DATABASE MANAGEMENT SYSTEMS
(MCA 1203)

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 of the following relational algebra operations must require the participating tables to be union-compatible?
(a) Inner Join (b) Outer Join (c) Intersect (d) Natural Join

(ii) Which of the following is not a property of transactions?
(a) Atomicity (b) Concurrency (c) Isolation (d) Durability

(iii) In a relation R, a multi valued dependency A→→B is called non trivial if and only if
(a) $B \subseteq A$ (b) AUB=R (c) $B \not\subset A$ (d) None of the above

(iv) A secondary index is created on the non ordering key field of a disk file. The number of records in the disk file is 30000. The record length of file is 30 bytes and for index it is 15 bytes. Block size of index and file = 1024 bytes. So number of blocks in index is
(a) 30000/(bfr of index) (b) 3000/(bfr of disk file)
(c) 30/(bfr of index) (d) 30000/15

(v) If a schedule S can be transformed into a schedule S' by a series of swaps of non-conflicting instructions, we say that S and S' are
(a) Conflict Serializable (b) View equivalent
(c) Conflict Equivalent (d) View Serializable

(vi) A system is in a _____ state if there exists a set of transactions such that every transaction in the set is waiting for another transaction in the set.
(a) Idle (b) Waiting (c) Deadlock (d) Ready

(vii) A referential integrity constraint is
(a) Primary key constraint (b) Check constraint
(c) Foreign key constraint (d) None of the above

(viii) In B Tree with 13, 4, 12, 34, 45 search key values, of order 3
(a) All search keys are at leaf nodes (b) Only [4, 13, 35] are leaf nodes
(c) [12, 4] are leaf nodes (d) None

(ix) In an RDBMS, which of the following statements about Weak Entities and Total Participation is true?
(a) Total Participation guarantees Weak Entity
(b) Weak Entity must have Total Participation
(c) Weak Entity may not have Total Participation
(d) Total Participation will never be applicable for Weak Entities.

(x) Which of the following is a procedure for acquiring the necessary locks for a transaction where all necessary locks are acquired before any are released?
(a) Record controller (b) Exclusive lock
(c) Authorization rule (d) Two phase lock.

Fill in the blanks with the correct word

(xi) Consider a Schedule S, with transactions T1 and T2. If S is conflict serializable it will also be _____.

(xii) The term _____ refers to a declaration with a size, scale, or precision limit.

(xiii) A person who manages and controls the overall DBMS is called a_____.

(xiv) The ability to query data, as well as insert, delete, and alter tuples, is offered by _____.

(xv) _____ indicates the maximum number of entities that can be involved in a relationship.

Group - B

2. (a) Illustrate with relevant example that a relation schema may be in 3NF but not in BCNF. *[(CO1,CO5)(Understand/LOCQ)]*

(b) Consider the following relational database of a college.
Student(RollNumber,StudentName,Address)
Teacher(TeacherId,TeacherName,TeachingSubject)
College(RollNumber,TeacherId)
Write relational algebra expression for the following requests.
(i) Find the name of teacher who live in "Jamtara".
(ii) Find the name of teacher who teaches "Hacking" subject.
(iii) Find the name of teacher who teaches "Networking" to Sumit Kumar.
[(CO1) (Apply/IOCQ)]

6 + 6 = 12

3. (a) Consider the following relation R(ABCDEF) with the following functional dependencies $F = \{AB \rightarrow C, C \rightarrow DE, E \rightarrow F, F \rightarrow A\}$
Analyze the normal forms for the above relation with detailed discussion.
[(CO1,CO5)(Analyze/IOCQ)]

(b) Suppose a relation R(ABCD)where $F = \{A \rightarrow B, B \rightarrow C, C \rightarrow D, D \rightarrow B\}$is defined. The relation R is decomposed into R1(AB), R2(BC), R3(BD). Evaluate whether the dependencies are preserved or not. *[(CO1,CO5)(Evaluate/HOCQ)]*

6 + 6 = 12

Group - C

4. Consider the following tables of a database of a computer training institute:
STUDENT (rollno, name, courseId, yearOf_enroll),
COURSE (courseId,courseName),
SUBJECT_PAPER(pcode, pname, courseId),
MARKS_OBTAINED (rollno, pcode, yearOfexam, marks),
FACULTY (empid,name, salary),
SUBJECT_TAUGHT (empid, pcode, courseId, year Of_teaching)
Write the SQL for the following queries using the given tables:
   (i) Display the course name along with course id, in which maximum number of students have enrolled in the year 2018.
   (ii) Display the name with employee id of those faculties, who have been teaching at least three papers in the year 2018.
   (iii) For each paper, display the paper name and the corresponding average of the paper's marks, obtained by those students, who have appeared for its exam in the year 2022.
   (iv) Find the name of the topper(s) of MCA 1st Semester of 2022 session.
   [Note: topper of a semester means one who obtained maximum aggregate marks considering all subjects of that semester]. *[(CO2,CO5)(Formulate/IOCQ)]*

(3 + 3 + 3 + 3) = 12

5. (a) Consider the following database schema:
Hotel (Hno, Name, Address)
Room (Rno, Rtype, Hno, Price)
Booking (Hno, Gno, Rno, Dt_from, Dt_to)
Guest (Gno, GName, GAddress)
Write the following queries in SQL:
   (i) Find the names of all guests who are staying in hotels either in Kolkata or in Chennai.
   (ii) Find the total number of guest in 'Hotel Taj'.
   (iii) List the number of rooms in each hotel.
   (iv) Find the hotel name with the most expensive room.
   (v) Find the hotel with 2nd maximum no. of rooms. *[(CO2,CO5)(Formulate/IOCQ)]*

   (b) Illustrate the left-outer join with relevant real life example. *[(CO6)(Remember/LOCQ)]*

(2 + 2 + 2 + 2 + 2) + 2 = 12

Group - D

6. (a) In PL/SQL, how can you verify whether an Update Statement is Executed or not? *[(CO3,CO6)(Analyse/HOCQ)]*

   (b) Write a Pl/SQL block of code that first withdraws an amount of Rs. 1,000. Then deposits an amount of Rs.1,40,000. Update the current balance. Then check to see that the current balance of all the accounts in the bank does not exceed Rs. 2,00,000. If the balance exceeds Rs. 2,00,000 then undo the deposit just made.
   Considering the following schema Customer (Name, Acc No, Balance)
   [(CO3,CO6) (Apply/IOCQ)]

(c) Illustrate the use of User-defined exception with example. *[(CO3,CO6)(Apply/IOCQ)]*

3 + 6 + 3 = 12

7. (a) What are COMMIT, ROLLBACK and SAVEPOINT statements in PL/SQL? *[(CO3)(Remember/LOCQ)]*

(b) Write a trigger which converts the employee name in upper case if it is inserted in any other case. Change should be done before the insertion only. *[(CO3,CO6) (Apply/IOCQ)]*

(c) Explain differences between Implicit Cursors and Explicit Cursors with example. *[(CO3)(Remember/LOCQ)]*

3 + 5 + 4 = 12

Group - E

8. (a) Illustrate the following terms
(i) B+ tree database indexing. (ii) ACID properties. (iii) Time stamp protocol. *[(CO4)(Remember/LOCQ)]*

(b) What is a Cascade less Schedule? Why is it desirable? "Every cascade less schedule is also recoverable" – Do you agree with this statement? Analyse your answer. *[(CO4) (Analyse/IOCQ)]*

(2 + 2 + 2) + 6 = 12

9. (a) Name the different types of file organization techniques. Illustrate the advantages and disadvantages of using Indexed sequential file organization over the Sequential file organization techniques. *[(CO4)(Analyse/IOCQ)]*

(b) Consider the concurrent schedule S of three transactions T1, T2 and T3, where Ri(A), Ri(B) are read operations and Wi(A), Wi(B) are write operations of Transaction Ti on data items A and B accordingly: **S = R1(A) R3(C) W1(A) R2(A) W3(C) W2(A) R1(B) R2(C) W1(B) W2(C).**
Find out whether the above concurrent schedule **S** is serializable or not – Justify your answer. *[(CO4) (Analyse/IOCQ)]*

(2 + 4) + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	21.87	68.75	9.38

Course Outcome (CO):

After the completion of the course students will be able to

MCA1203.1 Apply relational algebra, functional dependencies, normalization techniques and design the database.
MCA1203.2 Apply SQL queries to access data in relational database.
MCA1203.3 Perform PL/SQL programming using concept of cursor management, error handling, package and triggers.
MCA1203.4 Apply the concept of a database transaction, control and its role in maintaining the database's integrity and the concept of different levels of indexing to optimize query processing.
MCA1203.5 Familiarize the students with a good formal foundation on the relational model.
MCA1203.6 Recognize the importance of database analysis and design in the implementation of any real life Database application and different operations on it.

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