5. (a) Discuss with an example, the difference between 'deferred database modification' and 'immediate database modification'.

   (b) What is write-ahead logging (WAL) rule?

   (c) Briefly describe the following database recovery techniques:
   i. Forward recovery, ii. Backward recovery.

   (d) Explain the implementation problem with stable storage. How do database systems deal with this problem?

3 + 2 + 4 + 3 = 12

Group - D

6. (a) Display the employee information from EMP (emp_no, city) table, whose emp_no is **e01** and city is **Kolkata** using parameterized FOR cursor.

   (b) Write a trigger which will check the age of an employee while inserting the record in EMP (**emp_no**, emp_name, birth_date, street, city) table. If the age is less than 18 years then display an error message.

   (c) Explain mixed notation of parameter passing in procedures with example.

5 + 5 + 2 = 12

7. (a) Explain differences between Implicit Cursors and Explicit Cursors with example.

   (b) Why RAISE_APPLICATION_ERROR () is used. Explain with an example.

   (c) Why cursor is required? What is an active set?

   (d) Write a PL/SQL Function to reverse an input string and to check whether it is a palindrome or not.

4 + 3 + 3 + 2 = 12

Group - E

8. (a) With a suitable diagram discuss the referential architecture of Distributed DBMS.

   (b) How does an auxiliary program help in fetching data in a Distributed DBMS?

7 + 5 = 12

9. (a) Describe the characteristics of object oriented data model. Explain the advantages of Object Oriented DBMS.

   (b) Compare between Relational DBMS and Object Oriented DBMS.

   (c) What do you mean by system-maintained transaction time in a temporal database? Give an example.

6 + 3 + 3= 12

DATABASE MANAGEMENT SYSTEMS II
(MCAP 2103)

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 systems is responsible for ensuring isolation?
   (a) Recovery system (b) Atomic system
   (c) Concurrency control system (d) Compiler system.

   (ii) Which of the following occurs when one transaction read a changed record that has not been committed to the database?
   (a) Nonrepeatable read (b) Phantom read
   (c) Dirty read (d) Consistent read.

   (iii) A scheme that creates a new version of a data item for each transaction is defined by
   (a) Concurrency control scheme
   (b) Multiversion concurrency control scheme
   (c) Timestamp concurrency control scheme
   (d) Wound-Wait concurrency control scheme.

   (iv) _____ protocol guarantees that a set of transactions becomes serializable.
   (a) Two-phase locking (b) Two-phase commit
   (c) Transaction locking (d) Checkpoints.

   (v) For a transaction to be durable, its changes need to be written to _____ storage.
   (a) Volatile storage (b) Non-volatile storage
   (c) Stable storage (d) Dynamic storage.

   (vi) A checkpoint where transactions are allowed to perform updates even while buffer blocks are being written out is called as
   (a) buffer (b) fuzzy checkpoint
   (c) shadow paging (d) redo/undo.

(vii) The write-ahead logging (WAL) protocol simply means that
(a) writing of a data item should be done ahead of any logging operation
(b) the log record for an operation should be written before the actual data is written
(c) all log records should be written before a new transaction begins execution
(d) the log never needs to be written to disk.

(viii) Shadowing may result in
(a) page loss (b) data scattering
(c) page swap (d) page replication.

(ix) In case of transaction failure under a deferred update incremental logging scheme, which of the following will be needed?
(a) An undo operation (b) A redo operation
(c) An undo and redo operation (d) None of these.

(x) In Distributed DBMS, distributed physical data independence is provided by
(a) local conceptual schema (b) local external schema
(c) global conceptual schema (d) local mapping schema.

Group - B

2. (a) Define 4NF with an example.

(b) List the ACID properties. Explain the usefulness of each.

(c) Consider the following schedule S of transactions T_1, T_2, T_3, T_4:

T_1	T_2	T_3	T_4
	Reads (X)		
		Writes (X)	
		Commit	
Writes (X)			
Commit			
	Writes (Y)		
	Reads (Z)		
	Commit		
			Reads (X)
			Writes (Y)
			Commit

Prove that S is both conflict-serializable and recoverable.

2 + 4 + 6 = 12

3. (a) What is the two-phase locking protocol? How does it guarantee serializability?

(b) Consider the following schedule of transactions T_1, T_2 and T_3 and database with objects A, B, C and D. Insert shared and exclusive lock actions as well as unlock actions and modify the schedule where necessary. If a deadlock

occurs, abort the participating transaction that started last. Write down the complete schedules satisfying the **2PL** protocol.

$S = r_1(A), r_2(B), r_3(C), r_1(B), r_2(C), r_3(D), w_1(A), w_2(B), w_3(C), w_1(A)$

(c) Write down the *Thomas's write rule* for modification of the basic timestamp ordering algorithm.

(2 + 2) + 6 + 2 = 12

Group - C

4. (a) Consider the following figure, which shows the log corresponding to a particular schedule at the point of a system crash for four transactions T_1, T_2, T_3, and T_4. Suppose that the *immediate update protocol* with *checkpointing* are used.

i. Describe the recovery process from the system crash.
ii. Specify which transactions are rolled back.
iii. Which operations in the log are redone and which (if any) are undone?
iv. Will any cascading rollback take place?
v. Suppose that the system crashes before the [commit, T_4] entry is written to the log in the following figure. Will that make any difference in the recovery process?

[start_transaction, T_1]	
[read_item, T_1, A]	
[read_item, T_1, D]	
[write_item, T_1, D, 20, 25]	
[commit, T_1]	
[checkpoint]	
[start_transaction, T_2]	
[read_item, T_2, B]	
[write_item, T_2, B, 12, 18]	
[start_transaction, T_4]	
[read_item, T_4, D]	
[write_item, T_4, D, 25, 15]	
[start_transaction, T_3] [write_item, T_3, C, 30, 40] [read_item, T_4, A]	
[write_item, T_4, A, 30, 20]	
[commit, T_4]	
[read_item, T_2, D]	
[write_item, T_2, D, 15, 25]	← System Crash

(b) Explain the three important background processes of RDBMS.

(2 + 1 + 1 + 1 + 2) + 5 = 12