

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2025)**

CLASS: IMSc
BRANCH: MATHS & COMPUTING

SEMESTER : VI/ADD
SESSION : SP/2025

SUBJECT: CS301 DATABASE MANAGEMENT SYSTEMS

TIME: 02 Hours

FULL MARKS: 25

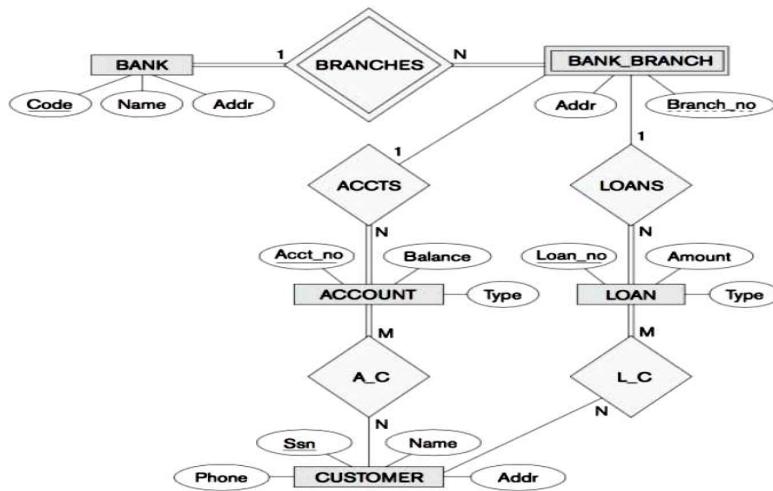
INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

Q.1(a) A company maintains an information system to track the processing and current location of each shipped item. Each shipped item is identified by a unique item number and has details such as weight, dimensions, insurance amount, destination, and the expected delivery date. Items are initially received at a specific retail center, which is identified by a unique ID and has information about its type and address. Shipped items make their way to their destination via one or more standard transportation events, i.e., flights, truck deliveries, etc. Each transportation event is identified by a unique schedule number and includes details about the type of transport and the delivery route. Identify the entities and the relationship set from the following information details. [2] CO 1 BL 3

Q.1(b) Draw the ER diagram corresponding to the following information details given in 1(a). [3] 1 3

Q.2(a) [2] 2 2



Consider the following ER diagram in the figure. Identify the primary key for the relation BRANCHES and the entity BANK_BRANCH.

Q.2(b) Considering the figure in Question 2(a), convert the following ER diagram into a relational schema, indicating the primary keys and foreign keys. [3] 2 3

Q.3(a) Suppose there is a relation joining the entities A and B. In each case, find the primary key of the relation R: [2] 2 3

- R is a many to one relation
- R is a many to many relation

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- Q.3(b) Consider the relational database given in the following relational schema [3] 2 3
- employee* (person-name, street, city)
works (person-name, company-name, salary)
company (company-name, city)
manages (person-name, manager-name)
- Write expressions in relational algebra to describe the following queries:
- Find the names and cities of residence of all employees who work for SBI.
 - Find the names, street address, and cities of residence of all employees who work for SBI and earn more than 10,000 per annum.
 - Find the names of all employees in this database who live in the same city as the company for which they work.
- Q.4(a) Explain aggregate functions in SQL. [2] 3 1
- Q.4(b) Consider the following tables: [3] 3 3
- Instructor (ID, Name, Salary, Dept_name)
 Course (Course_ID, Title, Dept_Name, Credits)
 Prerequisite (Course_ID, Prerequisite Id)
 Department (Dept_name, building, budget)
 Teaches (ID, Course_ID, Sec_ID, Semester, year)
- Write the SQL statements to retrieve the following query:
- Display the name of instructors who belongs to Physics Department and salary>90000.
 - Display the name of instructors who have higher salary than any other person belongs to Physics Department.
 - Display the names of the instructors of Computer Science Department in the descending order of their salary.
- Q.5(a) Suppose there exists a pair of relations R1(X, Y) and R2(X, Y) having t1 > 0 and t2 > 0 [2] 3 3
 tuples respectively. Find the minimum and maximum number of tuples in case (a) a projection is operated on R1 and (b) a selection is operated on R2.
- Q.5(b) Why normalization is essential? Give an example of a relation which is in 1 NF but not [3] 4 2
 in 2 NF.

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