RELATIONAL DATABASE MANAGEMENT SYSTEM
(IOT3101)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

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

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) Which type of constraint ensures that a value exists in parent/ base table before it can be referenced from another dependent table?
(a) Entity Integrity constraint (b) Participation constraint
(c) Referential Integrity constraint (d) Mapping cardinality constraint

(ii) Which of the following operations is NOT part of relational algebra?
(a) Selection (b) Aggregation
(c) Set difference (d) Cross product

(iii) Which SQL aggregate function will be most suitable for estimating the number of rows in a table?
(a) COUNT(*) (b) COUNT(column_name)
(c) SUM(column_name) (d) AVG(column_name)

(iv) Which integrity type does a FOREIGN KEY constraint enforce?
(a) Referential integrity (b) Relational integrity.
(c) Domain integrity (d) User integrity.

(v) Which keyword is used instead of the assignment operator to initialize variables?
(a) NOT NULL (b) DEFAULT
(c) %TYPE (d) %ROWTYPE

(vi) Which of the following is not a PL/SQL unit?
(a) Table (b) Type
(c) Trigger (d) Package

(vii) Consider a relation R with five attributes A, B, C, D and E. The following dependencies are given A→ B, BC→E, and ED→ A. The keys for R are
(a) CDE (b) ACD
(c) BCD (d) all of these

(viii) The normal form that is not necessarily dependency preserving is
(a) 2NF (b) 3NF
(c) BCNF (d) 4NF

(ix) Which one is not a state of RDBMS transaction?
(a) Active (b) Passive
(c) Partially Committed (d) Committed

(x) Which of the following statement is false?
(a) Consistency property cannot be ensured for all possible concurrent schedules of a set of transactions
(b) Atomicity always ensures that a transaction must always commit and never rollback
(c) Isolation property can be ensured if a concurrent schedule is serializable
(d) Durability property of a transaction can be achieved by using appropriate log-based recovery scheme along with regular database backup in stable storage.

Fill in the blanks with the correct word

(xi) The _____ property of database architecture allows for changes in the database schema without affecting the application using the database.

(xii) A _____ entity in an ER diagram is an entity that cannot exist without being associated with another entity.

(xiii) In SQL, the _____ command is used to remove all records from a table without deleting the table itself.

(xiv) In normalization, a relation is in _____ when it has no atomic attribute with non-atomic data value.

(xv) A relation R is not in 3NF, if there exist a mutual functional dependency between two _____ attributes of R.

Group - B

2. (a) Construct an ER Diagram for a Company having following details :
- Company organized into departments. Each department has unique name and a particular employee who manages the department. Start date for the manager is recorded. Department may have several locations.
- A department controls a number of projects. Projects have a unique name, number and a single location.
- Company's employee name, employee no, address, salary, sex and birth date are recorded. An employee is assigned to one department, but may work for several projects (not necessarily controlled by his/her dept). Number of hours/weeks an employee works on each project is recorded; the immediate supervisor for the employee is also recorded.
- Employee's dependent is tracked for health insurance purposes (dependent name, birth date, relationship to employee is recorded). *[(CO1)(Apply/IOCQ)]*

(b) Explain the following concepts with an example of each: unary relationship and weak entity. *[(CO1)(Understand/LOCQ)]*

8 + 4 = 12

3. (a) Design a concise ER diagram for an National Hockey League (NHL) database that satisfies these requirements:
   - The league contains multiple teams.
   - Each team has a unique name, city, one coach, one captain, and multiple players.
   - Each player belongs to exactly one team and has attributes: name, position, skill level; each player also has multiple injury records.
   - The captain is a player on the same team.
   - Games are played between two teams (host and guest), each game has a date and a score. *[(CO1)(Apply/IOCQ)]*

   (b) What is the difference between a database schema and a database instance? Which of them is liable to be changed frequently and why? *[(CO1)(Understand/LOCQ)]*

8 + 4 = 12

Group - C

4. Consider the following relational schema:
SALESPERSON (s_id, s_name, s_city, grade, commission)
CUSTOMER (cust_id, cust_name, cust_city, salesperson_id)
ORDERS (ord_id, order_amt, order_date, cust_id)
Notes:
Each customer is served by exactly one salesperson
A salesperson can serve many customers.
Each order belongs to one customer and a customer can have many orders.
Based on the above tables, write the following queries using SQL:

(i) Display the customer's name, customer city along with their salesperson name, salesperson city, salesperson commission if the following are true:
(a) Sales person does not live in the same city where the customer lives and
(b) Sales person has received a commission of more than Rs. 12000/- from the company.

(ii) List the name, city, and grade of salespersons who serve at least one customer, sorted by salesperson name.

(iii) Display the number of salespersons for every grade if the grade is above the average grade of salespersons living in New Delhi.

(iv) Find ord_id, order_amt, order_date and cust_id of all the orders issued by the salesperson named 'Rajiv'. *[(CO3) (Apply/HOCQ)]*

(3 + 3 + 3 + 3) = 12

5. (a) Consider a relation R with two sets of Functional Dependencies (FD) defined as:
$F=\{A \rightarrow C, AC \rightarrow D, E \rightarrow AD, E \rightarrow H\}$
$G=\{A \rightarrow CD, E \rightarrow AH\}$
Check whether two sets F and G are equivalent or not. *[(CO4) (Apply/IOCQ)]*

   (b) Given a relation R(ABCDEF) with the following FDs:
$\{AB \rightarrow C, C \rightarrow D, D \rightarrow E, F \rightarrow B, E \rightarrow F\}$
Identify the prime attributes and non-prime attributes of R. *[(CO4) (Apply/IOCQ)]*

6 + 6 = 12

Group - D

6. (a) Consider the relation R(A,B,C,D,E,F,G,H,I,J) satisfying the following functional dependencies:

$$\{AB \rightarrow C, A \rightarrow DE, B \rightarrow F, F \rightarrow GH, D \rightarrow IJ\}$$

Is this relation R in 3rd Normal Form (3NF)? If not, decompose it into 3NF relations.

[(CO4) (Apply/IOCQ)]

(b) Let R(ABCDEF) be a relation with the following set of functional dependencies :

$$F = \{A \rightarrow B, C \rightarrow DE, AC \rightarrow F\}$$

R is decomposed into D = {R1(BE), R2(ACDEF)}. Find whether D is Lossless or Lossy?

[(CO4) (Apply/IOCQ)]

6 + 6 = 12

7. (a) Suppose, the schema R = (A, B, C, D, E) is decomposed into R1(A, B, C) and R2(A, D, E). Show that this decomposition is a lossless-join decomposition if the following set of functional dependencies F holds in R: F= {A → BC, CD → E, B → D, E → A}. *[(CO4) (Apply/IOCQ)]*

(b) Given a relation R(W,X,Y,Z) with the following functional dependencies F. F={ Z→W, Y→XZ, WX→Y}. Find all the candidate keys of R. *[(CO4) (Apply/LOCQ*

6 + 6 = 12

Group - E

8. (a) What is meant by transaction rollback? What causes cascading rollback?

[(CO5)(Remember/LOCQ)]

(b) Why do practical recovery methods use protocols that do not permit cascading rollback? Which recovery techniques do not require any rollback?

[(CO5) (Understand/LOCQ)]

(3 + 3) + (3 + 3) = 12

9. (a) Every conflict serializable schedule is also a view serializable, but all view serializable schedules are not conflict serializable. justify this statement

[(CO5) (Analyse/HOCQ)]]

(b) Define a database transaction. Describe different states of a database transaction.

[(CO5) (Remember/LOCQ)

6 + (2 + 4) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	33	48	19