INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous) Dundigal-500043, Hyderabad

B.Tech IV SEMESTER END EXAMINATIONS (REGULAR / SUPPLEMENTARY) - AUGUST 2023

Regulation: UG-20

DATABASE MANAGEMENT SYSTEMS

(COMMON TO CSE CSE(AI&ML) | CSE (DS) | CSE(CS) |CSIT | IT)

Time: 3 Hours

Max Marks: 70

Answer ALL questions in Module I and II Answer ONE out of two questions in Modules III, IV and V All Questions Carry Equal Marks All parts of the question must be answered in one place only

MODULE - I

- 1. (a) Construct conceptual database model for an online shopping system, by identifying the entities involved in the system and their attributes [BL: Apply] CO: 1|Marks: 7]
 - (b) Construct an ER diagram for car insurance company that has a set of customers each of whom owns one or more cars. Each car has associated with it zero to any number of recorded accidents. [BL: Apply] CO: 1|Marks: 7]

$\mathbf{MODULE}-\mathbf{II}$

- 2. (a) Explain about non-procedural query language with example. Write a short note on cartesian product in relational algebra [BL: Understand] CO: 2|Marks: 7]
 - (b) Consider an online retail store that sells various products to customers. The store maintains a database with the following tables:

Customers (CustomerID, Name, Email)

Orders (OrderID, CustomerID, Date)

Products (ProductID, Name, Price)

OrderItems (OrderID, ProductID, Quantity)

Write relational algebra expressions to perform the following operations on the given tables:

- i) Calculate the total revenue generated by each product (Price * Quantity) and display it along with the product name.
- ii) Retrieve the names of all customers who have purchased a specific product (given its name).
- iii) Find the customer who has placed the highest number of orders.

[BL: Apply| CO: 2|Marks: 7]

$\mathbf{MODULE}-\mathbf{III}$

3. (a) Discuss about complex integrity constraints in SQL. Outline various data types in SQL.

[BL: Understand| CO: 3|Marks: 7]

(b) Consider a database for an HR management system that stores employee information in the following tables: Employees (EmployeeID, FirstName, LastName, DepartmentID, Salary) Departments (DepartmentID, DepartmentName) Projects (ProjectID, ProjectName, DepartmentID) EmployeeProjects (EmployeeID, ProjectID)

- i) Write SQL queries to perform the following operations on the given tables:
- ii) Retrieve the names of all employees who belong to the "Sales" department.
- iii) Find the total number of employees in each department.
- iv) Calculate the average salary of employees in the "Finance" department.

[BL: Apply| CO: 3|Marks: 7]

4. (a) Demonstrate normalization and its types with suitable examples. What are the conditions required for a relation to be in 3NF and 4NF? [BL: Understand| CO: 4|Marks: 7]

(b) Given a relation R (P, Q, R, S, T, U, V, W) and functional dependency set $FD = \{ PQ \rightarrow R, P \rightarrow ST, Q \rightarrow U, and U \rightarrow VW \},$ determine given R is in which normal form? [BL: Apply| CO: 4|Marks: 7]

$\mathbf{MODULE}-\mathbf{IV}$

- 5. (a) Describe the strict two-phase locking protocol and its role in ensuring serializability and recoverability in a DBMS [BL: Understand] CO: 5|Marks: 7]
 - (b) Check whether the given schedule S is conflict serializable or not. $S: R_1(A), R_2(A), R_1(B), R_2(B), R_3(B), W_1(A), W_2(B)$ [BL: Apply] CO: 5|Marks: 7]
- 6. (a) What is concurrency control? Explain how multiple granularity protocol is used to control concurrent transactions? [BL: Understand| CO: 5|Marks: 7]
 - (b) Consider the following actions taken by transaction T1 on database objects X and Y : R(X), W(X), R(Y), W(Y). Give an example of another transaction T_2 that, if run concurrently to transaction T without some form of concurrency control, could interfere with T_1 .
 - i) Explain how the use of strict 2PL would prevent interference between the two transactions.
 - ii) Strict 2PL is used in many database systems. Give two reasons for its popularity.

[BL: Apply] CO: 5|Marks: 7]

$\mathbf{MODULE}-\mathbf{V}$

- 7. (a) How variable length of organizing the records in file are handled in a record? Compare sorted file organization with hash file organization [BL: Understand] CO: 6|Marks: 7]
 - (b) Design the B+ tree with the following records (key*) format. A page can hold only two data records. Index record can hold two keys. 44*, 34*, 12*, 35*, 25*, 56*, 7*, 91*, 36*, 87*, 3*, 45*.
 [BL: Apply] CO: 6|Marks: 7]
- 8. (a) What is hashing? Discuss the relation between extendable hashing and linear hashing. What are their relative merits? [BL: Understand| CO: 6|Marks: 7]
 - (b) Demonstrate with an example insection operation in B⁺ tree for the values 8, 11, 2, 6, 18, 22, 17. Construct a B+ -tree for the following set of key values. (2,3,5,7,11,17,19,23,29,31)

Assume that the tree is initially empty and values are added in ascending order. Construct B^+ tree for the cases where the number of pointers that will fit in one node is as follows.

i) Four ii) Six iii) Eight.

[BL: Apply] CO: 6|Marks: 7]