

2025

COMPUTER SCIENCE — HONOURS

Paper : DSCC-12

(Database Management System)

Full Marks : 75

The figures in the margin indicate full marks.

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

1. Answer **any five** questions : 2×5
- (a) What is referential integrity?
 - (b) Define candidate key and alternate key.
 - (c) What is a view in SQL? Mention one advantage.
 - (d) Explain the difference between WHERE and HAVING clauses.
 - (e) What does the cardinality ratio specify?
 - (f) What is normalization? Why is it needed?
 - (g) Explain the concept of data independence.
 - (h) What is an index in a database? Why is it used?

Section - A

Answer **any three** questions.

2. Discuss the advantages of using a DBMS over a traditional file system with suitable examples. 5
3. What is a relational model? Describe its key components such as relation, tuple, attribute, and domain with examples. 1+4
4. Define functional dependency (FD). Explain different types of functional dependencies with suitable examples. 1+4
5. State the ANSI/SPARC architecture with proper diagram. State how it helps to achieve data independence. 3+2
6. What is a join? Explain all types of joins with suitable examples. 1+4

Please Turn Over

(4402)

Section - BAnswer *any five* questions.

7. Consider the relation R(A, B, C, D, E) with the following functional dependencies :

 $A \rightarrow B, C$ $C \rightarrow D$ $D \rightarrow E$ $B \rightarrow D$

- (a) Find all candidate keys of R.
(b) Justify each step used to determine the keys.
(c) Justify the statement with suitable example. "BCNF is stronger than 3NF". 3+3+4

8. (a) Consider the following relation :

STUDENT (RollNo, Name, Dept, HOD, HOD_Phone)

Functional dependencies :

 $\text{RollNo} \rightarrow \text{Name, Dept}$ $\text{Dept} \rightarrow \text{HOD, HOD_Phone}$

- (i) Identify partial and transitive dependencies.
(ii) Normalize the table up to BCNF.
(b) Discuss the differences between weak entity set and strong entity set. [(2+2)+3]+3

9. A database contains the following tables : 2×5

Employee (EID, Name, DeptID, Salary)

Department (DeptID, DeptName, Location)

Project (PID, ProjectName, DeptID)

WorksOn (EID, PID, Hours)

Write SQL queries for the following:

- (i) Retrieve names of employees who work on all projects of their department.
(ii) Find departments having average salary > 50,000 and list the top 3 highest-paid employees of each such department.
(iii) Display employees who do not work on any project.
(iv) Find employees who work on at least one project located in 'IT Department'.
(v) Retrieve employees who work more than 20 hours on any project.

10. (a) What do you mean by indexing in DBMS? Describe primary index, clustering index, and secondary index with suitable examples.
- (b) Compare dense index and sparse index with advantages and disadvantages. (1+5)+4
11. (a) Consider the schema R(A, B, C, D) with functional dependencies :
- $A \rightarrow BC$
 $C \rightarrow D$
- The schema is decomposed into R1(A, B) and R2(A, C, D). Check whether the decomposition is lossless or lossy.
- (b) Justify the statement with proper example— “Redundancy cannot be eliminated from RDBMS”.
6+4
12. Consider the following relational schemas :
- Books (bid, title, author, Pub_year)
- Members (mid, name, contact, address)
- Loans (lid, bid, mid, loan_date, return_date)
- Write the relational algebra expressions query for the following :
- (a) Display the title of books borrowed by each member along with the corresponding loan dates.
- (b) Find the members who have not returned the books they borrowed after the return date. 5+5
13. (a) Given a relational schema R(W, X, Y, Z) and a set of functional dependency as follows :
- $F : \{X \rightarrow W, WZ \rightarrow XY, Y \rightarrow WXZ\}$
- Find the canonical cover for F.
- (b) What do you mean by dependency preservation? State the different desirable properties of Transaction. 5+(2+3)
14. (a) “Primary key of a relation can be the foreign key of the same relation.”— Critically comment. What do you mean by self referencing foreign key?
- (b) State the differences among DROP, DELETE and TRUNCATE commands with the help of an example. Also differentiate between where and having clause. (4+1)+(3+2)
15. (a) Suppose you have two relations R and S with m and n rows respectively. If you perform cartesian product on R and S, what will be the space requirement for the resultant relation? Can you suggest a technique so that the space required to store the resultant relation will improve? Explain with an example. Also specify the maximum amount of space required after the improvement.
- (b) Explain the concepts behind ‘design by synthesis’ and ‘design by analysis’ approaches at the time of constructions of relational schemas. (1+3+1)+(2½+2½)