DATABASE MANAGEMENT SYSTEMS
(CSBS 3102)

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 entity in an ER model has a primary key that is composed of attributes from another entity?
(a) Strong Entity (b) Weak Entity
(c) Generalized Entity (d) Specialized Entity.

(ii) What does the "Projection" operator in relational algebra do?
(a) Combines two relations based on a common attribute
(b) Removes duplicate tuples from a relation
(c) Selects specific columns from a relation
(d) Selects specific rows based on a condition.

(iii) Which of the following describes the Closure of a set of Functional Dependencies?
(a) The set of all functional dependencies that can be derived from the original set
(b) The set of all attributes that can be derived from a set of functional dependencies
(c) The minimal cover of functional dependencies
(d) The set of functional dependencies that apply to a particular relation schema.

(iv) What is the primary goal of normalization in database design?
(a) To minimize redundancy and avoid anomalies
(b) To optimize query performance
(c) To simplify the database schema
(d) To enforce referential integrity.

(v) Which SQL clause is used to filter records based on a specific condition?
(a) GROUP BY (b) HAVING (c) WHERE (d) ORDER BY.

(vi) In SQL, which keyword is used to combine the results of two queries, including all duplicates?
(a) UNION (b) INTERSECT (c) UNION ALL (d) EXCEPT.

(vii) Immediate database modification technique uses
(a) Both undo and redo (b) Undo but no redo
(c) Redo but no undo (d) Neither undo nor redo.

(viii) What is the purpose of a LOCK in a database system?
(a) To ensure data is consistent by preventing concurrent access
(b) To optimize query execution
(c) To improve the performance of data retrieval
(d) To create indexes on tables.

(ix) In lock-based concurrency control, what is a deadlock?
(a) A situation where two or more transactions are waiting indefinitely for each other to release locks
(b) A situation where a transaction is aborted due to a lock timeout
(c) A situation where all transactions are executed without any locking
(d) A situation where locks are applied to non-existent data

(x) A statement that is executed automatically by the system a side effect of the modification of the database is
(a) Backup (b) Assertion (c) Recovery (d) Trigger.

Fill in the blanks with the correct word

(xi) Candidate key is the _____ set of super key.

(xii) The collection of data at a particular point in time is called a _____.

(xiii) A _____ entity depends on another entity for its existence.

(xiv) _____ is a process of organizing data to minimize redundancy.

(xv) The primary key is an example of a _____ index.

Group - B

2. (a) What are the roles and responsibilities of a Database Administrator (DBA)? Discuss the importance of each role. *[(CO1)(Remember/LOCQ)]*
(b) Compare and contrast two-level and three level architectures of a DBMS. *[(CO1)(Understand/LOCQ)]*
(c) What is a view? *[(CO3)(Remember/LOCQ)]*
5 + 5 + 2 = 12

3. A publishing company produces books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more book publications. Every book requires some items for publication. These items supplied by suppliers. One supplier can supply many items. Shop owner buys books from the publisher. Shop owner can buy many books but one book can be bought by one shop owner only. Books are uniquely identified by Bookid.
(i) Based on the description above, construct a clean and concise ER diagram for the publishing company database. *[(CO2)(Analyse/IOCQ)]*
(ii) Convert the ER design into a set of tables. *[(CO4)(Apply/IOCQ)]*

(iii) Merge and reduce the set of tables without introducing redundancy, if possible.
[(CO2)(Apply/IOCQ)]

(6 + 4 + 2) = 12

Group - C

4. (a) Suppose, a relational schema R (A, B, C, D, E, F, G, H) and set of functional dependencies: F { A -> BC, E -> C, AH -> D, CD -> E, D -> AEH, DH -> BC }. Compute AE + . Is BCD -> H valid or not. *[(CO3)(Apply/IOCQ)]*

   (b) Consider the Following Relation:
   r(R)={ A, B, C, D, E, F, G, H, I}
   Functional dependency is given below:
   F={A→B, C→D,E, F→G, B→GH, , AF→C, E→I }
   Determine the current normal form of the given relation. Decompose it upto 3NF.
   [(CO3)(Apply/IOCQ)]

   (c) Define trivial multi valued dependency and trivial join dependency.
   [(CO2)(Apply/IOCQ)]

5 + 3 + 4 = 12

5. (a) Suppose, a relation schema R = {A, B, C, D, E} and set of functional dependencies: F {A -> BC, CD -> E, B -> D, E ->A}. Find the list of the candidate keys of R.
   [(CO3)(Apply/IOCQ)]

   (b) R={A,B,C,D,E,F,G,H,I,J} where {A,B} forms the primary key.
   FD1:- {A, B} → {C} , FD2 :-{A}→{D,E} , FD3:- {B}→{F}, FD4:- {F}→{G,H} & FD5:- {D}→{I,J}
   Normalize the relation up to highest possible normal form. *[(CO3)(Apply/IOCQ)]*

   (c) Consider the following set F of functional dependencies: F= {A → BC, B → C, A → B, AB → C}. Clearly mention all the steps to find the canonical cover of the functional dependency given above. *[(CO3)(Apply/IOCQ)]*

2 + 4 + 6 = 12

Group - D

6. (a) What are the aggregation functions in SQL? *[(CO4)(Remember/LOCQ)]*

   (b) Consider the following relational schemas and write both SQL and relational algebric queries for (i)-(iv):
   Student(RollNumber,StudentName, Address)
   Teachers(TeacherID, TeacherName, TeachingSubject)
   College(RollNumber,TeacherID)
   (i) Find the name of the teacher who teaches DBMS.
   (ii) Find the name of the teacher who teaches Machine Learning subject to Amit Sen student.
   (iii) Insert a new tuple into relation teachers.
   (iv) Delete records from students whose address is 'Kolkata'? *[(CO4)(Apply/IOCQ)]*

   (c) Differentiate between union and union all commands in SQL. *[(CO4)(Understand/LOCQ)]*

2 + 8 + 2 = 12

7. (a) Compare and contrast drop, delete and truncate commands in SQL. *[(CO4)(Understand/LOCQ)]*

(b) "Every candidate key is a super key but the vice versa is not true"- justify the statement with example. *[(CO2)(Analyse/IOCQ)]*

(c) Consider the following relational schema
r(A,B, C, D,E,F,G)
The following functional dependency is held in the relation
A ->B ; B->C ; C-> D,E ; F ->G
Maintaining the functional dependency the relation r is broken as follows
r1(A, B) ; r2(B, C) ; r3(C, D, E) ; r4(F, G)
Verify whether this decomposition is dependency preserving or not.
[(CO3)(Apply/IOCQ)]

3 + 4 + 5 = 12

Group - E

8. (a) Consider the following schedule written in log:
$< T_0$, Start>
$< T_0$, X, 102>
$< T_0$, Y, 80>
$< T_0$, Commit>
$< T_1$, Start>
$< T_1$, X, 68>
$< T_1$, Y, 800>
What actions will be taken for recovery if (i) Deferred Database Modification & (ii) Immediate Database Modification applied? *[(CO6)(Evaluate/HOCQ)]*

(b) Briefly explain active set. *[(CO5)(Remember/LOCQ)]*

(c) Explain why secondary index is useful? *[(CO5)(Understand/LOCQ)]*

6 + 2 + 4 = 12

9. (a) Define strict 2PL and rigorous 2PL. *[(CO5)(Remember/LOCQ)]*

(b) Is the given schedule S both recoverable and cascadeless? Give reasons for your answer.
S: r1(A),r2(B),w1(A),r2(A),w2(A),r3(A),w3(A),w1(B),c1,a2? *[(CO5)(Analyse/IOCQ)]*

(c) Write a cursor to display the first five records on the following table:
Student(sno, sname, address, city). *[(CO4)(Apply/IOCQ)]*

2 + 5 + 5 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	28.12	65.63	6.25