



বাংলাদেশ আর্মি ইন্টারন্যাশনাল ইউনিভার্সিটি অব সায়েন্স এন্ড টেকনোলজি, কুমিল্লা
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Mid Term Examination, Fall 2025
Department of Computer Science and Engineering
Level-3 Term-I
Course Code: CSE 313
Course Title: Database Management System
Credit Hour: 3.0
Exam Duration: 1 hour 30 Minutes
Full Marks: 90

Notes:

- Figure on the right of each question indicates marks for respective question.
- Answer *all the* questions.
- Course Outcomes are:

CO1: Describe the theoretical concepts of database systems such as database architecture, database security, data models, relational algebra, query processing, and transactions.

CO2: Design database systems using ER/EER diagrams from given data requirements.

- A small school library keeps basic information about books, students, borrowing records, and the librarians who handle each borrowing. The library lends different types of books. For example: "Introduction to Science" and "Basic Mathematics for Beginners" are frequently borrowed. Each book belongs to a category such as Science, Math, or English. Students regularly borrow books. For instance:
 - Rahim, from Grade 6, borrowed a Science book last week.
 The library records essential details about each student to keep track of borrowing and book returns. When a student borrows a book, the librarian notes:
 - which student took the book,
 - which book was borrowed,
 - the date the book was issued,
 - the expected return date,
 - which librarian processed the borrowing.

Example:

- Mrs. Jahan, the assistant librarian, issued the Science book borrowed by Rahim.

Each librarian has their own role (e.g., Assistant Librarian, Senior Librarian). A student may borrow multiple books, and a book may be borrowed by multiple students over time. [CO2→C3]

- Identify all the entities in the scenario. 2
- List all possible attributes for each entity. 2
- Identify the primary key (PK) for each entity. 2

- iv. Identify the foreign keys (FK) in the system and specify which tables they reference.
- v. Draw a complete relational schema diagram.

Or,

Consider the music streaming database: [CO2→C3]

Artist (artist_id, artist_name, country)

Album (album_id, album_title, release_year, artist_id)

Song (song_id, song_title, duration, album_id)

ListenHistory (user_id, song_id, listen_timestamp, device)

Determine the possible keys for each table and justify your selection.

- b. Demonstrate how Cartesian Product and JOINS are related and how do they differ with suitable example. [CO1→C3] 15

Or,

Draw the architecture of a database system that runs on a centralized server machine explaining how different types of users interact with a database, and how the different components of a database engine are connected to each other. [CO1→C3]

2. a. Define transactions in DBMS. Demonstrate how ACID properties are maintained during a fund transfer between two accounts. [CO1→C3] 10
- b. Discuss how foreign key constraint ensures data consistency with suitable example. [CO1→C3] 10
- c. Write down the evolution of DBMS system with example and suggest which type of DBMS would appropriate in which cases. [CO1→C4] 10
3. Consider the following schema and write Relational Algebra for each questions- [CO1→C3]

Customer(CustID, Name, City)

Product(ProdID, ProdName, Category, Price)

Orders(OrdID, CustID, OrderDate)

OrderItem(OrderID, ProdID, Quantity)

Supplier(SuppID, SuppName, City)

Supply(SuppID, ProdID)

- a. Find the names of the customers who live in Dhaka. 3
- b. Find the names and prices of products in the 'Electronics' category. 3

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- c. List all the distinct product categories 3
- d. Use rename Product as P and Price as UnitPrice 3
- e. Find names of the products in category 'Electronics' but not priced above 20000 3
- f. List product name and quantities sold across all orders. 5
- g. Retrieve product names along with the suppliers who supply them 5
- h. Retrieve supplier names who supply products priced above 20000 5