SRINIVASA RAMANUJAN INSTITUTE OF TECHNOLOGY

(AUTONOMOUS)

II B. Tech I Sem – Question Bank

DATABASE MANAGEMENT SYSTEMS

[23CSE302]

(Common to All Branches)

SRIT R23

CO	COURSE OUTCOMES	BL
CO1	Implement fundamental concepts in database systems, including their benefits, data models, structures, and operations.	L2
CO2	Illustrate how databases are structured, including roles, applications, and different architectures.	L2
CO3	Implement ER diagrams, understand relational models, and perform SQL operations.	L3
CO4	Design tables, develop SQL queries, and use SQL functions for data manipulation.	L3
CO5	Use Normalization in databases; understand schema optimization techniques, and the role of surrogate keys.	L4
CO6	Demonstrate basic transaction management; concurrent data access, and indexing techniques to optimize data retrieval in a database system.	L3

***Note:** 1.Remeber(**L1**), 2.Understand (**L2**), 3. Apply (**L3**) 4. Analyze (**L4**), 5. Evaluate (**L5**), 6. Create(**L6**)*

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UNIT – 1 (2 Marks)				
#	Questions	M	CO	BL
1	Define a database system.	2	CO1	L1
2	Name two types of database users.	2	CO1	L1
3	Mention two advantages of using a database system over a file system.	2	CO1	L2
4	What is data consistency, and why is it important in databases?	2	CO1	L2
5	Identify two types of database users and their roles.	2	CO1	L1
6	Name two types of end users in a database system.	2	CO1	L1
7	Differentiate between a casual user and a naive user in a database environment.	2	CO1	L2
8	List two advantages of using a database management system (DBMS).	2	CO1	L1
9	What is data independence in a DBMS?	2	CO1	L2
10	Give two examples of database applications.	2	CO1	L1
11	Name two sectors where database applications are widely used.	2	CO1	L1
12	What is the importance of databases in healthcare?	2	CO1	L2
13	List two types of data models.	2	CO1	L1
14	What is a database schema?	2	CO1	L2
15	Differentiate between centralized and client-server database architectures.	2	CO1	L2
16	Define an entity in the context of an ER model.	2	CO1	L2
17	What is an attribute in an ER model?	2	CO1	L2
18	How is a relationship represented in an ER diagram?	2	CO1	L2
19	How are entities represented in an ER diagram?	2	CO1	L2
20	What is the difference between a single-valued attribute and a multi-valued	2	CO1	L2

	attribute?			
21	What are derived attributes in an ER model?	2	CO1	L2
22	How are composite attributes different from simple attributes?	2	CO1	L2
23	What is the cardinality of a relationship?	2	CO1	L2
24	What are constraints in an ER diagram?	2	CO1	L2
25	Define the concept of "total participation" in an ER model.	2	CO1	L2
26	What is the difference between primary and foreign keys in an ER diagram?	2	CO1	L2
27	What is a superclass in the context of an ER model?	2	CO1	L2

UNIT – 1 (5/10 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	Explain the concept of a database system and its components. How does it differ from a traditional file system?	5	CO2	L2
2	Discuss the role of metadata in a database system. Why is it important?	5	CO2	L2
3	Discuss the different types of database users. Provide examples of each type and explain their roles and responsibilities.	5	CO2	L2
4	Explain the role of a Database Administrator (DBA). What are the key functions a DBA performs to maintain a database system?	5	CO2	L2
5	What are the key advantages of using a database management system (DBMS) over a traditional file-based system? Discuss with examples.	5	CO2	L2
6	Describe the various applications of database systems in different industries. How do they improve efficiency and decision-making?	5	CO2	L2
7	Provide a brief overview of different types of data models (hierarchical, network, relational, and object-oriented). What are the key characteristics of each?	5	CO2	L2
8	Explain the relational data model in detail. What are its main components and how does it differ from other data models?	5	CO2	L2
9	Explain the concepts of schema and instance in a database system. How do they relate to each other?	5	CO2	L2
10	Describe the concepts of logical and physical data independence. Why are these important for database management systems?	5	CO2	L2
11	Describe the typical structure of a database management system (DBMS). What are its main components and their functions?	5	CO2	L2
12	Compare centralized and client-server database architectures. What are the advantages and disadvantages of each?	5	CO2	L2
13	Discuss the client-server architecture in detail. How does it enhance the performance and scalability of a database system?	5	CO2	L2
14	Explain the key concepts of the Entity-Relationship (ER) model. How is it used to design a database?	5	CO2	L2
15	Discuss the role of ER diagrams in database design. What are the main components of an ER diagram, and how do they represent real-world scenarios?	5	CO2	L2
16	How are entities, attributes, and entity sets represented in an ER diagram? Provide examples to illustrate each component.	5	CO2	L2
17	Discuss the significance of primary keys and candidate keys in representing entities in an ER model.	5	CO2	L2
18	Explain the concept of a relationship and relationship set in an ER model. How are they represented in ER diagrams?	5	CO2	L2
19	Discuss different types of relationships (one-to-one, one-to-many, many-to-	5	CO2	L2

	many) in an ER model with examples.			
20	Discuss the types of constraints in an ER model. How do they enforce data integrity?	5	CO2	L2
21	Explain the role of participation constraints and cardinality constraints in an ER model with suitable examples.	5	CO2	L2
22	Describe the concepts of subclasses, superclasses, and inheritance in the ER model. How are they used to represent hierarchical relationships?	5	CO2	L2
23	Explain specialization and generalization in the context of an ER model. How do these concepts contribute to the flexibility of database design?	5	CO2	L2

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UNIT – 2 (2 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	Define a domain in the context of a relational model.	2	CO1	L2
2	What is a tuple in a relational database?	2	CO1	L2
3	Explain the concept of an attribute in a relation.	2	CO1	L2
4	What is a relation in a relational database?	2	CO1	L2
5	Why are null values important in a relational database?	2	CO1	L2
6	What is a domain constraint in a relational model?	2	CO1	L2
7	Define a key constraint with an example.	2	CO1	L2
8	What are integrity constraints in a relational database?	2	CO1	L2
9	Why are key constraints important in a relational database?	2	CO1	L2
10	What is relational algebra in the context of databases?	2	CO1	L2
11	Explain relational calculus.	2	CO1	L2
12	What are data types in SQL? Give two examples.	2	CO1	L2
13	What is the purpose of the SQL CREATE statement?	2	CO1	L2
14	What is the use of the ALTER statement in SQL?	2	CO1	L2
15	Explain the INSERT operation in SQL.	2	CO1	L2
16	What is the difference between DELETE and UPDATE in SQL?	2	CO1	L2

UNIT – 2 (5/10 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	Define the following concepts in the relational model: ⁾ Domain ⁾ Attribute ⁾ Tuple ⁾ Relation	5	CO3	L2
2	Explain the importance of null values in a relational database. Provide examples of situations where null values are useful.	5	CO3	L2
3	What are integrity constraints in a relational database? List and briefly describe the different types of integrity constraints.	5	CO3	L2
4	Describe the difference between Relational Algebra and Relational Calculus. Why are both important in database theory?	5	CO3	L2
5	Explain the concept of a Domain in the relational model. Why is it important?	5	CO3	L2
6	What is a Key Constraint in a relational database? Provide examples of different	5	CO3	L2

	types of key constraints.			
7	Define Relational Algebra and describe its role in the relational database model. Provide examples of at least two relational algebra operations.	5	CO3	L2
8	Write SQL commands to: • Create a table named Students with columns for StudentID, Name, and Age. • Add a column Email to the Students table. Insert a new student record into the Students table.	5	CO3	L2
9	Explain the concepts of domain, attribute, tuple, and relation in the relational model.	5	CO3	L2
10	Write a short note on Relational Algebra and its significance in relational databases.	5	CO3	L2
11	What are the differences between Relational Algebra and Relational Calculus?	5	CO3	L2
12	Define the basic SQL data types and their use cases.	5	CO3	L2
13	Explain the SQL commands CREATE TABLE and ALTER TABLE with examples.	5	CO3	L2
14	Describe the different DML operations (INSERT, DELETE, UPDATE) in SQL with examples.	5	CO3	L2
15	Explain the relational model in detail, covering its core components: domain, attribute, tuple, and relation. Provide examples to illustrate each concept.	5	CO3	L2
16	Discuss the types of constraints in a relational database: Domain constraints, Key constraints, and Integrity constraints. Explain their importance for maintaining data integrity with examples.	5	CO3	L2
17	Explain the importance of constraints in relational databases. Discuss how Domain, Key, and Integrity constraints ensure data consistency and prevent anomalies, providing relevant examples for each type of constraint.	5	CO3	L2
18	Discuss the significance of relational algebra in database management systems (DBMS). Explain any five fundamental operations of relational algebra with examples.	5	CO3	L2
19	Design a simple database schema for a library management system using SQL. Include table definitions with appropriate data types and constraints. Also, write SQL statements to create and alter the tables.	5	CO3	L3

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UNIT –3 (2 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	What is the purpose of the SELECT statement in SQL?	2	CO1	L2
2	Write an SQL query to retrieve the name and salary columns from a table called employees.	2	CO1	L2
3	What is the use of the WHERE clause in SQL?	2	CO1	L2
4	What is a primary key in SQL?	2	CO1	L2
5	What is the difference between a primary key and a foreign key?	2	CO1	L1
6	What is a subquery in SQL?	2	CO1	L2
7	What is the purpose of the GROUP BY clause in SQL?	2	CO1	L2
8	What is an INNER JOIN in SQL?	2	CO1	L2
9	What is a view in SQL?	2	CO1	L2
10	What is the UNION operator in SQL?	2	CO1	L2

UNIT –3 (5/10 Marks)				
#	Questions	M	CO	BL
1	Write an SQL query to display the names and salaries of employees whose salary is greater than 5000, less than 15000, and the employee name does not start with the letter 'A'. Explain how the WHERE clause is used in this query.	5	CO4	L3
2	Write an SQL query to display the product_id, product_name, quantity, and total_price for all products in the sales table where the quantity sold is more than 50 and the total_price (calculated as quantity * price_per_unit) is greater than 1000. Explain how arithmetic operations are used in the SELECT statement.	5	CO4	L3
3	Explain the usage of the following SQL functions with examples: DATEADD(), DATEDIFF(), ROUND(), CONVERT(). Write an SQL query using these functions to manipulate and display data from a hypothetical employees table.	5	CO4	L2
4	Write SQL commands to create two tables, departments and employees, with appropriate primary and foreign key constraints. Ensure that the employees table references the departments table and enforces referential integrity.	5	CO4	L3
5	Write an SQL query to find the names of employees who earn a salary higher than the average salary of their department. Explain how subqueries are used in SQL to accomplish this task.	5	CO4	L3
6	Explain the difference between INNER JOIN, LEFT JOIN, and FULL OUTER JOIN. Write SQL queries using each of these joins on tables orders and customers and describe the results produced by each query.	5	CO4	L2
7	Write an SQL query to get each department's name and count how many employees have salaries higher than their department's average. Sort the result by the count, highest to lowest.	10	CO4	L3
8	Design a database for a small e-commerce app with tables for customers, orders, products, and order items. Include primary keys, foreign keys, and data types. Write SQL to create the tables, insert sample data, and explain the relationships between tables to ensure data integrity.	10	CO4	L3
9	Create a normalized database schema for an e-commerce app with tables for customers, orders, products, and order items. Include primary/foreign keys, data types, and integrity constraints. Write SQL to create tables, insert sample data, and explain how table relationships ensure referential integrity.	10	CO4	L3
10	Explain the types of SQL joins (INNER, LEFT, RIGHT, FULL OUTER, CROSS) with examples using employees and departments tables. Also, demonstrate SQL set operations (UNION, INTERSECT, EXCEPT) with examples and discuss when to use each join and set operation.	10	CO4	L2
11	Explain SQL views and the difference between updatable and non-updatable views. Create one of each using employees and departments tables, and explain why each is updatable or not. Give examples of when each type would be useful.	10	CO4	L3

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UNIT – 4 (2 Marks)

#	Questions	M	CO	BL
1	What is normalization in database design?	2	CO1	L2
2	Define functional dependency in the context of relational databases.	2	CO1	L2
3	What is the purpose of 1NF (First Normal Form)?	2	CO1	L2
4	Explain the concept of a surrogate key.	2	CO1	L2
5	State the difference between 2NF (Second Normal Form) and 3NF (Third Normal Form).	2	CO1	L2
6	What does BCNF (Boyce-Codd Normal Form) address that 3NF does not?	2	CO1	L2
7	What is meant by a lossless join in database normalization?	2	CO1	L2
8	Define MVD (Multivalued Dependency) and its significance in normalization.	2	CO1	L2
9	What is the primary goal of Fourth Normal Form (4NF)?	2	CO1	L2
10	Describe Fifth Normal Form (5NF) and its purpose.	2	CO1	L2

UNIT – 4 (5/10 Marks)				
#	Questions	M	CO	BL
1	Given a set of relations with functional dependencies, apply the steps of normalization to decompose them into 1NF, 2NF, and 3NF. Explain your process. **Relation (R):** Course_Enrollment (StudentID, CourseID, Instructor, InstructorPhone) **Functional Dependencies (FDs):** 1. StudentID, CourseID → Instructor, InstructorPhone 2. Instructor → InstructorPhone	5	CO5	L4
2	Apply the concept of functional dependency to identify and resolve violations of Boyce-Codd Normal Form (BCNF) in a given relation. Demonstrate with an example.	5	CO5	L3
3	Given a database schema, identify potential multivalued dependencies (MVDs) and apply Fourth Normal Form (4NF) principles to eliminate redundancy. Show your solution with an example. **Relation (R):** Student_Course_Activity (StudentID, CourseID, Activity, Instructor) **Functional Dependencies (FDs):** 1. StudentID, CourseID → Instructor 2. StudentID, CourseID → Activity **Multivalued Dependencies (MVDs):** - StudentID, CourseID →→ Activity - StudentID, CourseID →→ Instructor	5	CO5	L4
4	In a given relational schema, apply normalization techniques to ensure a	5	CO5	L4

	Lossless Join and Dependency Preserving Decomposition from 1NF to 3NF. Explain your approach. **Relation (R):** Student_Course_Enroll (StudentID, CourseID, Instructor, InstructorPhone) **Functional Dependencies (FDs):** 1. StudentID, CourseID → Instructor, InstructorPhone 2. Instructor → InstructorPhone			
5	Using a practical example, apply Fifth Normal Form (5NF) to decompose a relation and remove join dependencies. Discuss the impact of this decomposition on data redundancy.	5	CO5	L4
6	Given a relation schema with a set of functional dependencies, apply the steps of normalization to decompose the schema into 1NF, 2NF, and 3NF. Ensure that the decomposition is both lossless and dependency-preserving. Explain each step and the reasoning behind the decomposition. **Relation (R):** Employee (EmpID, EmpName, DeptID, DeptName, DeptLocation) **Functional Dependencies (FDs):** 1. EmpID → EmpName, DeptID 2. DeptID → DeptName, DeptLocation	10	CO5	L4
7	Apply Boyce-Codd Normal Form (BCNF) to a relation that is already in 3NF but still suffers from anomalies. Decompose the relation to satisfy BCNF, and explain how this resolves the remaining anomalies. Use a practical example to demonstrate the process.	10	CO5	L3
8	In a given database schema, identify multivalued dependencies (MVDs) and apply Fourth Normal Form (4NF) to eliminate them. Show how the decomposition reduces redundancy and discuss the trade-offs involved in the 4NF transformation. **Relation (R):** Student_Course (StudentID, Course, Instructor) **Functional Dependencies (FDs):** 1. StudentID → Course 2. StudentID → Instructor	10	CO5	L4
9	Given a complex relation schema with functional dependencies, apply the principles of normalization up to Fifth Normal Form (5NF) to resolve join dependencies. Explain the steps involved and justify why 5NF is necessary in the given scenario. **Relation (R):** Project_Skill_Employee (ProjectID, Skill, EmployeeID, EmployeeName) **Functional Dependencies (FDs):**	10	CO5	L4

	1. ProjectID, Skill → EmployeeID 2. EmployeeID → EmployeeName			
10	Apply the concept of surrogate keys to a normalized schema. Given a relational schema with composite natural keys, replace the natural keys with surrogate keys and discuss the impact on performance, data integrity, and database maintenance. Provide a detailed analysis.	10	CO5	L3

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UNIT – 5 (2 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	What are the ACID properties in a database system?	2	CO1	L2
2	Define serializability in the context of concurrent executions.	2	CO1	L2
3	Explain the concept of recoverability in database transactions.	2	CO1	L2
4	What is a deadlock in the context of database systems?	2	CO1	L2
5	Differentiate between lock-based and timestamp-based concurrency control mechanisms.	2	CO1	L2
6	What is the purpose of a recovery algorithm in a database system?	2	CO1	L2
7	Describe the basic operations that can be performed on a B+ Tree.	2	CO1	L2
8	What is the difference between hash-based indexing and B+ Tree indexing?	2	CO1	L2
9	Define a concurrent execution in the context of database transactions.	2	CO1	L2
10	What is the significance of testing for serializability in database systems?	2	CO1	L2

UNIT – 5 (5/10 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	Suppose a transaction T1 starts, performs several operations, and encounters an error before completing. Describe the different states T1 transitions through during this process and explain how the system ensures that T1 does not leave the database in an inconsistent state.	5	CO6	L3
2	Consider a database where two transactions T1 and T2 are running concurrently. T1 updates a customer record while T2 reads the same record. Apply isolation principles to explain how the database ensures that T2 sees a consistent view of the data and how potential issues like dirty reads are avoided.	5	CO6	L3
3	Given a schedule of transactions with interleaved read and write operations, apply the concept of serializability to determine if the schedule can be considered serializable. Use a precedence graph or conflict serializability test to support your answer. T1: r1(X), w1(Y) T2: w2(X), r2(Y) where r1(X) means Transaction T1 reads data item X, w1(Y) means T1 writes to data item Y, and similarly for T2.	5	CO6	L3
4	Apply a lock-based protocol, such as Two-Phase Locking (2PL), to a scenario where two transactions are competing for exclusive access to the same resource. Describe how locks are managed and how this protocol prevents conflicts and	5	CO6	L3

	ensures serializability.			
5	Apply optimistic concurrency control to a situation where multiple transactions are reading and writing data without acquiring locks. Describe how the system detects and resolves conflicts at commit time to ensure consistency.	5	CO6	L3
6	Apply the concept of B+ Trees to optimize data retrieval. Explain how B+ Trees are structured to support efficient search, insertion, and deletion operations and how they improve performance compared to other indexing methods.	5	CO6	L3
7	Apply hash-based indexing to a scenario where you need to quickly retrieve records based on a key value. Describe how hash functions are used to distribute records into buckets and discuss the benefits and limitations of this approach compared to other indexing techniques.	5	CO6	L3
8	Consider a transaction T1 that performs multiple operations and encounters a failure before it can be committed. Apply the concepts of transaction states and ACID properties to explain how the database system handles this situation to ensure consistency and recoverability. Describe each state transition and the mechanisms used to maintain ACID properties.	10	CO6	L3
9	Given a schedule involving transactions T1 and T2 with interleaved read and write operations, apply the concept of serializability to determine if the schedule is conflict-serializable. Construct a precedence graph for the given schedule, identify any cycles, and explain the implications for serializability.	10	CO6	L3
10	In a scenario where transactions T1 and T2 are running concurrently and T1 updates several records while T2 reads some of those records, apply the concepts of recoverability and isolation to ensure that the database remains consistent. Discuss the isolation levels and how they impact the recoverability of the transactions.	10	CO6	L3
11	Apply a lock-based concurrency control protocol (such as Two-Phase Locking) to a scenario where multiple transactions are accessing the same set of data items. Describe how locks are acquired and released to maintain data consistency, and explain how the protocol prevents issues like deadlocks and ensures serializability.	10	CO6	L3
12	Suppose you have a database system using timestamp-based concurrency control. Apply this protocol to a situation where two transactions, T1 and T2, attempt to update the same data item. Describe how timestamps are used to resolve conflicts and ensure the consistency of the database.	10	CO6	L3
13	Apply optimistic concurrency control to handle potential conflicts. Explain the process of validation at commit time and describe how conflicts are detected and resolved to maintain consistency.	10	CO6	L3
14	Consider a large dataset that requires frequent search, insertion, and deletion operations. Apply the concept of B+ Trees to explain how this indexing technique supports efficient data retrieval. Describe the structure of B+ Trees and how operations like insertion and deletion affect the tree.	10	CO6	L3
15	Compare hash-based indexing and B+ Trees in the context of a database with frequent search queries. Apply these indexing techniques to a scenario where efficient retrieval of data is critical. Discuss the advantages and limitations of each method, focusing on search efficiency, range queries, and overall performance.	10	CO6	L3

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