Reg.No.:												

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 60015

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2024
Third Semester
Computer Science and Engineering
U23IT404 – DATABASE MANAGEMENT SYSTEMS
(Regulation 2023)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define relational model and list its key components.	2	K1	CO1
2.	What is the difference between DML and DDL?	2	K2	CO1
3.	Find the candidate key for the schema R(A,B,C) and f : $\{A \rightarrow B, B \rightarrow C, C \rightarrow A\}$.	2	K2	CO2
4.	Define Boyce-Codd Normal Form (BCNF) and give an example. Why it is known as strict / tighter 3 NF.	2	K2	CO1
5.	State the ACID properties of a transaction. Give an example database instance where 'consistency' is violated.	2	K3	CO1
6.	Explain the concept of serializability in the context of database transactions.	2	K3	CO2
7.	What is the purpose of a data dictionary in a database system?	2	K4	CO2
8.	Differentiate between static hashing and dynamic hashing.	2	K4	CO2
9.	What is the CAP theorem in the context of distributed databases?	2	K5	CO2
10.	Define sharding in a NoSQL database system.	2	K5	CO2

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Construct SQL queries for the following using relational algebra: • Retrieve all employees working in the 'Sales' department. Whose salary is higher than the sales department manager. • Identify only the 3rd highest amount among the orders placed by customers.	13	K1	CO3
		(OR)			
	b)	Explain the architecture of a relational database management system. Discuss the roles of different data views and how keys play a crucial role in database design.	13	K1	CO4
12.	a)	Design an ER diagram for a hospital management system, and explain the process of mapping it to the relational model. Indicate weak and multivalued attributes in the E-R diagram.	13	K2	CO3
		(OR)			
	b)	Consider the following Relational Schema R (A,B, C, D, E) and the FD ruleset f: $\{BA \rightarrow C, AB \rightarrow D, D \rightarrow E, B \rightarrow C\}$. Find candidate key(s) and normalize it to BCNF.	13	K2	CO4
13.	a)	Discuss various concurrency control mechanisms, including two-phase locking and timestamp ordering. How do these mechanisms ensure consistency in a multi-user environment?	13	K3	CO4
		(OR)			
	b)	Explain the ARIES recovery algorithm in detail and describe its role in database recovery.	13	K3	CO4
14.	a)	Compare and contrast different indexing strategies such as ordered indices and hashing. How does query optimization benefit from efficient indexing techniques?	13	K4	CO4
		(OR)			
	b)	Explain the various file organization methods in databases, including the use of RAID systems, and how they affect database performance.	13	K4	CO4
15.	a)	Discuss the architecture of a distributed database system, and explain how transaction processing and query processing differ from centralized databases.	13	K5	CO4
		(OR)			

b)	Explain the role of database security measures like authentication, authorization, and access control. How can SQL injection be prevented in web applications?	13	K5	CO4

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	You have been hired as a database consultant for a new e-commerce platform that is set to launch. The platform will support a variety of products, customers, and orders. The requirements for the database system include: • Managing user accounts with personal details and order history. • Storing product details, including categories and inventory status. • Handling order transactions and payments. • Supporting product reviews and ratings. i. Design an ER Diagram for the e-commerce platform, including entities such as Users, Products, Orders, and Reviews. Ensure to capture key attributes and relationships and Map the ER Diagram to Relational Schema, providing the relational tables and key constraints. Include primary keys and foreign keys. ii. Normalize the Database schema up to Boyce-Codd Normal Form (BCNF), explaining the normalization process and ensuring that the database design avoids redundancy and update anomalies and Discuss Optimization Strategies for query performance, including indexing and query optimization techniques. How would you ensure efficient handling of queries for product searches and order retrievals?	15	K5	CO4
		(OR)			
	b)	Imagine you are responsible for the database management system of a bank. The system must handle multiple transactions concurrently while maintaining data consistency and integrity. The requirements include: • Processing customer transactions like deposits and withdrawals. • Ensuring that transactions are handled with ACID properties. • Managing concurrent access to accounts and handling potential deadlocks. • Providing robust recovery mechanisms in case of system failures.	15	K5	CO3

i. Explain the Concurrency Control Mechanisms that should be implemented to manage transactions. Discuss two-phase locking, timestamp ordering, and how these mechanisms ensure consistency and isolation and Describe the Recovery Techniques that can be used to recover from system crashes or failures. Include a detailed explanation of the ARIES recovery algorithm and how it ensures data integrity.

ii. Provide a Detailed Example of how deadlock detection and resolution might be handled in this system. Explain the potential impact of deadlocks on transaction processing and how your approach mitigates these issues and Discuss the Impact of ACID Properties on transaction processing and concurrency control. How do these properties contribute to the overall reliability and performance of the banking system?
