**2302AS302: Database Systems**

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| **PART A (Marks : 02)** | | **Marks** | **CO** | **BTL** |
| **Course Outcome : 01** | | | | |
| 1 | Discuss how DBMS performs better to file system. | 2 | CO1 | L2 |
| 2 | Explain the different types of data models and their characteristics. | 2 | CO1 | L2 |
| 3 | Identify the key applications of Database Management Systems. | 2 | CO1 | L2 |
| 4 | How are **Instance** and **Schema** defined in a Database Management System? | 2 | CO1 | L2 |
| 5 | Outline the use of Commit and Rollback statement with appropriate examples. | 2 | CO1 | L2 |
| 6 | Discuss the term Entity set and Relationship set. | 2 | CO1 | L2 |
| 7 | Interpret the need of a Primary key in Structured Query Language (SQL). | 2 | CO1 | L2 |
| 8 | Explain the different types of attributes with examples. | 2 | CO1 | L2 |
| 9 | How to specify the total participation in ER Diagram? | 2 | CO1 | L2 |
| 10 | Describe the concept of weak entity in the context of database? Explain how it differs from a strong entity? | 2 | CO1 | L2 |
| **Course Outcome : 02** | | | | |
| 1 | Explain the purpose and functionality of the additional operations in Relational Algebra | 2 | CO2 | L2 |
| 2 | Express the notations of relational algebra operations in DBMS. | 2 | CO2 | L2 |
| 3 | Discuss the various domain types in Structured Query Language (SQL). | 2 | CO2 | L2 |
| 4 | How can you modify or rename an existing relationship in a database or data model? | 2 | CO2 | L2 |
| 5 | Describe the basic operations in Structured Query Language (SQL) with appropriate examples. | 2 | CO2 | L2 |
| 6 | Summarize Data definition Language queries with examples. | 2 | CO2 | L2 |
| 7 | How to list in alphabetic order the names of all customers having a loan in Perryridge branch by SQL? | 2 | CO2 | L2 |
| 8 | List and describe various string operations available in SQL. | 2 | CO2 | L2 |
| 9 | Given a relational database with the following schema:   * **Branch**(*Branch\_Name*, Branch\_City, Assets) * **Account**(*Account\_Number*, Branch\_Name, Balance) * **Depositor**(*Customer\_Name*, *Account\_Number*)   Write the relational algebra expression to calculate the average balance of accounts at the Perryridge branch. | 2 | CO2 | L2 |
| 10 | Given a relational database with the following schema:   * **Branch**(*Branch\_Name*, Branch\_City, Assets) * **Account**(*Account\_Number*, Branch\_Name, Balance) * **Depositor**(*Customer\_Name*, *Account\_Number*)   Write the relational algebra expression to find the maximum balance among accounts at branches located in 'Boston' | 2 | CO2 | L2 |
| **Course Outcome : 03** | | | | |
| 1 | Describe the concept of functional dependency with example. | 2 | CO3 | L2 |
| 2 | Explain the importance of normalization and discuss the potential problems that it aims to resolve in relational databases. | 2 | CO3 | L2 |
| 3 | ‘Boyce-Coddnormalformisfoundtobestricterthanthirdnormalform’.Justifyt the statement. | 2 | CO3 | L2 |
| 4 | Explain the role transitive functional dependency in relational databases. | 2 | CO3 | L2 |
| 5 | Design a database to illustrate BCNF (Boyce-Codd Normal Form). | 2 | CO3 | L2 |
| 6 | Discuss about Second Normal Form in normalization with example. | 2 | CO3 | L2 |
| 7 | Describe composite attributes in the context of data modeling. | 2 | CO3 | L2 |
| 8 | Describe the join dependency in the context of relational databases. Explain its implications for database design and normalization | 2 | CO3 | L2 |
| 9 | Outline the role of multivalued dependencies in achieving 5NF. | 2 | CO3 | L2 |
| 10 | Develop a database to illustrate Third Normal Form (3NF). | 2 | CO3 | L2 |
| **Course Outcome : 04** | | | | |
| 1 | Discuss the basic definition of a transaction in the context of databases. | 2 | CO4 | L2 |
| 2 | Infer the need of shadow paging in database concept. | 2 | CO4 | L2 |
| 3 | Explain the different phases of two phase locking protocol. | 2 | CO4 | L2 |
| 4 | Differentiate strict two phase locking protocol and rigorous two phase locking protocol. | 2 | CO4 | L2 |
| 5 | Distinguish between Growing phase and Shrinking phase. | 2 | CO4 | L2 |
| 6 | Describe the concept of lock point with example. | 2 | CO4 | L2 |
| 7 | What is the primary purpose of an index in information retrieval technique? | 2 | CO4 | L2 |
| 8 | Illustrate the concept of Hash Indexing with example. | 2 | CO4 | L2 |
| 9 | Describe the procedure to reduce the occurrences of bucket overflows in a hashfile organization. | 2 | CO4 | L2 |
| 10 | Interpret the structure and function of a page table. | 2 | CO4 | L2 |
| **Course Outcome : 05** | | | | |
| 1 | List the key characteristics that differentiate cloud databases from traditional databases. | 2 | CO5 | L2 |
| 2 | Discuss the role of cache memory in a storage hierarchy. | 2 | CO5 | L2 |
| 3 | Explain the concept of database as a service (DBaaS) in a cloud environment. | 2 | CO5 | L2 |
| 4 | Distinguish between SQL and NOSQL. | 2 | CO5 | L2 |
| 5 | Describe examples of key-value databases, highlighting their features and use cases. | 2 | CO5 | L2 |
| 6 | Enumerate the types of databases in NoSQL. | 2 | CO5 | L2 |
| 7 | Outline the Aggregate Data Model in NoSQL with example. | 2 | CO5 | L2 |
| 8 | Summarize the Working of Document Data Model. | 2 | CO5 | L2 |
| 9 | What is Redis? Describe its primary functions and key features, and explain how it is used in modern applications. | 2 | CO5 | L2 |
| 10 | Identify the applications of the document data model in database systems. | 2 | CO5 | L2 |

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| **PART B (Marks : 16/12)** | | **Marks** | **CO** | **BTL** |
| **Course Outcome : 01** | | | | |
| 1 | Consider the following case study describing the academic functioning of a college:   * A College for many departments. * A department would have many students as well as employs many faculty members. * A Student can register into various courses; similarly a course can be registered by many students. * A Student lives in a hostel. * A department offers many courses but a particular course is offered by a particular department. * A Faculty teaches many courses. A course is taught by many faculties.   Model an ER diagram for the above scenario. | 16 | CO1 | L3 |
| 2 | Illustrate the components and structure of a database system architecture through a well organized diagram. | 16 | CO1 | L3 |
| 3 | Distinguish the characteristics and purpose of a DBMS by comparing it with a traditional file system in a real-world scenario. Explain how a DBMS helps resolve issues like data redundancy, inconsistency, and limited access control. | 16 | CO1 | L3 |
| 4 | Analyze the design issues in an ER Model and address various steps to improve the accuracy and efficiency of database systems. | 16 | CO1 | L3 |
| 5 | Apply the concepts of generalization, specialization, and aggregation in an Extended E-R diagram. Provide examples to illustrate your approach. | 16 | CO1 | L3 |
| 6 | Construct an ER diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examinations conducted. | 16 | CO1 | L3 |
| **Course Outcome : 02** | | | | |
| 1 | A sales office maintains a database to keep track of its salespersons and their business trips. The database consists of the following information:   * Each **salesperson** is identified by their Social Security Number (SSN), and details such as their **name**, the **year they started**, and their **department number** are recorded. * Every time a salesperson goes on a **business trip**, a record is created. This includes the **SSN** of the salesperson taking the trip, the **city of origin**, the **destination city**, the **departure date**, the **return date**, and a unique **Trip ID**. * For each trip, the company tracks various **expenses.** Each expense entry includes the **Trip ID**, the **account** to which the expense is charged, and the **amount spent.**   Specify the following queries in SQL on the above scenario and explain the query.  (i) Create the tables named Salesperson, Trip, and Expense, including the required fields..  (ii)Provide the details (all attributes of TRIP) for trips that exceeded $2000in expenses.  (iii) Print the SSN of salesman who looks trip to ‘Honolulu’  (iv)Print the trip expenses incurred by the salesman with SSN=’234-56-7890’. | 16 | CO2 | L3 |
| 2 | Examine how various types of Join operations are utilized within a database and evaluate their specific use cases. How would you differentiate between these Join types, and in what scenarios would each be most effectively applied? Provide detailed examples. | 16 | CO2 | L3 |
| 3 | Apply relational algebra concepts to perform the operations: Select, Project, Cartesian Product, Union, and Set Difference using appropriate relations. Demonstrate each operation with a clear expression and example result to show understanding of set-based query processing. | 16 | CO2 | L3 |
| 4 | Examine the effectiveness of using aggregate functions in SQL to summarize datasets. Provide an example to support your evaluation. | 16 | CO2 | L3 |
| 5 | a. Simplify the Nested subqueries with an example  b. Illustrate different types of views in SQL with appropriate examples. | 16 | CO2 | L3 |
| 6 | A government transport department maintains a database to manage information about **vehicles**, the **people who own them**,and ownership details. The database includes the following relations:   * The **Vehicle** table stores details of each registered vehicle. Every vehicle has a unique **registration number (reg\_no),** along with its **make** (brand/model) and **colour.** * The **Person** table stores information about individuals who may own one or more vehicles. Each person has a unique **employee number (eno)**, along with their **name** and **address**. * The **Owner** table establishes a relationship between persons and the vehicles they own. It records which **person (eno)** owns which **vehicle (reg\_no).**   Provide expressions in relational algebra to answer the following queries and explain the expression also.                 (i)   List the names of persons who do not own any car.                 (ii)  List the names of persons who own only Maruti Cars.  (iii) List details of the Person who have all the Vehicles.  (iv) List eno of person who do not have Vehicle number DB2003 | 16 | CO2 | L3 |
| **Course Outcome : 03** | | | | |
| 1 | Discuss the application of normalization rules to bring it to 1NF, then progress to 2NF, 3NF, and finally BCNF. Identify and justify each step of the normalization process. | 16 | CO3 | L3 |
| 2 | Why is normalization necessary in database design? Explain the concepts of Fourth Normal Form (4NF) and Fifth Normal Form (5NF) with examples. | 16 | CO3 | L3 |
| 3 | Describe the concept of hashing and categorize its different types. consider the example to explain the strategies such as chaining or open addressing for store student records in a hash table with10 slots (indices 0 to 9) where each record contains a student's ID, name, grade and insert some student records(Student 1: ID = 23, Name = "Alice", Grade = "A", Student2:ID=13, Name = "Diana", Grade = "A+” ). | 16 | CO3 | L3 |
| 4 | Design a scenario where the appropriate use of indexing significantly improves overall database performance. | 16 | CO3 | L3 |
| 5 | Examine the different levels of security in SQL, and determine the various forms of authorization, including the role of views and the process of granting privileges. Additionally, illustrate and analyze the limitations of SQL authorization and their implications for data management and security. | 16 | CO3 | L3 |
| 6 | Design a database schema for a hospital management system. The system should store and manage information about patients, doctors, appointments, and treatments. Ensure the schema adheres to the Boyce-Codd Normal Form (BCNF) by identifying functional dependencies and performing the necessary decomposition. | 16 | CO3 | L3 |
| **Course Outcome : 04** | | | | |
| 1 | Examine the effectiveness of the two-phase locking protocol in preventing conflicts and ensuring transaction atomicity. | 16 | CO4 | L3 |
| 2 | Differentiate between the different types of log-based recovery mechanisms used in database systems. Analyze and explain how each type ensures database consistency during transaction failures or system crashes. | 16 | CO4 | L3 |
| 3 | Determine the role of concurrency control and recovery mechanisms. Illustrate with examples of how timestamp ordering works to manage transactions in a multi-user environment. | 16 | CO4 | L3 |
| 4 | Examine how to perform an evaluation of the reliability of shadow paging in ensuring data consistency during system failures. Analyze the mechanisms involved and assess the effectiveness of shadow paging in maintaining data integrity. | 16 | CO4 | L3 |
| 5 | Consider the following transactions:  T1:read(A);  Write(C);  Read(C);  T2:read(B);  Write(B);  T3:Read(B);  Write(A);  AddlockandunlockinstructionstotransactionsT1,T2 and T3,sothattheyobservethe timestamp ordering protocol. Generalize your view. | 16 | CO4 | L3 |
| 6 | Describe the concept of concurrency control in database systems. Illustrate how it is managed through locking mechanisms and the two-phase commit protocol. Provide examples to demonstrate the role of each in maintaining data consistency during concurrent transactions. | 16 | CO4 | L3 |
| **Course Outcome : 05** | | | | |
| 1 | Design a data storage architecture for a cloud-based application, considering factors like redundancy, availability, and disaster recovery. | 16 | CO5 | L3 |
| 2 | Determine a comprehensive disaster recovery plan for a cloud-based database, and analyze potential challenges that may arise during implementation. How would you address these challenges to ensure data resilience and availability? | 16 | CO5 | L3 |
| 3 | Identify and describe the limitations of Relational Database Management Systems (RDBMS). Additionally, examine the challenges or barriers associated with adopting NoSQL databases. | 16 | CO5 | L3 |
| 4 | Assess how to determine the scalability of graph databases when handling evolving and growing datasets. Examine the factors that influence their performance and evaluate their effectiveness in managing large-scale data. | 16 | CO5 | L3 |
| 5 | Assess the impact of schema design on storage efficiency and query performance in a columnar NoSQL database. | 16 | CO5 | L3 |
| 6 | Generalize the Document data model and Graph based data model in database systems. Discuss their structures, key features, and typical use cases. Provide real-world examples for each to illustrate how they are applied in different scenarios | 16 | CO5 | L3 |