END SEMESTER EXAMINATION

COURSE NAME: B.TECH.
BRANCH NAME: CSE/IT

SEMESTER:3RD
SPECIALIZATION:

SUBJECT NAME: DATABASE ENGINEERING

FULL MARKS: 50

TIME: 2.5 Hours

Answer **All** Questions.
The figures in the right hand margin indicate Marks. *Symbols carry usual meaning.*
Any supplementary materials to be provided

Q1. Answer all Questions. **[2×5]**

a) List the main characteristics of the relational data model.
b) Define Tuple Relational Calculus and how does it differ from Relational Algebra?
c) Given relational schema **R(P, Q, R, S, T, U, V)** and a set of functional dependency denoted by **FD = {P->Q, QR->ST, PTV->V}**. Determine Closure of $(QR)^+$ **and** $(PR)^+$.
d) What are the different factors that are used for the measure of query cost?
e) Specify the differences between deferred update and immediate update techniques.

Q2.

a) Explain the three-schema architecture in database systems. Discuss their significance in achieving data abstraction and independence. **[4]**
b) Discuss the different types of integrity constraints in DBMS. Also specify their roles in maintaining the consistency of a database system. **[4]**

OR

a) Explain specialization and generalization concepts with an E-R diagram. **[4]**
b) Construct an E-R diagram for a car-insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents. **[4]**

Q3.

a) Discuss the Selection, Projection, Division and Cartesian product operations in relational algebra with examples. **[4]**
b) Consider the following relation schema: **[4]**
emp (eno, ename, bdate, title, salary, dno)
proj (pno, pname, budget, dno)
dept (dno, dname, mgreno)
workson (eno, pno, resp, hours)
   i) Write an SQL query that returns the employees (number and name only) who have a title of 'EE' or 'SA' and make more than $35,000.
   ii) Write an SQL query that returns the employees (name only) in department 'D1' ordered by decreasing salary.
   iii) Write an SQL query that returns the project name, department name, and budget for all projects with a budget < $50,000.
   iv) Write an SQL query that returns the employee numbers and salaries of all employees in the 'Consulting' department ordered by descending salary.

OR

a) What are SQL clauses? Define the following SQL clauses with examples: GROUP BY, ORDER BY, HAVING. **[4]**
b) Consider the following relation schema: **[4]**
author(authorid, firstname, lastname)
author_pub(authorid, pubid, authorposition)
book(bookid, booktitle, month, year, editor)
pub(pubid, title, bookid)
   i) Write a relational algebra expression that returns the names of all authors who are book editors.

ii) Write a relational algebra expression that returns the names of all authors who are not book editors.

iii) Write a relational algebra expression that returns the names of all authors who have at least one publication in the database.

iv) How many tuples are returned by the following relational algebra expression?

$$\text{author} \bowtie_{\text{author id=editor}} \text{book}$$

Q4.

a) Given a relation R(P, Q, R, S, T) and Functional Dependency set FD = {PQ → R, S → T}, determine whether the given R is in 2NF? If not convert it into 2 NF. [4]

b) Given a relation R(P, Q, R, S, T, U, V, W, X, Y) and Functional Dependency set FD = {PQ → R, P → ST, Q → U, U → VW, and S → XY}, determine whether the given R is in 3NF? If not convert it into 3 NF. [4]

OR

a) Given a relation R(P, Q, R, S, T, U, V, W, X, Y) and Functional Dependency set FD = {PQ → R, PS → VW, QS → TU, P → X, W → Y}, determine whether the given R is in 2NF? If not convert it into 2 NF. [4]

b) Suppose that we decompose the schema $R = (A, B, C, D, E)$ into R1(A, B, C) and R2(A, D, E). Show that this decomposition is a lossless-join decomposition if the following set F of functional dependencies holds: FD = $\{A \rightarrow BC,\ CD \rightarrow E,\ B \rightarrow D,\ E \rightarrow A\}$. [4]

Q5.

a) What are the basic steps in processing an SQL query? Explain the steps involved in query processing with a neat labeled diagram. [4]

b) What is query optimization? What is the role of equivalence rules in the process of query optimization? [4]

OR

a) Consider the following SQL query for a bank database: [4]

select *T.branch-name*
from *branch T, branch S*
where *T.assets* > *S.assets* **and** *S.branch-city* = "Brooklyn"

Write an efficient relational-algebra expression that is equivalent to this query.

b) Discuss the following algorithms for implementing join operation in query processing along with their cost expressions: i) Nested Loop Join ii) Block Nested Loop Join [4]

Q6.

a) Illustrate the concept of conflict serializability in DBMS with an example of suitable database transaction. [4]

b) Describe the working of timestamp-ordering protocol along with its advantages and disadvantages. [4]

OR

a) What is concurrency control in transaction? What are the problems encountered with concurrent transactions? Explain through examples. [4]

b) Explain the two-phase locking (2PL) protocol in DBMS. How does it ensure serializability? [4]