Graphic Era
HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Odd) Semester Examination NOV 2025

Roll no...............................

Name of the Program and semester: MCA (AIDS)
Name of the Course: Advance Database Management System
Course Code: TMD 104

Time: 3-hour   Maximum Marks: 100

Note:
- *(i)* All the questions are compulsory.
- *(ii)* Answer any two sub questions from a, b and c in each main question.
- *(iii)* Total marks for each question are 20 (twenty).
- *(iv)* Each sub-question carries 10 marks.

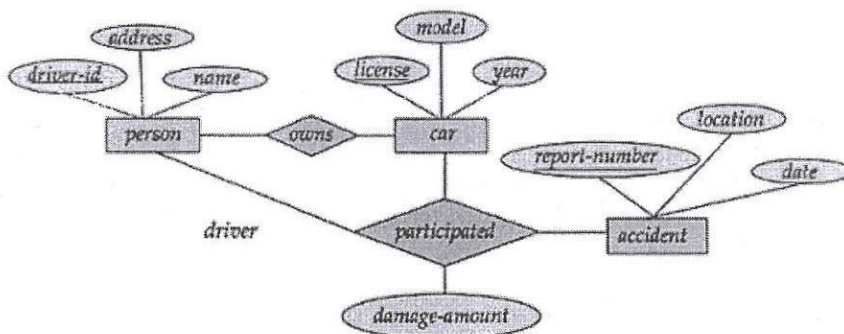Q1.   (2X10=20 Marks)
a. Discuss the functional components of a Database Management System (DBMS) and explain how they interact with each other, using a clearly labeled diagram.b. Define the following terms:
Co1

b. Design a relational database corresponding to the E-R diagram below. Specify the keys and foreign keys in the resulting schema   Co1

c. Define Super keys, candidate keys, primary keys and secondary keys. Identify all the keys for the relation given below. Give reason in support of your answer.

Co1

Student_ID	Name	Email	Course
S101	Anushka	anushka@gmail.com	BCA
S102	Varsha	varsha@gmail.com	MCA
S103	Rahul	rahul123@gmail.com	B.Tech

Q2.   (2X10=20 Marks)
a Draw the initial query tree and optimize the query tree using heuristic approach for the following query: Co2
Find the names of all faculty members in the IT department who have taught a course in 2019, along with the titles of the courses that they taught. Refer the following schema structures.
Faculty(ID, name, dept_name, salary)

Teaches(ID, course_id, sec_id, semester, year)
Course(course_id, title, dept_name, credits)

b. Explain the concept of a **minimal cover** (canonical cover) in the context of functional dependencies. Why is it important in database normalization?
Given the following set of functional dependencies (FDs) for a relation **R(A, B, C, D, E)**:
F = { A → BC, B → D, A → B, AB → C, D → E }
Find the **minimal cover** for the set of FDs and show all steps clearly.

Co2

c. Explain the concept of **Normalization** in database design. Discuss its objectives and importance in reducing redundancy and anomalies.
Given the following relation:

Student_ID	Student_Name	Course_ID	Course_Name	Instructor	Instructor_Phone
S1	Anushka	C101	DBMS	Dr. Mehta	9876543210
S2	Rahul	C102	OS	Dr. Sharma	9988776655
S1	Anushka	C102	OS	Dr. Sharma	9988776655

Perform **normalization** of the relation up to **Third Normal Form (3NF)**, clearly showing each step and the resulting tables.   Co2

Q3.   (2X10=20 Marks)
a. refereeing the following Database schema.   Co3
Employee(Fname, Minit, Lname, SSN, Bdate, Address, Sex, Salary, Sup_SSN,Dno)
Department(Dname, Dnumber, Mgr_SSN, Mgr_Start_date)
Dept_Locations(Dnumber, Dlocation)
Project(Pname, Pnumber, Plocation, Dnum)
Works_On(Essn, Pno, Hours)
Dependent (Essn, Dependent_Name, Sex, Bdate, Relationship)
Write the SQL Queries for the following
 (i). Retrieve the name and address of all employees who work for the 'Research' department.
(ii). Make a list of all project numbers for projects that involve an employee whose last name is 'Smith', either as a worker or as a manager of the department that controls the project.
(iii). List the names of managers who have at least one dependent.
(iv). Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary.
(v). For each project, count how many employees works on it.
b. Define the following with example: Co3
   i.   Alter command
   ii. How to add not null constraint
   iii. Drop and truncate
   iv. Rename
   v.   Having clause
c. Explain the difference between **implicit** and **explicit cursors** in PL/SQL. Under what situations would you prefer to use an explicit cursor? Write a PL/SQL program using an **explicit cursor** to display the names and salaries of all employees whose salary is greater than 50,000 from the table EMPLOYEES(emp_id, emp_name, salary).   Co3

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Q4.   (2X10=20 Marks)
a. Explain the role of **locking protocols** in concurrency control. Describe the **two-phase locking protocol** and the **strict two-phase locking protocol** in detail.
Using a suitable example, show how **deadlock** can occur under 2PL and explain one method to prevent or resolve it.   Co4
b. Compare different **recovery techniques** in ADBMS, such as: Co4
   * **Deferred Update**
   * **Immediate Update**
   * **Checkpoint-based Recovery**

c What is deadlock? Explain how wait-die and wait-wound protocols avoid deadlock and starvation. Co4

Q5.   (2X10=20 Marks)
a. An organization with multiple regional offices wants to decide whether to use a **centralized** or **distributed database system**.
As a database architect, analyze the pros and cons of both approaches and recommend the most suitable one, justifying your answer based on **data availability, communication cost**, and **system maintenance**. Co5

b. Define **data fragmentation** in the context of a distributed database system. How many types of fragmentation are possible for a relation, and what are they?   Co5

c. Define **query processing** in a distributed database system. Explain its main phases:
   * Query decomposition
   * Data localization
   * Global optimization
   * Local optimization and execution   Co5