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WINTER – 2022 EXAMINATION
MODEL ANSWER

Subject: Principles of Database **Subject Code** 22321

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.
8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students in first year (first and second semesters) write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

Q. No	Sub Q.N.	Answer	Marking Scheme
1.	**a)** **Ans.**	**Attempt any FIVE of the following:** **Define data independence. List its types.** Data independence: The ability to modify or change schema definition of one level without affecting schema definition in the next Higher level. Types of data independence: Logical data independence and physical data independence.	**10** **2M** **Definition 1M** **Types 1M**
	b) **Ans.**	**Define** **i) Tuple** **ii) Relation** Tuple: A row or a record is called as tuple in relational database management system. 2) Relation: A relation is nothing but a table which can store data in rows and columns form I relational database management system.	**2M** **Each definition 1M**

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	c) Ans.	**Define primary key. Give its example.** A primary key is a column or a group of columns from a table that can **uniquely identify** the rows of data in that table. It accepts unique and not null values. Example : Empno is a primary key in table employee, which identifies each row of employee table. ***(Any other relevant example can be considered)***	**2M** **Definition 1M** **Example 1M**
	d) Ans.	**List any two advantages of relational database.** 1) Controlled redundancy 2) Sharing of data 3) Improved data security 4) Consistency 5) Higher integrity ***(Any two advantages can be considered)***	**2M** **For each advantage 1M**
	e) Ans.	**List any two types of database.** ***(Any 2 names from following can be considered)*** 1. Centralized database. 2. Distributed database. 3. Personal database. 4. End-user database. 5. Commercial database. 6. No SQL database. 7. Operational database. 8. Relational database. 9. Cloud database. 10. Object-oriented database. 11. Hierarchical database. 12. Network database. 13. Graph database. 14. Parallel database	**2M** **For each type 1M**
	f) Ans.	**Explain syntax of Alter table command.** **i)To add a new attribute:-** Syntax: Alter table <Table_name> Add(<newcolumnname> <datatype(size)>); Example: Alter table student	**2M** **Any one syntax with explanation 2M**

		Add(age numeric(2)); This alter command adds a new column to the existing table. **ii) Drop an attribute:-** Syntax : Alter Table table_name Drop(<columnname>); Example: Alter table student Drop(age); This alter command removes the existing column from the table. **iii) Adding an constraint:-** Syntax: Alter table <table_name> Add constraint <constraint_name>(<columnname>); Example: Alter table student Add constraint unique(Name); This alter command adds a new constraint to a particular column in the existing table. **iv)Modifying :-** Syntax: Alter table <table_name> modify (<columnname> <newdatatype(size)>); Example: Alter table student Modify(Rollno numeric(20)); This alter command modify the existing column in the table. **v) Rename:-** Syntax Alter table table_name Rename column<old_column_nname> to <new_column_name>; Example: Alter table student Rename column Rollno to Stid; This alter command renames the existing column in the table.	

g) Ans. **List any two inference rules for functional dependency.** — **2M** (For each rule 1M)

(Any two rules can be considered)

1. Reflexivity: X->X // An attribute(s) determines itself.
2. Augmentation: if X->Y then XZ->YZ.
3. Transitivity: if X->Y & Y->Z then X->Z.
4. Additivity or Union : if X->Y & X->Z then X->YZ.
5. Projectivity or Decomposition: If X->YZ then X-> Y & X->Z.
6. Pseudo-Transitivity: If X->Y, YZ->W then XZ->W.

2. **Attempt any THREE of the following:** — **12**

a) Ans. **Compare file processing system and database management system (Any 4 points)** — **4M** (Any four points 1M for each point)

File processing system	DBMS
File entity exists which stores data on storage device of system.	A software is used to store and retrieve the user's data
Redundant data can be there.	Normalization improves Control over redundancy.
Query processing is not so efficient	Query processing is efficient
Low Data consistency.	Data consistency is high
Less complex, does not support complicated transactions.	More complexity in managing the data, easier to implement complicated transactions.
Less secure.	More secure.
Less expensive in comparison to DBMS	Higher cost compared to File system
Less support to backup and recovery mechanism.	Crash recovery mechanism is highly supported

b) Ans. **Describe types of attributes with suitable example.** — **4M** (List of correct types 1M, Description : ½M each)

1. Simple Attributes

Simple attributes are those that cannot be further divided into sub-attributes.

For example, A student's roll number of a student or the employee identification number.

2. Composite Attributes

Composite attributes are made up of two or more simple attributes.

For example, a person's address may be a composite attribute that is made up of the person's street address, city, state, and zip code.

		3. Single Valued Attributes Single-valued attributes can only have one value. Single-valued attributes are typically used to provide a unique identifier for an entity and are often used in databases. For example, a person's Social Security Number is a single-valued attribute. **4. Multivalued Attributes** Multivalued attributes can have more than one value. For example, a person may have multiple email addresses or phone numbers. **5.Key attributes** Key attributes are those attributes which can identify an entity uniquely in an entity set. Example: Roll_no in a student table is the key attribute. **6. Derived Attributes** Derived attributes are based on other attributes and are not stored directly in the database. For example: Consider a database of employees. Each employee has a date of birth, and we can calculate their age which can be called as derived attribute.	
	c)	**List and draw any 4 symbols used in E-R model. Give example of each.**	**4M** **4 Symbols 2M, example 2M**

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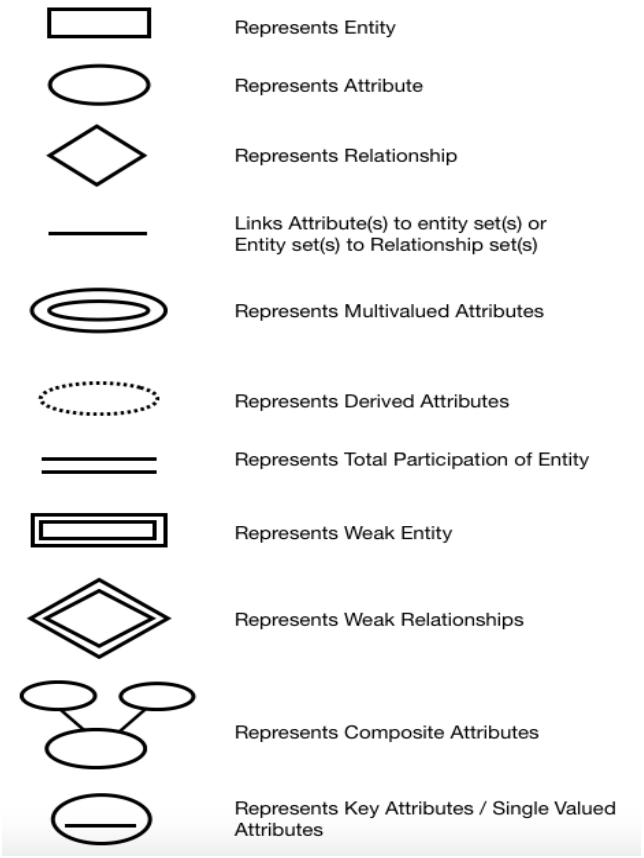
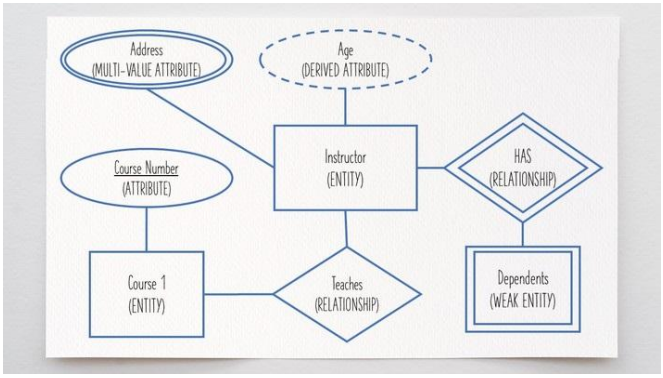
	Ans.	  ***(Any relevant ER diagram with minimum 4 symbols properly used can be considered)***	

	d) Ans.	**Explain components of database** Components of a Database: The five major components of a database are: **1. Hardware** Hardware refers to the physical, electronic devices such as computers and hard disks that offer the interface between computers and real-world systems. **2. Software** Software is a set of programs used to manage and control the database and includes the database software, operating system, network software used to share the data with other users, and the applications used to access the data. **3. Data** Data are raw facts and information that need to be organized and processed to make it more meaningful. Database dictionaries are used to centralize, document, control, and coordinate the use of data within an organization. A database is a repository of information about a database (also called metadata). **4. Procedures** Procedures refer to the instructions used in a database management system and encompass everything from instructions to setup and install, login and logout, manage the day-to-day operations, take backups of data, and generate reports. **5. Database Access Language** Database Access Language is a language used to write commands to access, update, and delete data stored in a database. Users can write commands using Database Access Language before submitting them to the database for execution. Through utilizing the language, users can create new databases, tables, insert data, and delete data.	**4M** **Correct Explanation 4M**
3.	**a) Ans.**	**Attempt any <u>THREE</u> of the following:** **Explain domain integrity constraint with example.** Domain integrity constraint contains a certain set of rules or conditions to restrict the kind of attributes or values a column can hold in the database table. Domain constraints are used to maintain value according to user specification. **There are two types of Domain constraint** • Not Null Constraint • Check Constraint	**12** **4M** **Explanation 2M,** **Relevant example 2M**

		Not Null Constraint: It is applied on a column to avoid null values. When a Not Null Constraint is enforced on column or set of columns it will not allow null values. **For Example:** Apply not null constraint on Ename column. create table employee (Empid number (3), Ename varchar (10)constraint nn not null, Salary number (7,2), Phone number (10)); **Check Constraint**: It defines a condition that each row must satisfy. A single column can have multiple check condition. **For Example:** Apply check constraint on Salary column create table employee (Empid number(3) , Ename varchar(10), Salary number(7,2)constraint ck check(salary >=5000), Phone number(10)); (* key word constraint nn/constraint ck are optional. Without them also query is correct.)	
	b) Ans.	**State and explain 1 NF and 2 NF with example.** **First Normal Form (1NF)** • The table is in 1NF which contains all atomic values. There should be no repeating in any one of the attributes. • All the attributes are functionally dependent on the primary key. • 1NF is achieved when all repeating groups are removed and a separate table is created with atomic values.	**4M** **Explanation 2M,**

For Example: Teacher_details (Teacher_id, Subject,Teacher_Age)

Teacher_id	Subject	Teacher_Age
1	Mathematics	30
2	Physics	35
3	Chemistry	40
4	Biology	45

Any relevant example of 1NF 1M

The above table is in 1NF because every attribute has single (atomic) value.

Second Normal Form (2NF)

- Fully functional Dependency: If a & b are the attributes of the relation, b is fully functionally dependent on a, if b is functionally dependent on a and a proper subset of a.
- So 2NF removes partial dependencies i.e. functionally dependent attributes are removed from the relation by placing them in a new relation along with their copy of determinants.
- 2NF is achieved when relation is in 1NF and each record is fully dependent on primary key of the relation for identification.

Any relevant example of 2NF 1M

For Example If we consider following Teacher_details table.

Teacher_id	**Subject**	**Teacher_Age**
1	Mathematics	30
2	Physics	35
3	Chemistry	40
4	Biology	45

Functional dependencies are as follows:
Teacher_id->Subject
Teacher_id->Teacher_Age
To convert the given table into 2NF, we decompose it into two tables considering above functional dependencies:

Teacher_id	Teacher_Age
1	30
2	35
3	40
4	45

Table 1: Teacher Table

Teacher_id	Subject
1	Mathematics
2	Physics
3	Chemistry
4	Biology

Table 2: Teacher_allocation Table

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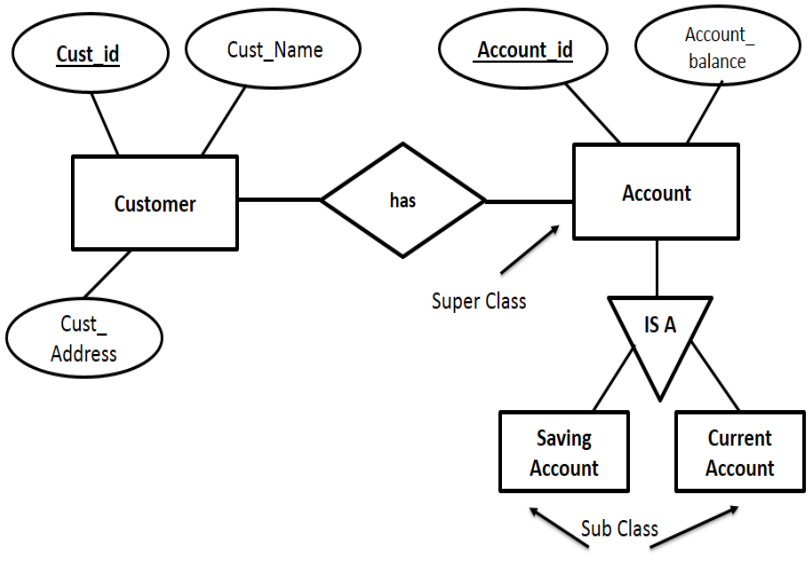
	c) Ans.	**Describe enhanced E-R model with suitable example.** • Enhanced ER is a high-level data model that incorporates the extensions to the original ER model. It is created to design more accurate database schemas. • EER reflects data properties and constraints more precisely. • It also includes more complex requirements than traditional application. • Enhanced ER model includes all concepts of ER model. Additionally, it includes concept of Super Class, Subclass, Generalization, Specialization, Union and Aggregation. • Generalization is union of two or more entity set to produce higher level entity set. It is bottom up approach. • Specialization is a process of deriving lower level entities from higher level entity. It is top down approach. • In aggregation, relation between two entities is treated as a single entity. • Higher level entities are called Super Class • Lower level entities are called Sub class 	**4M** **Explanation 3M,** **Any Relevant Example 1M**

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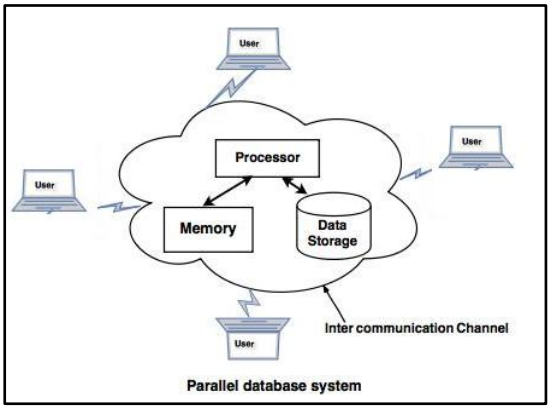
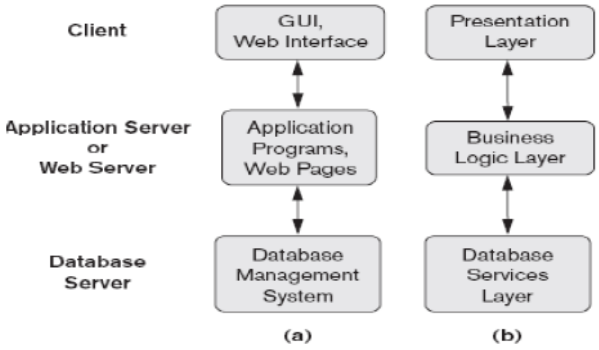
	d) Ans.	**Describe parallel database system. Give its two examples.** Parallel DBMS is a Database Management System that runs through multiple processors and disks. They combine two or more processors also disk storage that helps make operations and executions easier and faster. **Advantages** • Execution speed is fast. • Taking backup is easy because all PC at one site only. **Disadvantages** • It is difficult to expand. Not scalable after certain point. • Startup cost is high  Parallel database system **For Example:** 1) Parallel database systems are used in e-commerce **2)** Parallel databases are used in data warehousing and data mining	**4M** **Explanation 3M ,** **Relevant examples 1M**
4.	**a) Ans.**	**Attempt any THREE of the following:** **Compare 3 NF and BCNF (Any 4 points)**	**12** **4M** **Any four relevant points 1M each**

Sr. No	3NF	BCNF
1	A relation will be in 3NF if it is in 2NF and not contain any transitive partial dependency.	Boyce Codd Normal Form (BCNF) is considered a special condition of third Normal form. A table is in BCNF if every determinant is a candidate key.
2	It is not as strong as BCNF.	It is stronger than 3NF.

			3	The functional dependencies are already present in INF and 2NF.	The functional dependencies are present in 1NF, 2NF and 3NF.	
			4	The redundancy is high in 3NF.	The redundancy is comparatively low in BCNF.	
			5	It is comparatively easier to achieve.	It is difficult to achieve.	
			6	It can be used to achieve lossless decomposition.	It is difficult to achieve lossless decomposition using BCNF.	
	b) **Ans.**	**Describe 3 tier architecture with its advantages and disadvantages.**  In 3 tier architecture communication take place from client to application server and Application server to Database. Clients contain GUI interfaces and some additional application specific business rules. Application server is called "Middle Layer". It processes application code. Accepts requests from clients. Database server process database queries. It is used in W.W.W(World Wide Web) **Advantage:** • Improve data integrity. • Improve security Disadvantage: • It is more complex than the 2-tier architecture system • Cost is higher than 2- tier architecture system		**4M** **Explanation-2M** **Any relevant advantage – 1M ,** **Any relevant disadvantage – 1M**

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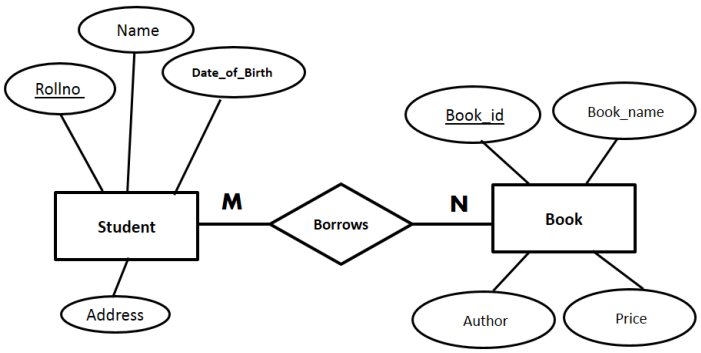
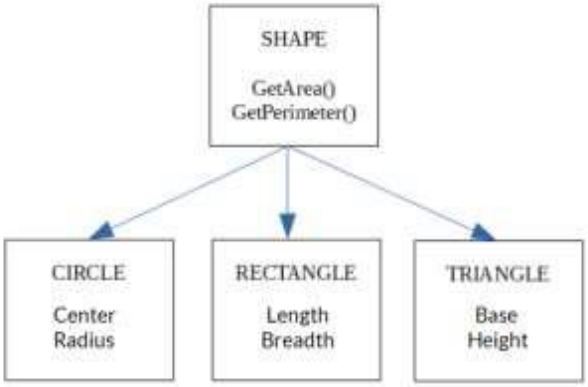
	c) Ans.	**Describe how to express M : N relation with suitable example.** **Many to Many Relationship (M:N)** When many instances of an entity A are associated with many instances of entity B. OR When many instances of an entity are associated with many instances of other entity. Many to many cardinality is represented by (M: N) **For Example:** Many Students can borrow many Books.  The above relationship indicates M: N(many-to-many) relation type because many students can borrow many books from library.	**4M** **Explanation 2M,** **Example2 M**
	d) Ans.	**List and explain any four Codd's rules of RDBMS** **Rule 1: The information rule** All information in relational database is represented by values in a table. **Rule 2: Guaranteed Access Rule** Whole data should be available or accessible to the user without any ambiguity. The ambiguity can be avoided only through the perfect combination of the table name, primary key, and column name. **Rule 3: Systematic treatment of null values** The null values i.e. absence of the values in the table should be treated properly. RDBMS Distinguish between ZERO (0) and Null Values. **Rule 4: Active on-line catalog based on the relational model** There are certain system tables that stores the database definition should be present. The data accessing tools should be used to access the database structure information. Description of the table and Contents of the table can be queried by DML.	**4M** **Explanation of Any 4 rules 1M each**

		Rule 5: The comprehensive data sub language rule: RDBMS supports many languages but at least one of them should allow user to Define table, view, Query and Constraints. **Rule 6: The view updating rule**: All views those can be updated theoretically, must be updated by the system. **Rule 7: High-level insert, update, and delete:** A database must support high-level insertion, update and deletion. This must not be limited to a single row, that is, it must also support union, inter section and minus operations to yield sets of data records **Rule 8: Physical data independence:** Changes to the physical level(how the data is stored, whether in arrays or linked lists etc.) must not require a change to an application based on the structure. **Rule 9: Logical data independence**: Changes to the logical level(tables, columns, rows, and so on) must not require a change to an application based on the structure. **Rule 10: Integrity independence**: Integrity constraints must be specified separately from application programs and stored in the catalog. It must be possible to change such constraints as and when appropriate without unnecessarily affecting existing applications. **Rule 11: Distribution independence**: The distribution of portions of the database to various locations should be invisible to users of the database. Existing applications should continue to operate successfully: when a distributed version of the DBMS is first introduced; and when existing distributed data are redistributed around the system. **Rule 12: The non-subversion rule**: If the system provides a low-level(record-at-a-time) interface, then that interface cannot be used to subvert the system, for example, bypassing a relational security or integrity constraint.	
	e) **Ans.**	**Describe object oriented database model with example. Give two advantages.** • Object oriented models were introduced to overcome the short comings of conventional models like Relational, Hierarchical and network model. • An object oriented database is collection of objects whose behavior, state and relationship are defined in accordance with object oriented with object oriented concepts(objects, class, class hierarchy)	**4M** **Explanation 2M,** **example 1M** **Any 2 advantages 1M**

- Object Oriented Database Model is product of object oriented programming and Relational Model.
- This model supports, Object oriented concepts like data encapsulation, polymorphism, inheritance and Relational Database concepts like integrity, query, concurrency etc.

Example:



An Example of the Object Oriented data model is −

- Shape, Circle, Rectangle and Triangle are all objects in this model.
- Circle has the attributes Center and Radius.
- Rectangle has the attributes Length and Breath
- Triangle has the attributes Base and Height.
- The objects Circle, Rectangle and Triangle inherit from the object Shape.

Advantages:(consider any 2 relevant points)

- Object oriented data model allows the real world to be modeled closely. The object encapsulates both state and behavior. The object can also store the relations with other objects.
- Object Oriented features provide clear modular Structure which is good for defining abstract datatype where internal implementation is hidden. It allows new data types to be built from existing types.
- Redundancy can be reduced as common factors of several classes can be grouped into a super class and can be shared by the subclasses.
- It can be used to store a variety of data.

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5.		**Attempt any TWO of the following:**	**12**
	a)	**Find 3NF decomposition of given relation schema. Shipping (ship, capacity, date, cargo, value).** **Functional dependencies** **Ship -> capacity.** **Shipdate -> cargo.** **Cargo, Capacity -> Value**	**6M**
	Ans.	R= (ship, capacity, date, cargo, value). Functional dependencies Ship -> capacity. Ship, date -> cargo. Cargo, Capacity -> Value 1)Find all attributes in R that are not involved in any functional dependency. Here no such attribute found. 2)R= (ship, capacity, date, cargo, value) No functional dependency has all the attributes. 3)For each Functional dependency i)Ship -> capacity **R1= (ship, capacity)** ii)Ship, date -> cargo. **R2= (ship, date, Cargo)** iii) Cargo, Capacity -> Value **R3= (cargo, capacity, value)** Above 3 relations R1, R2 and R3 gives 3NF decomposition which is lossless and dependency preserving	**Each decomposition R1, R2, R3 : 2M each**
	b)	**Draw an ER diagram for online sales system in which customer can order items online and pay through credit cards.**	**6M**

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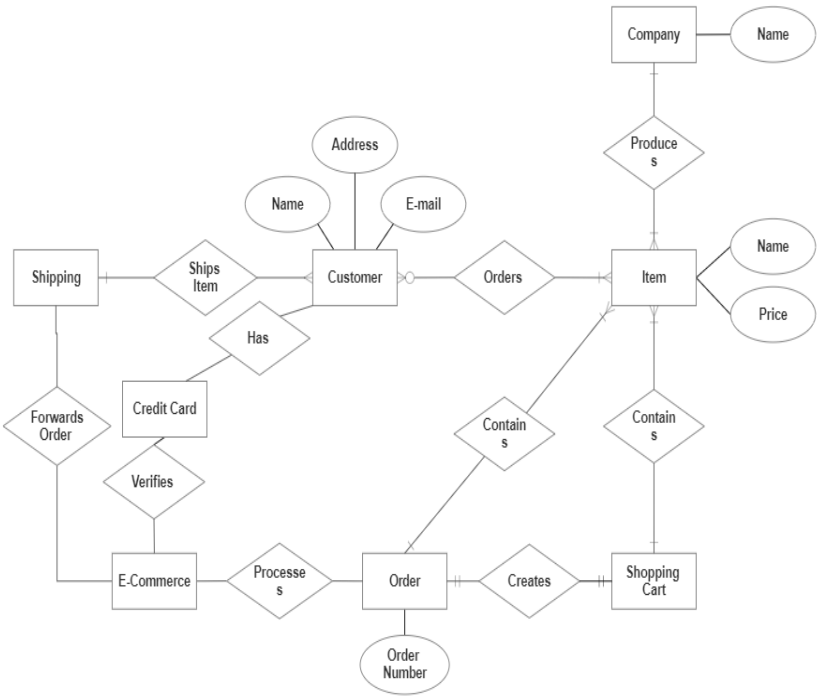
	Ans.		**Use of correct entities 2M Correct symbols 2M Correct relationships 2M**
	c) **Ans.**	**Let R = (A, B, C, D) and** **F={AB ⟶ C, C⟶ A}** **Find BCNF decomposition of R using the algorithm.** Let R1= (A, B, C, D) (Given relation) **Step:1** Find merged minimal cover of Functional Dependencies (FDs) which contain AB->C C->A **Round 1:** Checking whether R1 is in BCNF The FD [AB->C] violates BCNF as LHS is not superkey , so table is split as below R2 = (A, B, C) R3= (A, B, D)	**6M** **Round 1 Decomposition: 3M** **Round 2 Decomposition: 3M**

		Round 2: Checking whether R2 is in BCNF The FD [C->A] violates BCNF as the LHS is not superkey, so table is split as below R4= (C, A) R5= (B, C) Relation R3, R4, and R5 are in BCNF	
6.	**a)** **Ans.**	**Attempt any <u>TWO</u> of the following:** **Consider schema student (roll no., name, marks, address, mobile no., birthdate). Write commands for :-** **i) create table.** **ii) insert values.** **iii) alter table.** **iv) truncate table.** **v) delete row.** **vi) drop table** **Write proper output of each.** i) SQL>create table student (rollno number(5), name varchar2(15), marks number(5,2), address varchar2(20), mobileno number(15), birthdate date); ii)SQL> insert into student values(101,'Rajesh',75, 'Thane',98899923 (OR) SQL>insert into student(rollno,name,marks,address,mobileno,birthda 'Thane',9889992345, '13-JAN-2004'); iii)SQL>Alter table student modify (name varchar2 (20)); (OR) iii)SQL>Alter table student add (course varchar2 (10)); iv)SQL>truncate table student; v)SQL>Delete from student where rollno=101; vi)SQL>drop table student;	**12** **6M** **Each Correct Query 1M**

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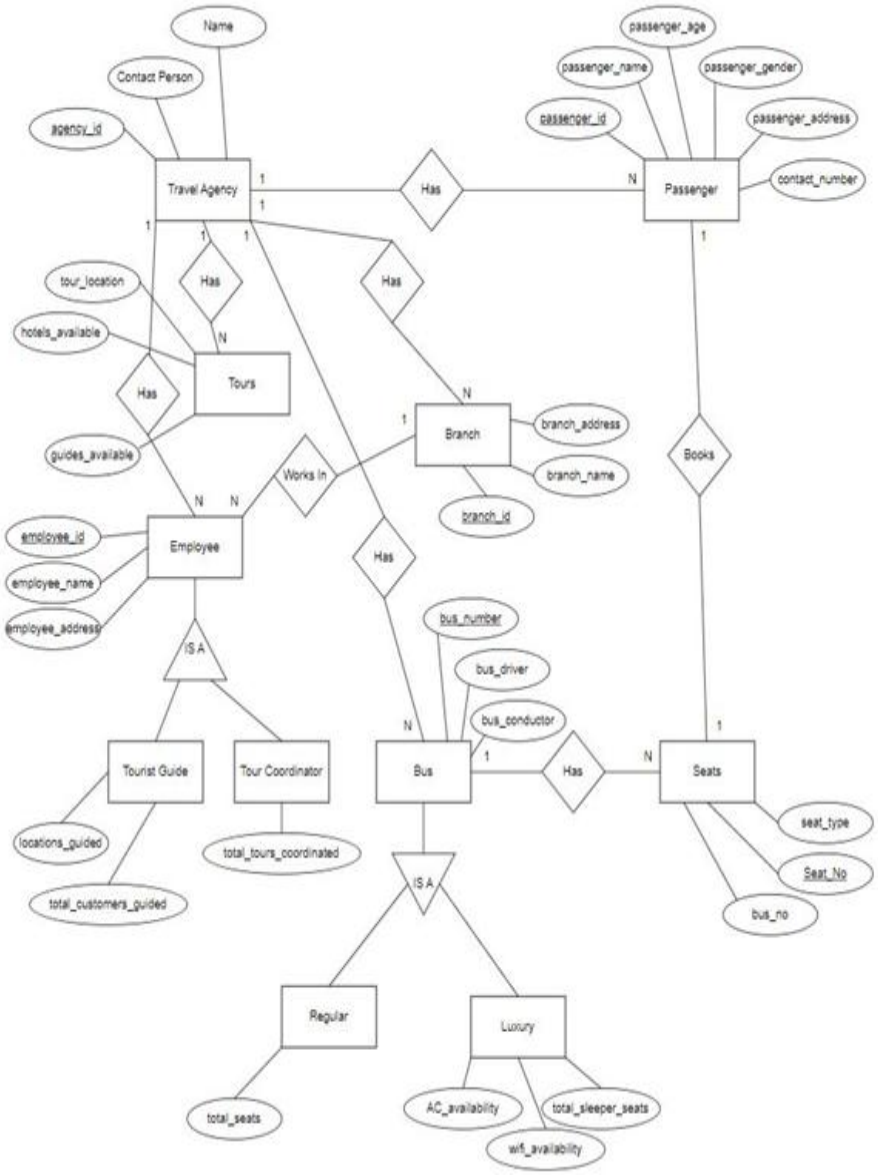
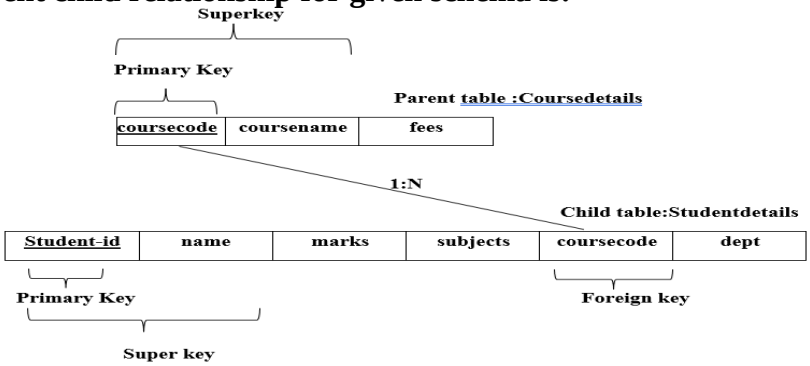
	b) **Ans.**	**Construct an ER diagram for travel agency consider various entities such as travel agency, passenger, branch, seat, bus, employee, tours etc.** **Design specialization and generalization EER features.**  **(Any other relationship, attributes can be considered)**	**6M** **Use of given entities 1M** **Correct symbols 1M** **Correct relationships 2M** **EER Features 2M**

	c) **Ans.**	**Consider following schemas.** **i) Course details (course code, course name, fees)** **ii) Student details :- (Student-id, name, marks, subjects, course code, dept.)** **Identify :- l) Primary key 2) Super key 3) Foreign key** **With justification, draw and explain parent child relationship for above schemas.** **Primary key** 1)coursecode attribute is a primary key of Coursedetails relation 2)Student-id is attribute is a primary key of Studentdetails relation **Super key** 1. Coursedetails (coursecode,coursename) 2. Studentdetails (Student-id,name) **Parent child relationship for given schema is:**  **Foreign key** :coursecode is a foreign key of studentdetails relation. Since there exist a common attribute coursecode in both tables Course details and Student details coursecode attribute uniquely identifies course, is a primary key of Course details relation, coursecode is a foreign key of student details relation. A student can have a course that exist in Course details table and hence we need to reference coursecode in Student details table from coursecode in Course details table. To ensure this referential integrity coursecode in Student details table becomes the foreign key referenced to coursecode primary key from Course details table	**6M** **Identification of primary key (Any relation): 1M ,** **Identification of super key (Any relation): 1M ,** **Identification of foreign key :1M** **Parent child relationship: 2M** **Justification 1M**