BASICS OF RDBMS
(CSEN 3206)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Which of the following language is used to specify database schema?
(a) Data Management Language (b) Data Definition Language
(c) Data Development Language (d) Data Manipulation Language.

(ii) Which of the following relational algebra operations does not require the participating tables to be union-compatible?
(a) Union (b) Intersection (c) Difference (d) Join.

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

(iv) _____ is a special type of stored procedure that is automatically invoked whenever the data of the table gets modified.
(a) View (b) Cursor (c) Trigger (d) Procedure

(v) 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 of R are
(a) CDE (b) ACD (c) BCD (d) all of these.

(vi) Which of the following statement is true about tables?
(a) A table can have only one PRIMARY KEY constraint but can have several UNIQUE constraints
(b) A table cannot have multiple primary keys
(c) Null value cannot be stored in the primary key
(d) All of these.

(vii) If a schedule S can be transformed into a schedule S' by a series of swaps of non-conflicting instructions, then S and S' are
(a) conflict serializable (b) conflict equivalent
(c) view equivalent (d) view serializable.

(viii) Which of the following is a not a constraint in SQL?
(a) UNIQUE (b) CURSOR (c) CHECK (d) NOT NULL.

(ix) Database locking concept is used to solve the problem of
(a) lost update (b) uncommitted dependency
(c) inconsistent data (d) all of these.

(x) A transaction in which either all of the database actions occur or none of them do is called
(a) Atomic (b) Consistent (c) Isolated (d) Durable.

Group- B

2. (a) 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)]

(b) What is data independence? How is physical data independence different from logical data independence? Explain with example. [(CO1)(Analyze/IOCQ)]

(c) Explain the difference between an attribute and domain.
Define the following terms with example
(i) Composite attribute
(ii) Weak entity set
(iii) Degree of relation. [(CO1)(Remember/LOCQ)]

(2 + 2) + (2 + 2) + (1 + 3) = 12

3. (a) Given is the following set of properties and functionalities of a simple online book store:

- A book can be identified by its ISBN. The book has a title, year of publishing, and price recorded against it.
- A book is written by one or more authors. Each author can be identified uniquely by his/her Name and Phone Number. An author may have multiple books to his/her credit. An author may be attached to one or more publishers.
- A book is published by a publisher, uniquely identified by its name. A publisher has address and a phone number. A publisher may publish many books. A publisher has many authors associated with it and pays royalties to the authors for their books.
- A customer registers via his/her email id, and information about their name, address, and phone number is recorded. The customer may add several books to their shopping cart.

Construct an ER diagram for the above system requirements, clearly depicting each entity, required attributes, primary keys and cardinality of the relationships. You may add additional conditions also. Please state clearly such assumptions. [(CO1)(Design/HOCQ)]

(b) Explain the following terms using suitable example:
(i) Candidate Key (ii) Aggregation. [(CO1)(Understand/LOCQ)]

8 + (2 × 2) = 12

Group - C

4. (a) Consider a relational database as given below:
Boarder (b-no, b_name, age)
Flight (f-no, b-no, date_of_flight)
where the underlined attributes are the primary keys.
Write the following queries using Relational Algebra:
(i) Find names of boarders who have reserved flight no. 'SE1224'
(ii) List the b-no, names and age of boarders whose age is more than 50.
(iii) List the b-no and names of those boarders, who are flying between 10th and 20th May 2022. [(CO2)(Construct/HOCQ)]

(b) What do you understand by outer join? Differentiate between left and right outer join. Is there any demerit(s) of outer join? [(CO2)(Analyze/IOCQ)]

(2 + 2 + 3) + (1 + 3 + 1) = 12

5. (a) Describe briefly the different anomalies that may arise if a database is not properly normalised. [(CO4)(Understand/LOCQ)]

(b) Consider the relation R = {P, Q, R, S, T, U, V} and the set of functional dependencies F = {PQ→STU, TU→V, P→R}
(i) Find the candidate key(s) of R.
(ii) With respect to the given set of FDs F, identify the partial and transitive dependencies (if any) and hence decide in which normal form relation R is in?
(iii) Decompose R to highest normal form. Show all the intermediate steps clearly. [(CO4)(Analyze/IOCQ)]

5 + (2 + 2 + 3) = 12

Group - D

6. Assume that a "Supplier" table exists with the given structure:
Supplier = { S_Id, S_Name, phn} where S_Id is the primary key.
Create the "Products" table with appropriate integrity constraint as per following specifications.

Field Name	Data Type	Constraints
PNo	Number(5)	Unique product number for each product
PName	Varchar(30)	Must be in upper case
Supp_ID	Char(4)	A valid supplier id which must exist in 'Supplier' table where S_Id is primary key
Price	Number(7,2)	
Expiry_date	Date	Must provide some value

After creating the table, write the following queries using SQL:
(i) List the product numbers (PNo) and names (PName) of those products whose price is more than the average price of all products.
(ii) List the Product numbers and expiry dates of those products those will expire within 15th June, 2022 and 25th December, 2022, both days inclusive.
(iii) Count and list the number of products supplied by each Supplier.
[(CO3)(Design/HOCQ)]

(3 × 4) = 12

7. (a) What is a trigger? Why are the triggers used? [(CO3)(Remember/LOCQ)]
   (b) PRODUCT (PID, Quantity, Price, Cost) is a table in which Cost is a computed column. It stores cost of the item, which is computed as Price times Quantity.
   Write a trigger on table PRODUCT that will calculate the Cost automatically for a row when the user inserts the other values for that row. [(CO3)(Understand/IOCQ)]
   (c) What is subquery? Explain with syntax and an example. [(CO3)(Understand/IOCQ)]

(1 + 2) + 6 + (1 + 2) = 12

Group - E

8. (a) What is a transaction with respect to DBMS? Describe different states of a transaction with the help of a diagram. [(CO5)(Understand/IOCQ)]
   (b) How does recovery manager implement shadow-copy scheme to implement atomicity and durability of a transaction? [(CO5)(Understand/LOCQ)]
   (c) What benefit does strict two-phase locking provide? [(CO5)(Remember/LOCQ)]

(1 + 4) + 5 + 2 = 12

9. (a) What are dense indexing and sparse indexing? Explain with example. [(CO6)(Understand/IOCQ)]
   (b) Define serializable schedule. Give an example. [(CO5)(Remember/LOCQ)]
   (c) Differentiate between wait-die and wound-wait schemes. [(CO5)(Analyse/HOCQ)]

(2 + 2) + (4 + 1) + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	33.33	35.42	31.25

Course Outcome (CO):

After the completion of the course students will be able to

CO1. Identify the basic concepts and various data model used in database design. Be able to model an application's data requirements using conceptual modelling tools like ER diagrams and design database schemas based on the conceptual model.

CO2. Formulate relational algebra expression for queries and evaluate it using the concept of query processing and optimization.

CO3. Create RDBMS schema mapping various business validations and formulate queries based on that schema using SQL to satisfy business requirements.

CO4. Apply normalization and various types of dependencies for evaluating a relational database design. CO5. Apply and relate the concept of transaction, concurrency control and recovery in database.

CO6. Understand with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question