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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech Integrated

SEM: IV - THEORY EXAMINATION (2025-2026)

Subject: Database Management Systems

Time: 3 Hours

Max. Marks:100

General Instructions:

IMP: Verify that you have received question paper with correct course, code, branch etc.

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.
2. Maximum marks for each question are indicated on right hand side of each question.
3. Illustrate your answers with neat sketches wherever necessary.
4. Assume suitable data if necessary.
5. Preferably, write the answers in sequential order.
6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION – A

20

1. Attempt all parts:-

- | | | |
|-------|---|---|
| (1.1) | In a file system, redundancy leads to which critical issue that DBMS solves using normalization? (CO1, K2) | 1 |
| | <ul style="list-style-type: none"> (a) Data abstraction (b) Data inconsistency (c) Data independence (d) Data indexing | |
| (1.2) | If a DBA changes the storage structure (e.g., indexing or file organization) without affecting user queries, this demonstrates: (CO1, K2) | 1 |
| | <ul style="list-style-type: none"> (a) Logical independence (b) Physical independence (c) Data abstraction (d) Schema mapping | |
| (1.3) | Which of the following is always minimal? (CO2, K2) | 1 |
| | <ul style="list-style-type: none"> (a) Super Key (b) Candidate Key | |

- (c) Foreign Key
- (d) Unique Key

- (1.4) Which query is valid? (CO2, K2) 1
- (a) WHERE COUNT() > 5
 - (b) HAVING COUNT() > 5
 - (c) GROUP BY WHERE
 - (d) SELECT HAVING
- (1.5) UNION vs UNION ALL difference is: (CO3, K2) 1
- (a) UNION sorts, UNION ALL doesn't
 - (b) UNION removes duplicates, UNION ALL keeps them
 - (c) UNION is faster
 - (d) No difference
- (1.6) Natural join may produce unexpected results because (CO3, K1) 1
- (a) It uses all columns
 - (b) It matches columns with same names automatically
 - (c) It ignores keys
 - (d) It creates duplicates
- (1.7) Which ACID property ensures that partial updates are not saved? (CO4, K2) 1
- (a) Consistency
 - (b) Isolation
 - (c) Atomicity
 - (d) Durability
- (1.8) Which condition is NOT required for deadlock? (CO4, K2) 1
- (a) Mutual exclusion
 - (b) Hold and wait
 - (c) Pre-emption
 - (d) Circular wait
- (1.9) Which of the following is NOT a type of NoSQL database? (CO5, K2) 1
- (a) Document store
 - (b) Key-value store
 - (c) Relational store
 - (d) Graph database
- (1.10) Which NoSQL database is best for relationship-heavy queries? (CO5, K1) 1
- (a) MongoDB
 - (b) Cassandra

- (c) Neo4j
- (d) Riak

2. Attempt all parts:-

- | | | |
|-------|--|---|
| (2.1) | How does a DBMS reduce data redundancy compared to file systems? (CO1, K2) | 2 |
| (2.2) | How do you identify a candidate key from a given set of attributes?(CO2, K2) | 2 |
| (2.3) | When would you use FULL OUTER JOIN instead of LEFT JOIN? (CO3, K2) | 2 |
| (2.4) | What is the difference between active and partially committed state? (CO4, K2) | 2 |
| (2.5) | Give one real-world scenario where a document database is preferred over RDBMS.(CO5, K3) | 2 |

SECTION – B

30

Answer any one of the following-

- | | | |
|-------|--|---|
| (3.1) | Explain the three-schema architecture of DBMS. How does it support logical and physical data independence? Illustrate with an example. (CO1, K2) | 6 |
| (3.2) | Differentiate between schema and instance with examples. Explain how frequent instance changes differ from schema modifications.(CO1, K2) | 6 |

Answer any one of the following -

- | | | |
|-------|---|---|
| (3.3) | Explain different types of keys (super key, candidate key, primary key, alternate key, foreign key, unique key) with examples. How do they ensure data integrity?(CO2, K3) | 6 |
| (3.4) | Given a relation:
R(A, B, C, D) with functional dependencies: $A \rightarrow B$, $B \rightarrow C$, $C \rightarrow D$ <ul style="list-style-type: none"> • Find all candidate keys • Identify super keys • Justify your answer(CO2, K3) | 6 |

Answer any one of the following-

- | | | |
|-------|--|---|
| (3.5) | Explain UNION, INTERSECT, and MINUS operators with examples. What conditions must be satisfied for these operations to work correctly? (CO3, K3) | 6 |
| (3.6) | Differentiate between inner join, natural join, equi join, and non-equijoin with examples. When is each used? (CO3, K3) | 6 |

Answer any one of the following-

- | | | |
|-------|---|---|
| (3.7) | Describe the transaction life cycle with all states (active, partially committed, committed, failed, aborted). Explain transitions with diagram.(CO4, K4) | 6 |
| (3.8) | Explain conflict serializability using precedence graph. Demonstrate with an example how to check if a schedule is serializable.(CO4, K4) | 6 |

Answer any one of the following-

- | | | |
|--------|--|---|
| (3.9) | Explain different types of NoSQL databases (key-value, document, column-family, graph) with examples. Compare their use cases. (CO5, K4) | 6 |
| (3.10) | Differentiate between ACID and BASE properties. In which scenarios is BASE preferred over ACID? (CO5, K4) | 6 |

SECTION – C

50

4. Answer any one of the following-

- (4.1) Discuss the evolution of database systems from file systems to relational DBMS. Highlight key challenges that led to DBMS development. (CO1, K4) 10
- (4.2) Differentiate between schema and instance with examples. Explain how changes in schema and instance affect database operations. (CO1, K4) 10
5. Answer any one of the following-
- (5.1) Explain the execution order of SQL clauses (FROM, WHERE, GROUP BY, HAVING, SELECT, ORDER BY) with an example query. Why is HAVING required when WHERE exists? (CO2, K3) 10
- (5.2) Explain different types of constraints (entity integrity, referential integrity, domain constraints) with examples. Discuss consequences of violating these constraints. (CO2, K3) 10
6. Answer any one of the following-
- (6.1) Explain different types of subqueries (IN, EXISTS, ANY, ALL) with examples. Compare their behavior and performance. (CO3, K3) 10
- (6.2) Compare joins vs subqueries in terms of performance, readability, and optimization. When should each be preferred? (CO3, K3) 10
7. Answer any one of the following-
- (7.1) Differentiate between conflict serializability and view serializability. Discuss their advantages, limitations, and practical applicability. (CO4, K4) 10
- (7.2) Define schedule and explain different types of schedules. Compare serial and non-serial schedules in terms of performance and correctness. (CO4, K4) 10
8. Answer any one of the following-
- (8.1) Provide a detailed comparison between relational databases and NoSQL databases in terms of: Schema design, Scalability, Consistency, Query complexity, Performance. 10
- (8.2) Also discuss when each should be preferred. (CO5, K4) 10
- Discuss the evolution from relational databases to NoSQL systems. What challenges in RDBMS led to the emergence of NoSQL? (CO5, K4)