

**VIT**

Vellore Institute of Technology

**Final Assessment Test- Jan/Feb 2023**

Course: ITA5008 - Database Technologies

Class NBR(s):5100/5105/5109

Time: Three Hours

Slot: B2+TB2

Max. Marks: 100

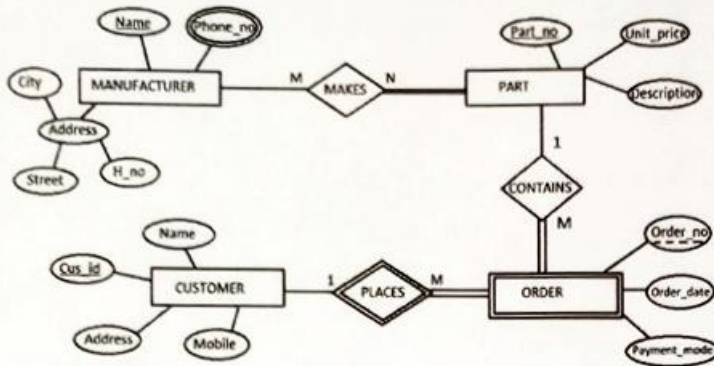
**KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS TREATED AS EXAM MALPRACTICE****Answer any TEN Questions****(10 X 10 = 100 Marks)**

1. Consider the following information about a university database.

Professors have a social security number (SSN), name, age, rank, and research specialty. Projects have a project number, a sponsor name (e.g., DST), a starting date, an ending date, and a budget. Graduate students have an SSN, a name, an age, and a degree program (e.g., M.S. or Ph.D.). Each project is managed by one professor (known as the project's principal investigator). Each project is worked on by one or more professors (known as the project's co-investigators). Professors can manage and/or work on multiple projects. Each project is worked on by one or more graduate students (known as the project's research assistants). When graduate students work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one. Departments have a department number, a department name, and a main office. Departments have a professor (known as the chairman) who runs the department. The Professors work in one or more departments and for each department that they work in, a time percentage is associated with their job. Graduate students have one major department in which they are working on their degree. Each graduate student has another, more senior graduate student (known as a student advisor) who advises him or her on what courses to take.

Design an entity-relationship diagram for the above data requirements. Indicate key constraints, cardinality constraints and participation constraints on the diagram.

2. a) Convert the following entity-relationship schema diagram into a relational database schema diagram. [7]



- b) Define *foreign key*. What is foreign key used for? [3]

3. Consider the following relational database schema. The primary keys are underlined. The foreign keys are self-explanatory.

REVIEWER(Reviewer\_id, Reviewer\_name, Email, Mobile)

REVIEWS(Product\_id, Reviewer\_id, Review\_date, Feedback)

PRODUCT(Product\_id, Name, Description, Price\_per\_unit)

Translate each of the following statements into an expression of *relational algebra*.

- (a) Display the name and description of products and the name and email address of the reviewers of the products. [2]

- (b) Remove product information with no review. [2]

- (c) Display product name and reviewer name for product with price per unit higher than Rs. 1000/-. [3]

- (d) Display the product name with more than ten reviews. [3]

4. a) Consider three tuples  $t_1 = \langle 14, 9, 18 \rangle$ ,  $t_2 = \langle 14, 8, 19 \rangle$  and  $t_3 = \langle 17, 8, 19 \rangle$  for a state of a relation schema  $R(A, B, C)$ . Justify whether  $A \rightarrow B$  holds on  $R$  and whether  $B \rightarrow C$  holds on  $R$ . [3]

- b) Consider a relation schema  $R(A, B, C, D, E, G, H)$  with a set of functional dependencies  $F = \{C \rightarrow D, A \rightarrow B, B \rightarrow EG, B \rightarrow C, ED \rightarrow H, G \rightarrow H\}$ . Perform a key based decomposition of  $R$  so as to produce a relational database schema in the highest possible normal form. [7]

5. Consider the following relational database schema. The primary keys are underlined. The foreign keys are self-explanatory.

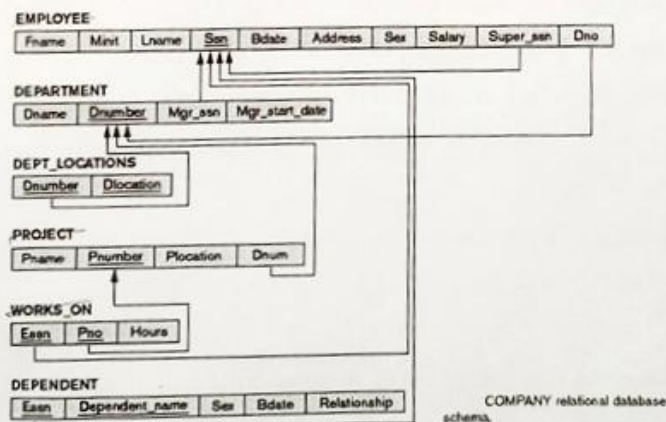
CUSTOMERS(Cus\_id, Cus\_fname, Cus\_lname, Cus\_address, Mobile\_no)

PURCHASE(Prod\_id, Cus\_id, Quantity\_purchased, Purchase\_date)

PRODUCTS(Prod\_id, Prod\_name, Prod\_price)

- (a) Write down SQL statements for creating the above tables with necessary primary key and foreign key. Ensure that the mobile number of every customer has exactly ten digits. [4]
- (b) Write down an SQL statement to display the first name, last name and name of the products purchased by customers on March 31, 2021. [2]
- (c) Write down an SQL statement to display the first name and last name of customers and the total quantity of product purchased by them for each product, if only the total quantity of the product purchased exceeds 500 units. [2]
- (d) Write down an SQL statement to display the product name and product price for products that were purchased by at least one hundred customers. [2]

6. Consider the following relational database schema.



Use heuristic optimization to find out the best evaluation plan for the following query.

Display the department name and first name and last name of employees drawing salary higher than \$30000 and living in the Brooklyn area working on more than two projects related to Computer Applications and located in Sugarland.



7. a) Write down Date's twelve rules for distributed database system. [6]  
 b) Write down the two-phase commit protocol used for transaction management in a distributed database management system. [4]
8. a) Describe different data partitioning techniques along with its advantages and disadvantages used in parallel database system. [6]  
 b) Describe the software architecture for parallel sorting. [4]
9. Consider the following schema (primary key is underlined) relating to reservation information in trains.  
 RESERVATION(Train\_no, Train\_name,  
 {Days\_of\_week\_train\_runs}, {Classes\_available},  
 {Passengers(Name, Address(House\_no, Street, City, Pin\_code), Mobile)}).  
 There are trains that run daily and there are other types of trains that run only on a few days of a week. There are various classes available in a train.  
 Write down an object-relational implementation of the schema in Oracle and write down an insert statement for entering data into the reservation table.
10. a) What are semi-structured data and what is Object Exchange model? [3]  
 b) Create an XML schema that corresponds to the following relational database schema relating to employee and department entity type. The primary keys are underlined and the foreign key is self-explanatory. [7]  
 EMPLOYEE(Eid, Fname, Lname, Address, Dnumber)  
 DEPARTMENT (Dnumber, Dname, Dlocation, D\_contact\_person).
11. a) What are unstructured data? Cite some examples of unstructured data. [2]  
 b) Give a brief description (500 to 600 words) of key-value databases and document databases. [8]
12. a) What are the different states a cell in an LOB column may be in? Distinguish between LOB locator and LOB value. Where are various LOB objects stored? [6]  
 b) Write down a create table statement for creating a table containing an identification number and an LOB column. Write down an insert statement to initialize the LOB column of the table with an LOB locator. [4]

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