M.Tech. (CSE) 1st Semester CBCS Scheme

Examination, December–2025

DATA COMMUNICATION AND COMPUTER NETWORKS

Paper–MTCSE21C1

Time allowed : 3 hours] *[Maximum marks : 100*

Note: ***Question No. 1 is compulsory.*** *Attempt* ***four*** *more questions selecting* ***one*** *question from each unit. All questions carry equal marks.*

1. Compulsory question :

(i) Differentiate between digital communication and analog communication in terms of signal type, reliability, and applications.

(ii) What is packet switching? Mention one major advantage of packet switching over circuit switching.

(iii) Define CIDR addressing. How does it improve upon classful addressing?

(iv) Write a short note on IPv6 global unicast addresses and explain their significance.

(v) What is an SCTP association? How does it differ from a simple TCP connection?

(vi) Write any two differences between POP and IMAP protocols in handling emails.

(vii) What is Simple Network Management Protocol (SNMP)? Mention one of its main uses.

(viii) Define a Virtual Private Network (VPN). State one advantage of using VPNs in enterprises.

Unit–I

2. Describe in detail circuit switching, packet switching, and message switching. Use diagrams to illustrate how data flows in each switching method.

3. Explain the seven layers of the OSI model, discussing the role and function of each layer with suitable examples.

Unit–II

4. Describe the working principles and applications of the routing protocols RIP, OSPF, and BGP.

5. Write a detailed note on IPv6 addressing, including address space allocation, features, and differences from IPv4.

Unit–III

6. Describe the working of email protocols such as SMTP, POP, IMAP, and MIME. Mention their roles in sending and receiving emails.

7. Explain the Dynamic Host Configuration Protocol (DHCP). Discuss its working process and role in automatic IP address configuration.

Unit–IV

8. Discuss in detail the various encryption techniques such as traditional ciphers, modern ciphers, symmetric and asymmetric encryption. Explain the role of digital signatures in ensuring authenticity.

9. Explain the concepts of Network Layer Security (IPSec), Transport Layer Security (TLS), and Application Layer Security (e.g., HTTPS, PGP). Compare their scope and applications.

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M.Tech. 1st Semester (CSE) (CBCS Scheme)

Examination, December–2025

ADVANCED OPERATING SYSTEM

Paper–MTCSE21C2

Time allowed : 3 hours] *[Maximum marks : 100*

Note : ***Question No. 1 is compulsory.*** *Attempt* ***five*** *questions in all. All questions carry equal marks.*

1. (a) What is the critical section problem ? How does semaphore solve it ?

   (b) Explain the usefulness of Lamport's Logical Clock.

   (c) Discuss Basic Approaches to Recovery.

   (d) Explain the Concurrency Control Algorithms.

Unit–I

2. Why do we use Operating System? Give the Functions of an Operating System. Also, discuss various Design Approaches. What are the different Types of Advanced Operating Systems?

3. What are Process Deadlocks? Write about models of Deadlocks. Write the difference between Deadlock Prevention and Deadlock Avoidance techniques.

Unit–II

4. What is a Distributed File system? Discuss its architecture and design Issues,

5. What is a Distributed Shared Memory? Also, discuss its architecture and design Issues,

Unit–III

6. What is Recovery? Write various Approaches to Recovery and discuss the concept of Recovery in a Concurrent System.

7. Discuss Two-phase and Non-blocking Commit Protocols and their associated algorithm in detail.

Unit–IV

8. What do you mean by Process? Explain the various types of processing queues.

Consider the following set of 5 processes

Processes	Arrival Time	Burst Time
P1	1	2
P2	0	5
P3	4	7
P4	3	6
P5	2	4

Calculate the average waiting time and average turnaround time for the following algorithms :

(i) FCFS

(ii) SJF (Non-Preemptive and Preemptive)

(iii) Round Robin Scheduling(Time Quantum = 2 units)

(iv) Priority Scheduling (Non-Preemptive and Preemptive)

9. Differentiate between paging and segmentation with an example.

Consider the following set of page references:

7, 4, 4, 3, 2, 3, 7, 5, 5, 4, 4, 8, 9, 2, 1, 4, 5

Calculate the Page fault rate for the following algorithms :

(a) FIFO

(b) LRU

(c) Optimal Page Replacement

Initially, there are four empty frames.

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M. Tech. 1st Semester (CSE) – CBCS Scheme

Examination, December-2025

ADVANCED DATABASE MANAGEMENT SYSTEM

Paper : MTCSE21C3

Time allowed : 3 Hours] *[Maximum marks : 100*

Note : Question No. 1 is compulsory. *Attempt **five** questions in total, first being compulsory and selecting **one** from each unit.*

1. (a) What is DBMS? Explain its various advantages and disadvantages. 5

   (b) Write short note on disaster recovery. 5

   (c) What is Serializability? Explain. 5

   (d) Describe the various advantages of object relational approach. 5

Unit–I

2. Write short note on the following: 2×10=20

   (i) Normal Forms

   (ii) Relational Algebra

3. Explain the concept of query processing in detail by taking suitable example. 20

Unit–II

4. What do you mean by concurrency control? Explain and contrast the timestamp-based ordering protocol. Also discuss the multi-version schemes. 20

5. What is database recovery? Explain recovery in centralized DBMS. 20

Unit–III

6. Explain the following : 2×10=20

   (i) Object oriented database

   (ii) Object query language

7. What is Distributed Database? Explain different approaches of distributed data storages. Why is data replication useful in Distributed Database? Explain. 20

Unit–IV

8. Define Data Warehousing. Explain data warehouse architecture in detail. 20

9. Explain Object Relational database in detail. 20

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M. Tech. 1st Semester (CSE) CBCS Scheme

Examination, December-2025

DATA WAREHOUSE AND MINING

Paper : MTCSE21C4

Time allowed : 3 Hours] *[Maximum marks : 100*

Note : Question No. 1 is compulsory. *Attempt **five** questions by selecting **one** question from each unit. All questions carry equal marks.*

1. **Compulsory Question :**

   (a) What is a data cube in OLAP?

   (b) What are the key characteristics of OLAP systems?

   (c) Explain the Direct Hashing and Pruning (DHP) technique in data mining.

   (d) What is the FP-Growth algorithm, and how does it differ from Apriori?

   (e) What is a decision three in classification?

   (f) Explain the role of the Gini index in the split algorithm.

(g) What is Web Content Mining?

(h) Define Web Usage Mining.

Unit–I

2. Explain the process of ETL (Extract, Transform, Load) in detail and its role in data warehousing. Discuss the design guidelines for implementing a data warehouse.

3. What is OLAP? What are the characteristics? What are the types of OLAP Servers? Write and explain OLAP operations.

Unit–II

4. Explain the FP-Growth algorithm and how it avoids candidate generation.

5. Discuss the working of the Apriori algorithm for association rule mining.

Unit–III

6. Discuss the Naïve Bayes method and its application in classification problems.

7. Describe the process of evaluating the predictive accuracy of a classification method and explain its importance.

Unit–IV

8. Explain the partitional and hierarchical clustering methods and discuss their advantages and disadvantages.

9. Discuss the challenges of dealing with large database in cluster analysis and the methods used to address them.

M. Tech. (CSE) 1st Semester, CBCS Scheme

Examination, December 2025

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Paper : MTCSE21C5

Time allowed : 3 Hours] *[Maximum marks : 100*

Note: *Attempt total **five** questions by selecting **one** question from each Section. **Question No. 1 is compulsory.***

1. (i) Design a DFA to accept the language L = {aa, aaab, aabaa, aabb, ...}, here aa is taken as a substring. 8×2.5=20

(ii) Process the string $\omega = abbb$ through the Moore Machine.

Q/Σ	a	b	Output
→ q_0	q_1	q_0	0
q_1	q_1	q_2	0
q_2	q_1	q_3	0
q_3	q_1	q_0	1

(iii) Write short note on Top Down parsing.

(iv) PDA is more powerful than DFA. Justify it.

(v) List the variants of Turing machine.

(vi) Write a note on Turing machine and computers.

(vii) Write a suitable note on PCP.

(viii) Define normal forms of grammar.

Section-A

2. (i) $M = (\{q_0, q_1, q_2\}, \{0, 1\}, \delta, q_0, \{q_2\})$ is a NDFA, where δ is given by : 8

$\delta(q_0, 0) = \{q_1, q_2\}$,	$\delta(q_0, 1) = \{q_0\}$,
$\delta(q_1, 0) = \{q_0, q_1\}$,	$\delta(q_1, 1) = \phi$
$\delta(q_2, 0) = \{q_1\}$,	$\delta(q_2, 1) = \{q_0, q_1\}$,

Construct an equivalent DFA by converting the states into substates method only. Draw the transition diagram and table both of DFA.

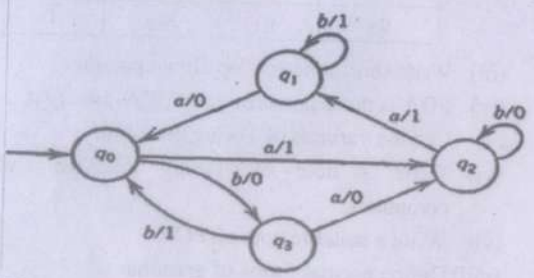
(ii) Construct a DFA for the regular expression $ba + (a + bb)\,a^*\,b$ 8

(iii) Convert the following grammar in CNF 4

$S \rightarrow aAS \mid a$

$S \rightarrow SbA \mid bS \mid a$

3. (i) Convert the following Mealy Machine to Moore Machine by dividing the sates into substates method. 8



(ii) Design a DFA that accept all strings starting with 0 and ending with 1. 8

(iii) Mathematical definition of mealy and Moore machines. 4

Section-B

4. (i) Construct a PDA equivalent to the following CFL. 10

$S \rightarrow 0BB$

$A \rightarrow 0S \mid 1S \mid 0$

Test whether 010^4 is in N(P)?

(ii) Construct a PDA for the language. 10

$L = \{WW^r \mid W \in \{a, b\}^*\}$

5. (i) Design a top-down parser for the following CFG and parse the word aabbba. 10

$S \rightarrow aX \mid bY,$

$X \rightarrow b \mid aYY,$

$Y \rightarrow a \mid bXX$

(ii) Construct a PDA for the language. 10

$L = \{0^n 1^m \mid n,\ m \geq 1\}$

Section-C

6. (i) Explain the halting problem of Turing machine. 6

(ii) Design a Turing Machine recognize strings containing equal number of a' s and b' s. Draw transition diagram and table both. Also perform the trace of machine by taking a suitable example. 10

(iii) Write a short note on restricted Turing machine. 4

7. (i) Design a T.M to perform proper subtraction. The machine computes $m - n$ if $m \geq n$ and output if zero if $m \leq n$. 10

(ii) Design a T.M. to accept the string 0^n1^n. Draw transition diagram and table both. Also perform trace of machine by taking a suitable example. 10

Section-D

8. (i) Explain Church Turing thesis. 10

(ii) Write a detailed note on primitive recursive functions. 10

9. Write notes on : 7+7+6

(i) Tractable decision problems

(ii) Recursive Enumerable language

(iii) Computability