Unit -1 (2 marks)

1.What is an Entity-Relationship (E-R) model?
2.What is the purpose of an ER diagram in database design?
3.What distinguishes the Enhanced E-R model from the basic E-R model?
4.What is ER-to-Relational mapping in database design?
5.What is a functional dependency in a database?
6.What is non-loss decomposition in database normalization?
7.What does First Normal Form (1NF) ensure in a database table?
8.What is the main condition for a table to be in Second Normal Form (2NF)?
9.What is the rule for a table to be in Third Normal Form (3NF)?
10.What does dependency preservation mean in database normalization?
11.What is the difference between Third Normal Form (3NF) and Boyce-Codd Normal Form (BCNF)?
12.What is the purpose of Fourth Normal Form (4NF)?
13.What is the purpose of Fifth Normal Form (5NF)?

Unit-1(16 Marks)

1.Consider a database system for a university, which stores information about students, courses, and departments. The system must capture details such as students enrolling in courses, courses belonging to specific departments, and the students' grades for each course. The following entities and relationships are identified:

1. **Entities**:
    - Student: student_id, name, age
    - Course: course_id, course_name, department_id
    - Department: department_id, department_name
    - Enrollment: student_id, course_id, grade
2. **Relationships**:
    - A student can enroll in multiple courses.
    - A course can belong to only one department.
    - A department can offer multiple courses.

a) Draw an Entity-Relationship (E-R) diagram for the above system, including entities, relationships, and attributes. Represent the many-to-many relationship between students and courses.
(8 Marks)

b) Convert the given E-R diagram to a relational schema by applying the ER-to-Relational mapping technique. Ensure that relationships and attributes are properly mapped into tables, and explain how each entity and relationship is represented in the relational schema.
(8 Marks)

2.Consider the following scenario for a University Management System:

1. **Entities**:
    - Student: Each student has a unique student_id, name, email, phone_number, and date_of_birth.
    - Course: Each course has a unique course_id, course_name, and credits.
    - Instructor: Each instructor has a unique instructor_id, name, email, and salary.
    - Department: Each department has a unique department_id, department_name, and building_name.
2. **Relationships**:
    - A student can enroll in multiple courses. Each enrollment has a grade and semester.
    - A course can have multiple students enrolled.
    - An instructor can teach multiple courses.
    - A course can have one or more instructors (a course may have multiple instructors in team-teaching scenarios).
    - Each course belongs to one department.
    - A department has multiple instructors and courses.

a) Draw the Entity-Relationship (E-R) diagram for the University Management System. Identify and represent the entities, relationships, and key attributes. Use cardinality constraints to indicate the relationship types.
(4 Marks)

b) Convert the E-R diagram into a relational schema by applying the ER-to-Relational Mapping technique. For each entity and relationship, provide the corresponding relational tables with attributes and primary/foreign keys.
(4 Marks)

c) Suppose the University Management System requires storing the courses that students have enrolled in, including the grades they received. Write a relational schema for the Student-Course Enrollment relationship, and explain the key attributes that will be used to uniquely identify each enrollment.
(3 Marks)

d) Using the Enhanced E-R model, assume that each student can have multiple addresses (e.g., home address and temporary address). Extend the E-R diagram by incorporating multi-valued attributes and weak entities (if applicable), and show how the system could manage multiple addresses for each student.
(3 Marks)

e) Explain how you would handle the many-to-many relationship between students and courses in the relational schema. What are the challenges that arise when converting many-to-many relationships into relational tables, and how can they be resolved?
(2 Marks)

3.Consider a Library Management System used by a university. The system manages information about books, members, authors, publishers, and book loans. The following entities and relationships are identified:

1. **Entities**:
    - Book: Each book has a unique book_id, title, ISBN, publish_year, publisher_id.
    - Member: Each member has a unique member_id, name, email, membership_date.
    - Author: Each author has a unique author_id, name, birth_year.
    - Publisher: Each publisher has a unique publisher_id, publisher_name, contact_number.
2. **Relationships**:
    - A book is written by multiple authors (many-to-many).
    - A book is published by one publisher (many-to-one).
    - A member can borrow multiple books.
    - A book can be borrowed by multiple members over time (many-to-many).
    - A book loan contains information such as loan_date, return_date, and fine.

a) Draw the Entity-Relationship (E-R) diagram for the Library Management System. Represent entities, relationships, and key attributes. Identify the cardinality of the relationships.
(4 Marks)

b) Convert the E-R diagram into a relational schema using the ER-to-Relational mapping technique. Provide relational tables, primary keys, and foreign keys, and explain your mapping for each entity and relationship.
(5 Marks)

c) Using the Enhanced E-R model, assume that members can have multiple addresses (e.g., home and work addresses). Extend the E-R diagram to represent the multi-valued attribute and map it into a relational schema.
(4 Marks)

d) Discuss how the many-to-many relationships between books and authors and between members and books can be represented in the relational schema. Provide the relational tables for each of these relationships.
(3 Marks)