Name of the Course : **B.Sc. Prog./Mathematical Sc.**

Semester : **II**

Name of the paper : **Database Management Systems**

Unique Paper Code : **42341202_OC**

Year of Admission : **2015, 2016, 2017 & 2018**

Duration: 3 Hours **Maximum Marks: 75**

Instructions for Candidates

1. Attempt any FOUR out of SIX questions.
2. All questions carry equal marks.
3. All parts of a question must be answered together in a single PDF file.
4. If required, you may make suitable assumptions and state them clearly.

Q1 Assume a Relational Schema:

`Faculty (Faculty_id, Name, Department_name)`

Diagrammatically give the three-schema architecture for the **`Faculty`** schema, clearly indicating the respective view of the schema at each level. How is data independence achieved between different levels?

Q2. A University database contains information about research supervisors in different departments and their students working on different projects. Draw ER (Entity-Relationship) diagram, specifying all the structural constraints for the following scenario:

- Each research supervisor is identified by Sup_id, Name, Age, Position and Speciality.
- Each research student is identified by Stud_id, Name, Age and Course (e.g. MS/PhD)).
- Each project has a project number, Start date, End date, Funding agency, budget, and a Supervisor.
- A supervisor can supervise multiple projects.
- Every student is associated with only one project.
- Each department has a department number, Name and Location.

- Projects are controlled by a department.

Map the ER-diagram into relations taking into account different entity types, relationships and attributes. Specify all primary keys and foreign keys.

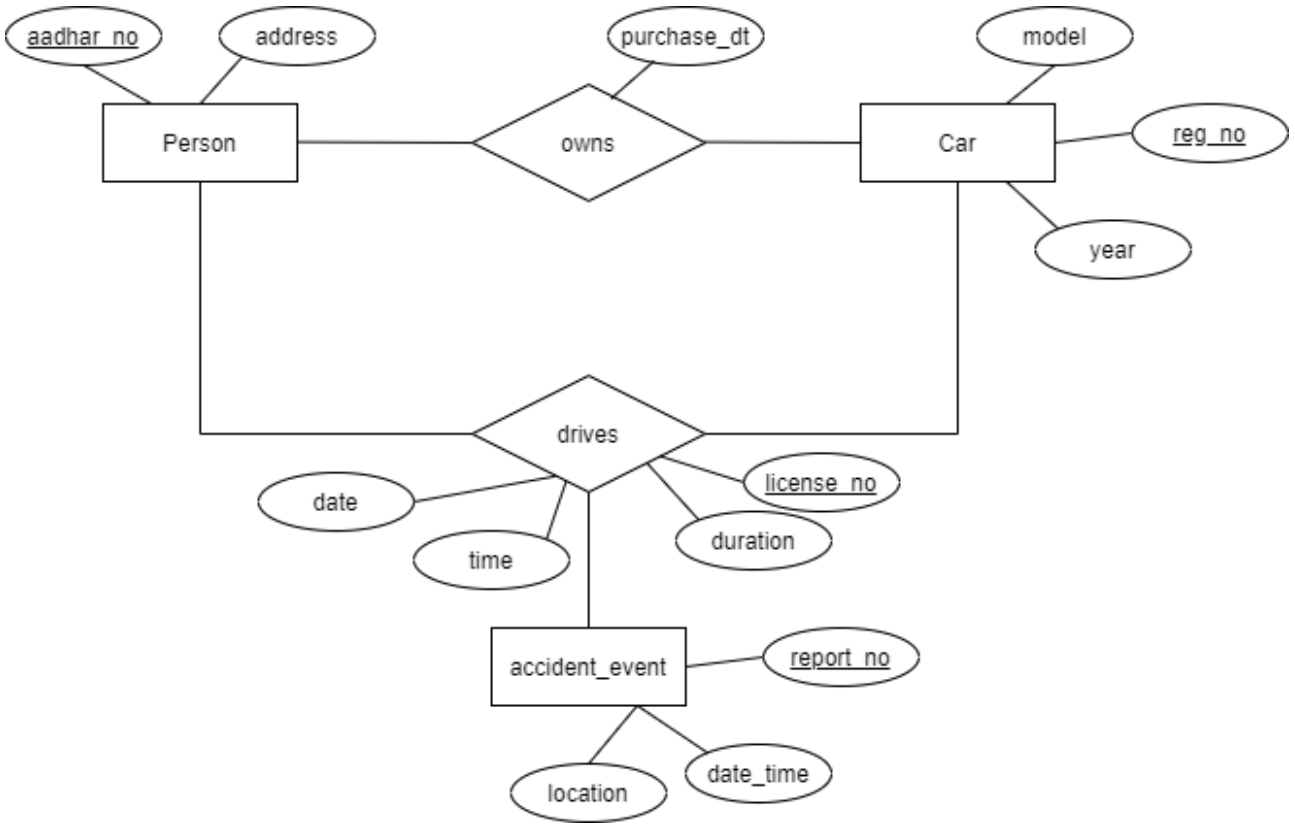
Q3. Consider the following database relations:

Teacher (<u>TID</u>, Name, Address, Gender, Specialisation)
Course (<u>CNo</u>, CName)
Teaches (<u>TID</u>, <u>CNo</u>)

where the primary keys are underlined. Give an expression in the relational algebra to express each of the following queries:

- List course numbers which are not taught by any teacher.
- List ids of the teachers who specialise in **'Algorithms'** or **'Data Analysis'**.
- List the name of the course and the teacher id for the courses taught by teachers specialising in **'DBMS'.**
- List the names of female teachers who teach course **'C105'.**

Q4.



Design a relational database schema for the above ER diagram.

- Give two relational database states for a relation of your choice.

- Identify entity integrity constraint which may be applied on all the relations
- Identify referential integrity constraints

Q5. Consider online vaccination database with the following tables

Nurse (<u>Nurse_id</u>, Name, Age, Experience)
Vaccinates (<u>Nurse_id</u>, <u>Patient_id</u>, <u>Date</u>)
Patient (<u>Patient_id</u>, Patient_name, Locality, Age)

Write an SQL query for each of the following:

- Display the name of the oldest nurse who has done at least one vaccination.
- Display Patient ids of patients who have been vaccinated by a nurse with an experience between 2 to 5 years.
- For each *popular* locality, print the locality along with its total number of vaccinations and the number of different dates on which vaccinations are done in that locality. (A locality is said to be *popular* if 200 or more vaccinations are done in that locality).
- Delete all the records of Nurses whose name contain the letter **'a'**.
- List the number of vaccines that have been administered by each Nurse.

Q6. Consider the following functional dependencies for a relational schema:

Sup_Cust (Cust_id, Cust_name, Cust_city, Sup_id, Sup_name, {Sup_city_loc, Part_id}, Sup_city_loc, Sup_city_loc, Part_id, Part_name, Qty)

Cust_id → Cust_name, Cust_city

Sup_id → Sup_name, {Sup_city_loc, Part_id}

Sup_id, Part_id → Sup_city_loc

Part_id → Part_name

Cust_id, Sup_id, Part_id → Qty

Systematically, normalize the table **Sup_Cust** up to the third normal form (3NF). At each level of normalization, justify that the tables formed after decomposition are in a particular (1NF, 2NF or 3NF) normal form.