N.B. :(1) Question No. **1** is **compulsory**.
    (2) Attempt any **four** questions out of remaining **six** questions.
    (3) Make **suitable** assumptions if needed.

1. (a) Explain the deletion of a entry in a B+ tree.   **10**
   (b) What is normalization ? Explain 1NF, 2NF, 3NF, BCNF and 4NF with suitable example.   **10**

2. (a) Draw the E-R diagram for banking enterprise (state assumptions clearly). Convert ER diagram into tables.   **12**
   (b) State whether following statements are TRUE/FALSE with proper justification :–   **8**
     (i) Functional dependencies are generalization of key dependencies.
     (ii) Every 4NF schema is also in BCNF.
     (iii) Every view serializable schedule is conflict serializable.
     (iv) Recovery management component of database is responsible for ensuring the atomicity and durability of the transaction.

3. (a) What is recoverable schedule ? Why recoverability of schedule desirable ? Explain checkpoint based recovery mechanism.   **10**
   (b) What do you understand by deadlock in a database system ? Explain how it is prevented ? Explain deadlock recovery methods.   **10**

4. (a) Draw and explain database system architecture.   **8**
   (b) Differentiate the following :–   **4**
     (i) Relation schemas and relation instances
     (ii) Views and relations.
   (c) Define the following term with suitable example :–   **8**
     (i) Weak and strong entity set
     (ii) Primary key, super key, candidate key and foreign key
     (iii) Mapping cardinalities
     (iv) Specialization and generalization.

5. (a) Explain validation based protocol.   **8**
   (b) Explain time stamp ordering protocol and Thomas write Rule.   **12**

6. (a) What is view ? How it is defined and stored ? What are benefits and limitation of a view ?   **10**
   (b) What is transaction ? Discuss state transition diagram and properties of transactions.   **10**

7. Write short notes on (any **four**) :–   **20**
   (a) Triggers
   (b) Assertions
   (c) Security Mechanism
   (d) Data dictionary storages
   (e) Shadow paging.

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