PG/IS/MCA/101/24

MCA 1st Semester Examination, 2024

MCA

(*Advanced Database Management System*)

PAPER — MCA-101

Full Marks : 100

Time : 3 hours

Answer **all** questions

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

GROUP – A

Answer the following questions (any *five*) : 2 × 5

1. Write the basic properties of a relational database model.

(2)

2. What is meant by "Atomicity" in the context of database transactions ?

3. What is a lossless join ?

4. What is a weak entity ? Explain with an example.

5. Define 2NF.

6. What is a functional dependency ? Give example.

7. Write the properties of a transaction.

8. What is an integrity constraint ? Give an example.

GROUP—B

Answer the following questions (any *four*) :
$$15 \times 4$$

9. (*a*) Explain the concept of a database schema with an example.

(3)

(b) Describe the three-tier architecture of DBMS and its advantages.

(c) Explain the concept of a foreign key. How does it enforce referential integrity ? Provide an example.   3 + 6 + (2 + 3 + 1)

10. (a) Write the purpose of the normalization process.

(b) What is the difference between 3NF and BCNF ? Explain with examples.

(c) What are insertion, deletion, and update anomalies in databases ? How does normalization help in resolving these anomalies ?   15

11. (a) What is a multivalued attribute in an ER model ? How is it represented in an ER diagram ?

(b) Explain how to convert an ER diagram into a relational schema.

(4)

(c) Construct an E-R Diagram for the following scenario :

Design a database for an online job portal where job listings have a unique job ID, title, company name, location, and salary range. Users can apply for multiple jobs, and each application should track the user ID, application data, and status. Each user has a unique ID, name, email, and phone number. A company can have multiple job listings, but each job is associated with a single company.

$3 + 4 + 8$

12. (a) Consider the relational schema :

Student (RollNo, Name, Course, Dept, Year) with functional dependencies :

RollNo $\rightarrow$ Name, Dept, Year
Course $\rightarrow$ Dept

Find the candidate key and normalize the schema into 3NF.

(b) Given the relation :

BOOK (BookID, Title, Author, Price, Publisher)

Functional dependencies :
BookID → Title, Author, Price
Title → Publisher

Determine the highest normal form of the relation and justify your answer. 8 + 7

13. (a) What is a database transaction ? Explain the ACID properties that govern database transactions.

(b) Define a "rollback" operation in transactions. When and why would it be used in a DBMS ?

(c) What are "conflicting operations" in transaction processing ? Explain with examples. $(2 + 5) + (1 + 3) + 4$

(*Turn Over*)

(**6**)

14. The given database schema is :

Employee (EmpID, Name, Department,
Salary, ManagerID)

Department (DeptID, DeptName, Location)

Project (ProjID, ProjName, DeptID)

WorksOn (EmpID, ProjID, HoursWorked)

Write the SQL queries for the following :
3×5

(*i*) Retrieve the names of employees working in the "IT Department".

(*ii*) Find the total number of hours worked by each employee across all projects.

(*iii*) List all departments with no employees assigned.

(*iv*) Retrieve the details of employees earning the highest salary in each department.

(*v*) Find the total hours worked by employees on each project.

15. (*a*) Explain SELECT, PROJECT, and JOIN operators with suitable examples.

(*b*) Compare Hierarchical, Network, and Relational data models.

(*c*) What is a data dictionary ? Why is it important in DBMS ?

(*d*) Explain the concept of an "instance" in a database. $6 + 5 + 2 + 2$

16. Write short notes on the following topics (any *two*) : $7\frac{1}{2} \times 2$

(*i*) Shadow Paging

(*ii*) 2-phase locking protocol

(*iii*) Keys in relational database

(*iv*) DBA.

[Internal Assessment — 30 Marks]