PAPER ID-310484

Subject Code: MTCS101

Roll No: | | | | | | | | | | | | | |

MTECH
(SEM I) THEORY EXAMINATION 2025-26
FOUNDATION OF COMPUTER SCIENCE

TIME: 3 HRS **M.MARKS: 70**

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief. **02 x 7 = 14**

Q no.	Question
a.	What is a Priority Queue? How is it different from a standard queue?
b.	Differentiate between Linear and Non-Linear data structures with examples.
c.	What are the necessary conditions for a Deadlock to occur?
d.	Explain the concept of Context Switching.
e.	Define Chomsky Normal Form (CNF).
f.	What are ACID properties?
g.	Define Hashing. What do you understand by the term 'Collision'?

SECTION B

2. Attempt any *three* of the following: **07 x 3 = 21**

Q no.	Question
a.	Explain Merge Sort. Show the divide and conquer steps for {38, 27, 43, 3, 9, 82, 10}.
b.	Explain the concept of Multithreading. Differentiate between User-level threads and Kernel-level threads.
c.	Explain the closure properties of Regular Languages and Context-Free Languages.
d.	Explain Normalization. Discuss 1NF, 2NF, 3NF, and BCNF with suitable examples.
e.	Explain the Entity-Relationship (ER) Model. Draw an ER diagram for a "University Management System" considering entities like Student, Course, Department, and Faculty.

SECTION C

3. Attempt any *one* part of the following: **07 x 1 = 07**

Q no.	Question
a.	Explain Breadth First Search (BFS) and Depth First Search (DFS) traversal algorithms. Compare their complexities and applications.
b.	Define B-Trees. Construct a B-Tree of order 5 with the following data: {1, 12, 8, 2, 25, 5, 14, 28, 17, 7, 52, 16, 48, 68, 3, 26, 29, 53, 55, 45}.

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4. Attempt any *one* part of the following: 07 x 1 = 07

Q no.	Question
a.	Explain the Banker's Algorithm for Deadlock Avoidance with Consider the following record of a system:

Process	Allocated			Maximum			Available		
	A	B	C	A	B	C	A	B	C
P1	0	1	0	7	5	3	3	3	2
P2	2	0	0	3	2	2			
P3	3	0	2	9	0	2			
P4	2	1	1	2	2	2			
P5	0	0	2	4	3	3			

Answer the following questions using the banker's algorithm:
1) What is the content of the matrix need?
2) Is the system in a safe state?

b.	Explain Virtual Memory. Discuss the concept of Demand Paging and Page Fault handling.

5. Attempt any *one* part of the following: 07 x 1 = 07

Q no.	Question
a.	Explain Pushdown Automata and its relation to Context-Free Languages.
b.	Discuss the P vs NP problem. Define NP-Complete and NP-Hard problems with examples.

6. Attempt any *one* part of the following: 07 x 1 = 07

Q no.	Question
a.	Explain Deadlock prevention and detection techniques in Distributed Databases.
b.	Describe the Architecture of a Distributed Database System. What are the concepts of Fragmentation and Replication?

7. Attempt any *one* part of the following: 07 x 1 = 07

Q no.	Question
a.	Discuss Backup and Recovery concepts. Explain Immediate Update and Deferred Update techniques
b.	Explain Quick Sort and compare it with Merge Sort.