2025 salary details of all employees who are working in Maintenance Department
3. Get employee names along with their basic salary and employee type
4. Find top 5 highest paid employee (highest basic salary) in August 2025
5. Show average allowances per employee for July 2025
6. Show employees whose tax deductions exceed ₹20,000 in July 2025

7. Count the number of employees in each department
8. Find employees who were absent between June 10, 2025 and Jule 15, 2025
9. List engineers with net salary > ₹75,000 in August 2025
10. Find the sum of net salary paid to all the employees
11. Find average salary of employees in July 2025 for maintenance department
12. Find total number of employees working in the company in May 2025.

Section 2: Java Lab

Question 1: Write a program to demonstrate use of different data types in Java. **(2 Marks)**

Question 2: Write java programs to demonstrate use of abstract class and interface. Make necessary assumptions. **(6 Marks)**

Question 3: Write a java program to demonstrate interthread communications. **(4 Marks)**

Question 4: Write java program to demonstrate useJavaFX in GUI development. **(2 Marks)**

Question 5: Write a program using JDBC for simple CRUD application for billing of a general store. Make necessary assumptions. **(6 Marks)**