# The National Institute of Engineering

Department of CS&E / IS&E/ AI&ML

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| Course: **Database Management Systems** | | Course Code: **BCS403** |
| Max Marks: 25 | **TEST - 1** | Time:1hr (3:45-4:45pm) |
| **Date: 27-03-2025** | | Semester: 4 |

**Scheme and Solution**

| Q.No. | Questions | Marks |
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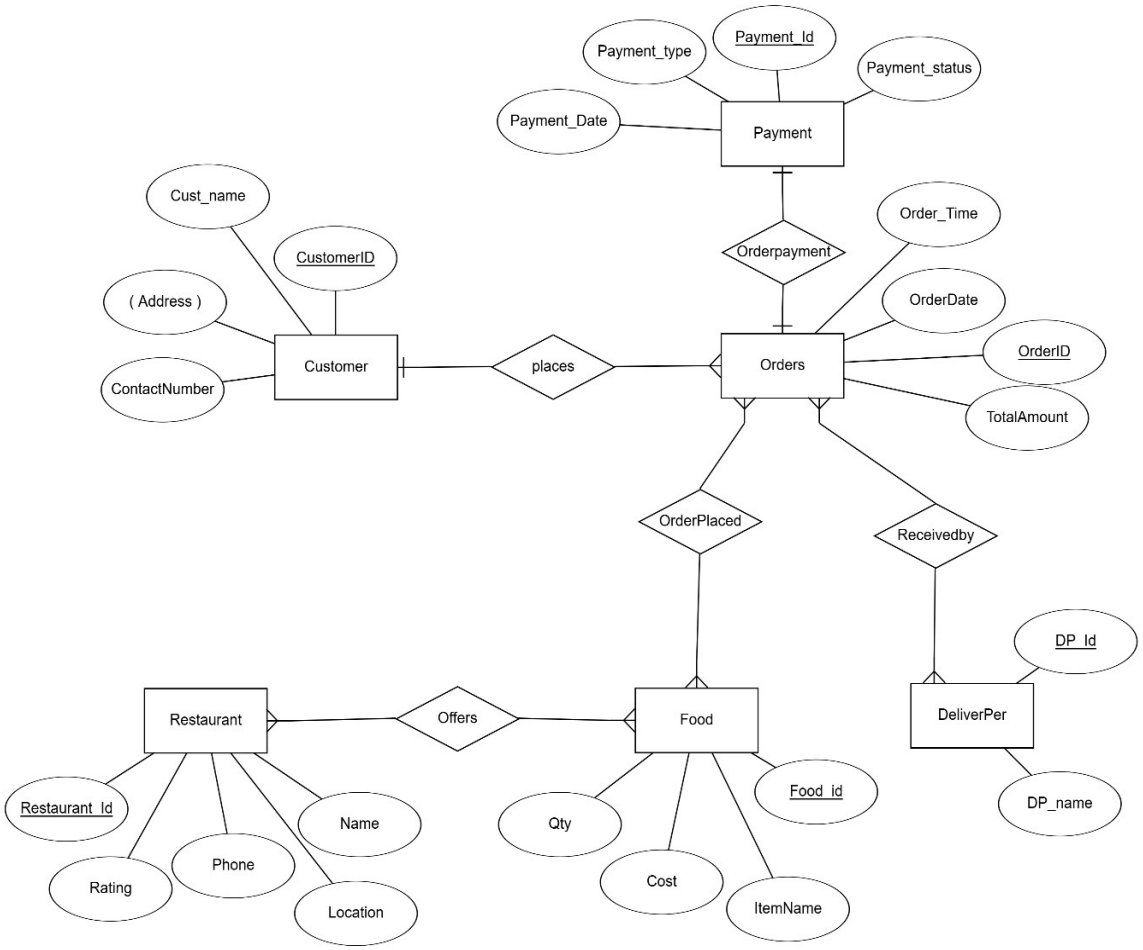
| 1 | Define the following:<br>i. Data model<br>A data model is a collection of concepts that can be used to describe the structure of a database. By structure of a database - the data types, relationships and constraints that apply to the data. Most data models also include a set of basic operations for specifying retrievals and updates on the database.<br><br>ii. Conceptual schema<br>conceptual schema, which describes the structure of the whole database for a community of users. The conceptual schema hides the details of physical storage structures and concentrates on describing entities, data types, relationships, user operations, and constraints.<br><br>iii. Logical data independence<br>Logical data independence is the capacity to change the conceptual schema without having to change external schemas or application programs | 2m X 3 = 06 |
| 2 | Design an ER diagram for an **Online food delivery system** where customers, restaurants, and delivery personnel are involved. Each customer can place multiple orders, each order is prepared by a restaurant, and a delivery person is assigned to fulfill the order. Mention the entities (Assume minimum 4 entities), relationships, attributes, and key attributes and cardinality ratios in the ER diagram.<br><br>Any valid Entities considered [2M]<br>Related attributes, Key attribute[1M]<br>Relationship[2M]<br>Cardinality[1M]<br>Representation used in the sample as follows (can be mentioned as 1(one) M(many)<br>  <br> | 07 |

**Sample ER diagram for Online food delivery**

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| 3 | Apply your understanding of database constraints to identify and explain which types of constraints might be violated by an Insert operation. Provide a suitable example to illustrate your explanation<br><br>INSERT may violate mainly 4 constraints:<br>• Domain constraint: [1M]<br>o if one of the attribute values provided for the new tuple is not of the specified attribute domain<br>• Key constraint: [1M]<br>o if the value of a key attribute in the new tuple already exists in another tuple in the relation<br>• Referential integrity: [1M]<br>o if a foreign key value in the new tuple references a primary key value that does not exist in the referenced relation<br>• Entity integrity: [1M]<br>o if the primary key value is null in the new tuple<br>Examples [2M] | 06 |

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| 4 | Consider the following relational schema:<br>Faculty (FacID, Name, Dept_Name, Salary, Experience)<br>Section (Course_code, Section_No, Sem, Year, Room_No,FacID)<br>Answer the following queries using relational algebra:<br>* The answers to the queries may be split into multiple relations for better clarity and logical representation<br><br>i) List the details of faculty who works in Information Science Department.<br>**$\sigma_{Dept\_Name='InformationScience'}$ (Faculty)** [1M]<br><br>ii) Find the names of the faculty who earn more than 30,000 salary in Computer Science department.<br>**$\pi_{Name}(\sigma_{Dept\_Name='ComputerScience' \wedge Salary > 30000}$ (Faculty))** **[1M]**<br><br>iii)Retrieve the list of all courses taught in the Even 2020 and Odd 2021 semesters.<br>**$\pi_{Course\_code}(\sigma_{((Sem \% 2 = 0) \wedge Year = 2020) \vee ((Sem \% 2 = 1) \wedge Year = 2021)}$ (Section))** **[1M]**<br><br>***if semester is assumed as odd/even***<br>**$\pi_{Course\_code}(\sigma$ ( ( Sem ='even') ∧ Year = 2020) ∨ ( ( Sem = 'odd') ∧ Year = 2021) (Section))** **[1M]**<br><br>iv)List the Courses offered in even semester 2020 but not in odd semester 2022.<br>$\pi_{Course\_code}(\sigma_{Sem \% 2 = 0 \wedge Year = 2020}(Section)) - \pi_{Course\_code}(\sigma_{Sem \% 2 = 1 \wedge Year = 2022}(Section))$ [1M]<br>*semester may be considered as odd/even*<br><br>v) Find the faculty who is having more than 15 years of teaching experience in Mechanical Department.<br>**$\sigma_{Dept\_Name = 'Mechanical' \wedge Experience > 15}$ (Faculty)** **[1M]**<br><br>vi)Retrieve the department names of faculty members who have more than 10 years of experience and are teaching a course in semester 6.<br><br>**$\pi_{Dept\_Name}(\sigma_{Experience > 10 \wedge Sem = 6}$ (Faculty ⋈ Section))** **[1M]**<br>• above is used the natural join<br>• Even theta join or equi join can be considered | 06 |