| Manmohan Technical University<br>Office of the Controller of Examinations<br>Exam Year: 2081, Baishak(Model Question)                                      | Exam Roll:                               |  |                             |  |
|--|--|--|-----------------------------|--|
| School: SOE  | Level: BE                                | Invigilator                                      | 's Sign:                    |  |
| Program: BEEE  | Year/Part: III/II                        | Superinter                                       | Superintendent's Sign:      |  |
| Subject: Database Manag  | ement System                             | Code No  | Code No                     |  |
| i Answers should be given by filling the   | Multinle-Choice Questions'               | X<br>∆nswer Sheet                                | Code No.                    |  |
| ii. The main answer sheet can be used for  | rough work.                              | inswer oneer.                                    |                             |  |
| GROUP A (Multiple-Choice Questions)  | [10x1=10]                                |  | Time: 20 Minute             |  |
| <ol> <li>Which of the following describes data<br/>independence?</li> </ol>  | 6. Which inde<br>and allows eff          | xing method organizes<br>icient range queries?(נ | data hierarchically<br>unit |  |
| A. The ability to maintain data in a cloud storage platform  | A. Hash Index                            | ργ   |                             |  |
| <ul> <li>B. The ability to modify database schema without affecting the application</li> <li>C. The ability to restrict data access based on up</li> </ul> | C. B+ Tree Ind<br>Ser D. Order Indic     | ex<br>es   |                             |  |
| roles<br>D. The ability to store data across different phy<br>location   | sical 7. Which of th                     | ne following is NOT a de                         | eadlock prevention          |  |
| <ol> <li>Which of the following is NOT an extended E-R</li> </ol>  | A 10/pit                                 | DiaSchomo  |                             |  |
| A. Aggregation   | B. Wou                                   | nd-Wait Scheme                                   |                             |  |
| B. Composition   | C. Strict                                | Two-Phase Locking                                |                             |  |
| C. Generalization  | D. Incre                                 | asing the Priority of Tra                        | ansactions                  |  |
| <ol> <li>Which of the following statements is true abou<br/>weak entity set?</li> </ol>  | t a 8. Which of th relational data       | ne following is a feature<br>abase?              | e of a well-designed        |  |
| A. It has its own primary key<br>B. It is independent of other entities  | A Deducedent                             | data atawara                                     |                             |  |
| C. It is uniquely identified by a combination of i   | ts B Anomalies i                         | in data storage                                  | eletion                     |  |
| attributes and the primary key of a related enti   | y C. Minimal redundancy and no anomalies |  |                             |  |
| <ul> <li>D. It cannot participate in relationships</li> <li>4 Which of the following is NOT a key considerat</li> </ul>                                    | D. Lack of nor                           | malization                                       |                             |  |
| in query optimization?   | 9. Which of th                           | e following techniques                           | s is commonly used          |  |
| A. Choice of evaluation plans<br>B. Transformation of relational expressions   | to ensure high                           | n availability in databas                        | se systems?                 |  |
| C. Network bandwidth for user interface design   | ) A Shadow Pa                            | aina   |                             |  |
| D. Cost estimation of query operations   | B. Remote Bac                            | ckup Systems and Repl                            | ication                     |  |
| <ol> <li>which of the following SQL KeyWords is used to<br/>combine rows from two table on a related colu</li> </ol>                                       | mn? C. Log-based F                       | Recovery   |                             |  |
| A. WHERE   | D. Failure Clas                          | sification                                       |                             |  |
| B. JOIN  | 10. Which SO                             | L command is used to                             | grant privileges to a       |  |
| C. GROUP BY  | user in databa                           | ase security                                     | 3. s. it prininges to u     |  |
| D. HAVING  | A. REVOKE                                | -  |                             |  |
|  | B. GRANT                                 | FIFCT  |                             |  |
|  | U. ALILIND. JE                           |  |                             |  |

| Multiple | Choice | Questions' | <b>Answer She</b> | et |
|----------|--------|------------|-------------------|----|
|----------|--------|------------|-------------------|----|

| Marks Secured:            |                |                    |             |
|---------------------------|----------------|--------------------|-------------|
| In Words:                 | Corrected Fill | 1. A B C D         | 6. A B C D  |
| Examiner's Sign: Date:    |                | 2. A B C D         | 7. A B C D  |
| Scrutinizer's Marks:      |                | 3. A B C D         | 8. A B C D  |
| In Words:                 |                | 4. (A) (B) (C) (D) | 9. A B C D  |
| Scrutinizer's Sign: Date: |                | 5. A B C D         | 10. A B C D |

## Manmohan Technical University Office of the Controller of Examinations Exam Year: 2081, mangsir

| School: SOE              | Level: BE         | Time: 3 Hours  |
|--------------------------|-------------------|----------------|
| Program: BEEE            | Year/Part: III/II | Full Marks: 50 |
| Subject: : Database Mana | gement System     |                |

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

GROUP A (Multiple-Choice Questions in separate paper)

GROUP B (Short Answer Questions - Attempt Any Eight Question)

1. Explain the main purpose of a database system with an example of its application in real life

2. What are integrity constraints and domain constraints, and why are they important in relational databases?

3. What are the key differences between BCNF (Boyce-Codd Normal Form) and 3NF (Third Normal Form)?

4. What are materialized views, and how do they improve query performance?

5. What is a bitmap index, and in what scenarios is it most effective

6. What is the difference between conflict serializability and view serializability.

7. What are the key differences between shadow paging and log-based recovery methods?

8. What is database encryption, and why is it essential for securing sensitive information?

9. What are graph databases, and what advantages do they offer compared to traditional relational databases?

## GROUP C (Long Answer Questions – Attempt Any Six Questions)

[6×4=24]

[10x1=10]

[8×2=16]

1. Draw an ER diagram from the following case:

The procurement department of the Ministry of Transportation (MOT) is responsible for tracking all items (such as furniture and equipment, e.g., chairs or printers) in the Ministry offices. Each building under the MOT has a unique name for identification purposes. When an item is purchased, it is assigned a unique ID, which is used for tracking purposes. Every item is allocated to a specific room within a building. Rooms within buildings are assigned to particular departments, and each department has one 7employee serving as its manager.

2. Normalize the following table with first, second, third and BCNF normalization.

| Student ID | Student'S Name | Courses          | Grades |
|------------|----------------|------------------|--------|
| 1          | John Smith     | Math, Science    | А, В   |
| 2          | Jane Doe       | English, History | В, А   |

3. Consider the following relational database.

Consider the following schema:

account (account-number, branch-name, balance)

branch (branch-name, branch-city, assets)

customer (customer-name, customer-street, customer-city)

loan (loan-number, branch-name, amount)

depositor (customer-name, account-number)

borrower (customer-name, loan-number)

a) Write an SQL query to list the names of all depositors along with their account number, street and city address.

b) Write a query in SQL to list the branch-cities and total assets where the total assets are more than \$1,000,000 in the city.

c) Write an SQL query to find the names and loan-numbers of all customers who have a loan of over \$15,000.

d) Write a query in SQL to increase all accounts with balances over \$10,000 by 6%.

e) Give an expression in QBE to find the customer-name, loan-number, and amount for all

4. a) Write a query to find the names of customers who have a loan from the "Biratnagar" branch. Consider the following log contents at the time of a crash:

<To start>. <To, A, 1000, 950> <To, B, 2000, 2050> <To commit> <T<sub>1</sub> start> <T1, C, 700, 600> b. How can you optimize the following query?

## $\Pi_{name, title}(\sigma_{dept_name= "Music"} (instructor \bowtie \Pi_{course_id, title} (teaches \bowtie course)))$

5. Explain the difference between cost-based and heuristic query optimization techniques. Discuss how cost estimation is used in query operations to choose an optimal evaluation plan.

6. Discuss the differences between B+ tree indexing and hash indexing (static and dynamic hashing). Highlight their advantages and disadvantages in terms of efficiency, memory usage, and use cases

7. Explain the ACID properties of transactions with examples. How do these properties ensure reliable transaction management in a database system?

THE END