# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## June 2025 Semester End Main Examinations

Programme: B.E.                                                    Semester: III

Branch: Artificial Intelligence and Machine Learning    Duration: 3 hrs.

Course Code: 22AM3PCDBM                            Max Marks: 100

Course:  Database Management Systems

**Instructions**:  1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

<div style="writing-mode: vertical">**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.</div>

| | | | **UNIT - I** | **CO** | **PO** | **Marks** |
|---|---|---|---|---|---|---|
| 1 | a) | | Describe the advantages of Database Management System over File Processing System. | CO1 | PO2 | **7** |
| | b) | | Write SQL syntax for the following with example:<br>(i) SELECT<br>(ii) ALTER<br>(iii) UPDATE<br>(iv) DROP<br>(V) TRUNCATE | CO1 | PO1 | **5** |
| | c) | | Illustrate three-schema architecture and its dependencies. | CO2 | PO2 | **8** |
| | | | **OR** | | | |
| 2 | a) | | Describe the various data models used in Database Management Systems (DBMS). | CO1 | PO1 | **5** |
| | b) | | Consider the following library database:<br><br>Book (bid: integer, title: string, author: string, genre: string)<br>Member (mid: integer, mname: string, membership_date: date, age: integer)<br>Loan (mid: integer, bid: integer, loan_date: date, return_date: date)<br><br>Write SQL queries for the following scenarios:<br><br>i. Retrieve the names of members who have borrowed a book titled "The Great Gatsby."<br>ii. Find the average age of members who have borrowed at least one book.<br>iii. List the titles of books along with the total number of times each book has been loaned.<br>iv. Find the number of members who have borrowed more than | CO3 | PO3 | **10** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | five books.<br>v. Retrieve the names of members who have borrowed the highest number of different books. | | | |
| | | c) | Create the tables Product and Category with the following constraints and attributes respectively.<br><br>Product:<br>Product_Id: Primary Key<br>Name: NOT NULL<br>Category_Id: Foreign Key referring to Category (Category_Id)<br>Price: Check price between 10 to 1000<br>InStock: Default value of 'Yes'<br><br>Category:<br>Category_Id: Unique, Not Null<br>Name: Unique | CO4 | PO3 | **5** |
| | | | **UNIT II** | | | |
| 3 | a) | | Define the following terms with a suitable example:<br>   i) Weak entity<br>   ii) DBMS catalog<br>   iii) Cardinality ratio<br>   iv) Degree of relationship<br>   v) Database State | CO1 | PO1 | **10** |
| | b) | | Construct an ER diagram for the Hospital Management System considering at least five entities. Also mention Primary Key & Structural constraints. | CO2 | PO2 | **10** |
| | | | **OR** | | | |
| 4 | a) | | Construct an Entity Relationship (ER) diagram for the Library Management System taking into account at least five entities. Also mention Primary Key and Structural constraints. | CO2 | PO3 | **10** |
| | b) | | Illustrate the steps involved in converting the ER constructs to corresponding relational tables with an example. | CO1 | PO1 | **10** |
| | | | **UNIT - III** | | | |
| 5. | a) | | Explain the following terminologies with a suitable example:<br>   i. Domain constraints<br>   ii. Key constraints or Uniqueness Constraints<br>   iii. Entity Integrity constraints<br>   iv. Referential integrity constraints<br>   v. Null Value Constraint | CO2 | PO2 | **10** |
| | b) | | Define the following terms with a suitable example for each:<br>   i. Join<br>   ii. Union<br>   iii. Intersection<br>   iv. Select<br>   v. Project | CO2 | PO2 | **5** |
| | c) | | Illustrate the concept of relational model concept with a suitable example. | CO1 | PO1 | **5** |
| | | | **OR** | | | |

| | 6 | a) | Illustrate Entity Integrity and Referential Integrity constraints with examples. | CO1 | PO1 | 6 |
|---|---|---|---|---|---|---|
| | | b) | Explain Theta Join, Equi Join, Natural Join, Outer Join with suitable examples using relational algebra notation. | CO1 | PO1 | 8 |
| | | c) | Describe select and project operations in relational algebra with an example for each. | CO1 | PO1 | 6 |

**UNIT IV**

| | 7 | a) | Given relation *R* with four attributes *ABCD*. For each of the following sets of Functional Dependencies (FDs):<br>$ABC \rightarrow D, D \rightarrow A$<br>$A \rightarrow B, BC \rightarrow D, A \rightarrow C$<br>Assume these are the only dependencies that hold for *R*, do the following:<br>  i.    Identify the candidate key(s) for *R*.<br>  ii.   Identify the normal form that *R* satisfies (1NF, 2NF, 3NF, or BCNF).<br>  iii.  If *R* is not in BCNF, decompose it into a set of BCNF relations that preserve the dependencies. | CO4 | PO3 | 10 |
|---|---|---|---|---|---|---|
| | | b) | Describe the Fourth Normal Form (4NF) in database normalization with a suitable example. | CO2 | PO2 | 4 |
| | | c) | Consider the following relation instance<br><br>| A | B | C |<br>|---|---|---|<br>| John | 1 | Van |<br>| John | 2 | Rmd |<br>| Jane | 3 | Rmd |<br>| Jane | 3 | Rmd |<br>| Jill | 4 | Bby |<br>| Jill | 5 | Cql |<br><br>Check whether the following dependencies hold with respect to the instance given and explain why?<br>  i.    $A \rightarrow B$<br>  ii.   $B \rightarrow C$<br>  iii.  $C \rightarrow A$ | CO2 | PO2 | 6 |

**OR**

| | 8 | a) | Explain the different informal guidelines used as a measure to determine the quality of the relation schema design. | CO1 | PO1 | 10 |
|---|---|---|---|---|---|---|
| | | b) | i. Illustrate any three Normal Forms (NF).<br><br>ii. If the given relation is not in 1NF, 2NF and 3NF, then normalize it. Justify your answer for the same. | CO2 | PO3 | 10 |

Note that {Property_id#} and {County_name, Lot#} are the candidate keys. Refer the Functional Dependencies (FD1 to FD4) given in the Figure 5b.



Figure 5b

| | | | **UNIT - V** | | | |
|---|---|---|---|---|---|---|
| 9 | a) | | Consider the three transactions T1, T2 and T3 and schedules S1 and S2 given below.<br>T1: r1(x); r1(z); w1(x); w1(z)<br>T2: r2(y); r2(z); w2(z);<br>T3: r3(y); r3(x); w3(y);<br>S1: r1(x); r3(y); r3(x); r2(y); r2(z); w3(y); w2(z); r1(z); w1(x); w1(z)<br>S2: r1(x); r3(y); r2(y); r3(x); r1(z); r2(z); w3(y); w1(x); w2(z); w1(z);<br>Determine whether each schedule is serializable or not? | CO3 | PO3 | **10** |
| | b) | | Consider the following two transactions:<br>T1:<br>      Read(X)<br>      X: = X + 10<br>      Write(X)<br>T2:<br>      Read(Y)<br>      Y: = Y * 2<br>      Write(Y)<br>Describe how these transactions would be structured under two phase locking. | CO3 | PO3 | **5** |
| | c) | | Explain the desirable properties of transactions. | CO3 | PO3 | **5** |
| | | | **OR** | | | |
| 10 | a) | | Illustrate working principle of ARIES recovery algorithm. | CO3 | PO3 | **6** |
| | b) | | Explain state transition diagram with a neat sketch. | CO2 | PO2 | **6** |
| | c) | | Why concurrency control and recovery management are necessary in DBMS? Describe the types of problems that may occur during their implementation. | CO2 | PO2 | **8** |

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