



# VIT

Vellore Institute of Technology  
(Deemed to be University under Section 3 of the UGC Act, 1956)

Reg. No. :

22BPS1224

## Final Assessment Test (FAT) - May 2024

Name	B.Tech.	Semester	WINTER SEMESTER 2023 - 24
Course Title	DATABASE SYSTEMS	Course Code	BCSE302L
Faculty Name	Prof. Appalaraju Muralidhar	Slot	D2+TD2
Time	3 Hours	Class Nbr	CH2023240501557

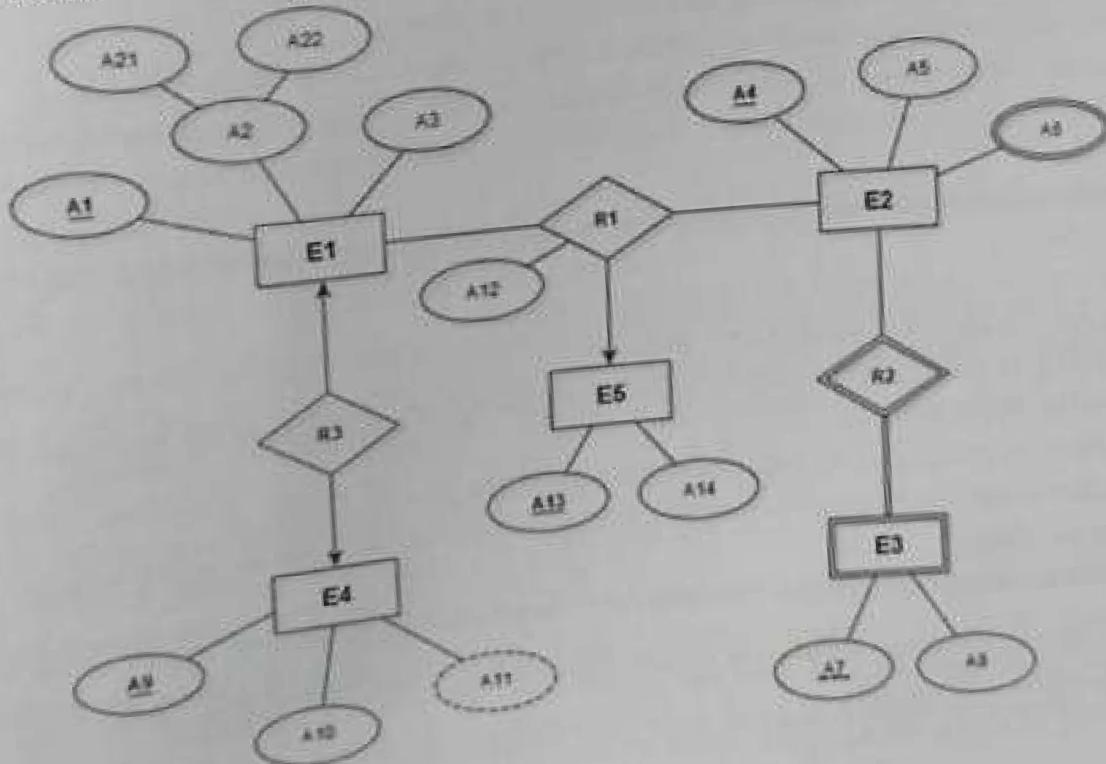
### General Instructions:

- Write only Register Number in the Question Paper where space is provided (right-side at the top) & do not write any other details.

### Answer all questions (10 X 10 Marks = 100 Marks)

Q1. An investigation agency stores the crime data confidentially, including video taken by the investigation cameras, audio recorded by legally authorized phones, wiretaps, still photos taken by investigators, fingerprints taken on the spot, text documents seized by the police, and geographical data relevant to the operation. As a database expert, suggest a database architecture with the necessary components to manage, store, and retrieve the data, such as photos, fingerprints, text documents, etc. [10]

Q2. Consider the ER diagram below and convert it into relations by applying ER mapping rules. [10]  
Show the final schema diagram after mapping.



03. a) Consider the relation R(X, Y, Z) with the following functional dependencies. [5 marks]

$$FD = \{XY \rightarrow Z, Z \rightarrow XY, Y \rightarrow Z, XYZ \rightarrow XZ, X \rightarrow Z, XZ \rightarrow Y\}$$

Find the minimal cover of the given set of functional dependencies.

b) Consider the relation Team\_info(team\_id, country, national\_anthem, coach, hotel\_id, hotel\_name, hotel\_type, floor\_info) with the following functional dependencies:

$$FD = \{team\_id \rightarrow country, coach; country \rightarrow national\_anthem; hotel\_id \rightarrow hotel\_name, hotel\_type; team\_id, hotel\_id \rightarrow floor\_info\}$$

Identify the above relation is in which normal form. Also, decompose it till third normal form. [5 marks]

04. (a) Construct a B+ Tree in the order 4 for indexing the Key values. Use lexicographic ordering to compare the strings. (7 Marks)

Key Values are: Banana, Mango, Apple, Orange, Grapes, Papaya, Watermelon, Blueberry, Strawberry, Guava, Cranberry, Kiwi, Pomegranate, Jackfruit, Muskmelon.

(b) Delete the values Guava and Grapes from the constructed B+ tree in the above question 4(a) (3 Marks)

05. (a) Consider the following database schema for a Student Play Item distribution scenario:

Student(S\_Id, S\_Name, Dept\_Name)

Membership(Mem\_Id, S\_Id, PlayItem\_Id)

Playitem(PlayItem\_Id, Playitem\_Name, Quantity)

Issue\_record(Issue\_no, Issue\_date, PlayItem\_Id)

Write the Relational Algebra expression for the following questions.

(i) List the name of the play item along with the quantity taken on 12-Apr-2024. (2marks)

(ii) Count the total number of students from Mechanical department who is having membership. (2marks)

(b) Consider an extendible hashing scheme with bucket size 3. Assume the following keys are inserted in the

given order: 55, 44, 12, 56, 77, 43, 83, 10, 17, 31, 16, 22.

The Hash Address of the key values are as follows :

55 (00110111), 44 (00101100), 12 (00001100), 56 (00111000), 77 (01001101), 43 (00101011), 83 (01010011), 10 (00001010),

17 (00010001), 31 (00011111), 16 (00010000) and 22 (00010110).

Show the state of the directory and buckets after each insertion, including any necessary splitting or merging operations.

(Consider the Least Significant Bits for the above-mentioned process) (6 Marks)

06. a) Check whether the given schedule is conflict serializable or not. If yes, give all possible serializable orders. [5 marks]

S1: r1(A); w1(A); r2(A); w2(A); r3(A); w3(A); r1(B); w1(B); r4(B); w4(B).

for the following schedule:

	T2	T3
Read (X)	Read (X)	
X = X + 30		
Write (X)		
	Read (X)	
	X = X + 10	
	Write (X)	
	Commit	
Commit		
	Commit	

Whether the above mentioned schedule ensures recoverability under any circumstances? If yes, justify your answer. If not, then what are changes you should do to make it recoverable? [5 marks]

07. Consider a database with objects X and Y, and the following two transactions T1 and T2 involving these objects. [10]

T1	T2
begin transaction read (X). read (Y). X = X - Y. write (X). read (Y).	begin transaction read (X), read (Y). X = X + t0. Y = X - Y. write (X). write (Y).

Add lock and unlock instructions to transactions T1 and T2 so that they adhere to the two-phase locking protocol (2PL).

Determine if the introduced lock/unlock instructions lead to a deadlock. If a deadlock occurs, explain how it could have been prevented. (10 marks)

08. Consider two concurrent transaction A and B which are accessing the data at the same time. At the point T, the conflict has occurred between the two concurrent transactions. By considering this scenario as an example, explain the following [10]
- Write Read conflict [4 Marks]
  - Read Write conflict [4 Marks]
  - Lost update problem. [2 Marks]

09. Nature is a Social Media page which consists of images, videos and characteristics of followers such as comments, likes and Shares etc. Highlight the design challenges for the data using NoSQL. There may be some areas for which NoSQL can be used for this application, elaborate on those issues. Illustrate on the need of NoSQL along with the different data models for the above scenario. [10]

10. Product (pid, pname, price, category)

Purchase (buyer\_ssn, seller\_ssn, store, pid)

Company (cid, cname, stock\_price, country)

Person(ssn, per\_name, phone\_number, city)

Consider the above mentioned relations and write the SQL queries for the following: (2 x 5=10marks)

- a. Find people who bought telephony products.
- b. List the company that sells American products.
- c. Find names of people who bought American products and did not buy French Products.
- d. Find names of people who bought American products and they live in Seattle.
- e. Find people who bought stuff from cid = 5 or from a company whose stock price is more than Rs.5000.

