VIT-AP UNIVERSITY	Final Assessment Test – Winter (2024-25) - April 2025	
	Maximum Marks: 100	Duration: 3 Hours
Course Code: SWE2006	Course Title: Database Systems	
Set No: 03	Exam Type : **Closed Book**	School: SCOPE
Date: 08/05/2025	Slot: D2	Session: FN

Keeping mobile phone/smart watch, even in 'off' position is treated as exam malpractice

General Instructions if any:

1. **"*fx* series" - non Programmable calculator are permitted : NO**
2. **Reference tables permitted : NO**

PART – A: Answer any TEN Questions, Each Question Carries 10 Marks (10×10=100 Marks)

1. Database systems are characterized by features like minimizing redundancy, supporting multiple user views, providing controlled access, ensuring data consistency, and maintaining data integrity through transaction management. Discuss how the characteristics of modern database systems are evolving to meet the future challenges of cloud computing and distributed environments? **(10M)**

2. The concept of three-schema architecture in DBMS plays a vital role in simplifying database design and improving flexibility by isolating user views from physical storage details. How can this architecture help to achieve logical and physical data independence in a database environment?**(10M)**

3. Design an ER diagram for an Online Examination Management System that effectively handles the process of student registration, exam scheduling, question paper management, conducting online exams, and result generation. Key aspects of the system include maintaining a normalized database of student profiles, subject and course details, exam schedules, and marks obtained by students. The system should also provide reporting features for administrators and faculty to track student performance and exam statistics. **(10M)**

4. Draw an ER diagram of Hospital Management System and explain the mapping of the ER diagram to relational model by considering the following constraints:
   - A hospital has multiple departments, and each department has multiple doctors (one doctor is Head of Department).
   - Each doctor works in only one department.
   - Each department handles multiple patients, and a patient is treated by one or more doctors.
   - A patient can take appointments for different doctors from various departments. **(10M)**

5. Consider the following Schema:

   Employee(Eid, Ename, Salary, Deptid)
   Department(Deptid, Dname, Location)
   Project(Pid, Pname, Deptid)
   Works_On(Eid, Pid, Hours)

   Write an SQL query for the following:
   (a) Find the highest and lowest salary of the employees.
   (b) List the employees who are working on more than one project.

(c) Find the names of employees whose salary is greater than 50,000.
(d) List the project names handled by the 'HR' department.
(e) Find the names of employees who are working on projects located in 'Delhi'. **(10M)**

6. Consider a relation R with four attributes given in the following table. Check whether the relation is in 1NF,2NF and 3NF. If not decompose the relation R into multiple tables as required. **(10M)**

Name	Reg.No	Branch	Language
Sai	21	CSE	English
Sai	22	AIML	Hindi
Shiva	23	ECE	Tamil
Shiva	24	Mech	English

7. Describe in detail the functions and operations of the query optimizer and query processor in a database management system with a neat diagram. Also, illustrate how both components work together to generate and choose the most efficient query execution plan from all possible alternatives. **(10M)**

8. Write a SQL Query to retrieve the names of employees who are working in the department located in the city 'Mumbai' using the below schema:
Employee(eid, name, deptid)
Department(deptid, dname, city)
Works(eid, pid, hours)
Project(pid, pname, location)
Convert the SQL query into relational algebra expression and perform query optimization. **(10M)**

9. Consider the following two schedules for transaction T1 and T2 and check whether they are view serializable or not with a proper explanation. **(10M)**

T_1	T_2
read(A)	
write(A)	
	read(A)
	write(A)
read(B)	
write(B)	
	read(B)
	write(B)

T_1	T_2
read(A)	
write(A)	
read(B)	
write(B)	
	read(A)
	write(A)
	read(B)
	write(B)

10. Consider a Transaction with the following operations:
Begin Transaction T1;
Read(A);
A = A + 500;
Write(A);
Read(B);

B = B - 300;
Write(B);
End Transaction T1;

Assume that after writing the value of A, the transaction fails, and there is no commit record in the log. Explain with a neat diagram how the deferred update recovery technique will handle this failure and recover the database to a consistent state. **(10M)**

11. Draw the B-Tree of order 4 and explain the minimum number of children and the maximum number of children a node can have in the structure. Also, insert the following data arriving in sequence into the B-Tree: 15, 3, 7, 9, 25, 12, 18, 5, 20, 1, 23, 8, 30. **(10M)**

12. Design a B+-Tree for the following set of values: (3, 7, 9, 14, 18, 22, 27, 30, 33, 38). Assume that the tree is initially empty and the values are inserted in ascending order. You can take any order for the tree and show the deletion with value '27' in the tree structure. **(10M)**