Computer Network Exam Preparation Guide

Mumbai University | Subject Code: 48891 | Semester V

Document Overview

This comprehensive preparation package contains:

1. Analysis of 6 previous year question papers (2022-2024)
2. Top 30 most important questions with frequency analysis
3. Three practice papers following Mumbai University format
4. One predicted paper for 2025 examination
5. Study strategy and important formulas

Paper Analysis Summary

Papers Analyzed:

- December 2022 (Paper Code: 10014058)
- May 2023 (Paper Code: 10026348)
- December 2023 (Paper Code: 10038971)
- May 2024 (Paper Code: 10056909)
- December 2024 (Paper Code: 10065193)
- CN 2025 Practice Paper

Exam Pattern

Duration: 3 hours
Maximum Marks: 80

Structure:

- **Q1:** Compulsory - 4 sub-questions (5 marks each) = 20 marks
- **Q2-Q6:** Attempt any 3 questions (2 sub-questions per question)
  - Each sub-question = 10 marks
  - Total from Q2-Q6 = 60 marks

Format:

- Q1 typically has 4-5 short questions (5 marks each)
- Q2-Q5 have two parts (a) and (b) of 10 marks each
- Q6 typically has 4 short notes (5 marks each) OR two 10-mark questions

Topic-wise Frequency Analysis

Most Important Topics (Top 15):

Rank	Topic	Frequency	Marks Distribution
1	SDN (Software Defined Networking)	8	10 marks
2	IP Addressing (IPv4/IPv6)	7	10 marks
3	OSI & TCP/IP Reference Models	6	10 marks
4	Sliding Window Protocol	6	10 marks
5	TCP vs UDP	6	5 marks
6	LAN, MAN, WAN	5	5 marks
7	Transmission Media	4	10 marks
8	Channel Allocation Problem	4	10 marks
9	CRC Error Detection	4	10 marks
10	CSMA/CD Protocol	4	10 marks
11	NOX and POX Controllers	4	10 marks
12	Cisco SONA Architecture	4	5-10 marks
13	DNS	4	5 marks
14	Network Devices	3	5 marks
15	Cisco PPDIOO Methodology	3	10 marks

Question Type Distribution

Q1 (Compulsory) - Common Topics:

- Network basics (LAN/MAN/WAN, Topologies)
- Error detection (Hamming code, Parity check, CRC basics)
- Protocol comparison (TCP vs UDP)
- IP addressing basics
- Short definitions (SMTP, DNS, NAT, etc.)

Q2-Q5 (10 Marks Questions) - Core Topics:

- OSI and TCP/IP reference models (Q2a typically)
- Sliding window protocols
- Routing algorithms (Distance Vector, Link State)
- SDN architecture and controllers
- CSMA/CD with numerical problems
- Subnetting calculations
- TCP connection management
- Cisco architectures (PPDIOO, SONA, Hierarchical)

Q6 (Short Notes) - Common Topics:

- DNS, DHCP, NAT, FTP, SMTP, Telnet
- OpenFlow messages
- Sliding Window Protocol
- TCP Timers
- Cisco architectures
- Static vs Dynamic routing

High-Priority Numerical Problems

1. CSMA/CD Minimum Frame Size

Formula:

$$text{Minimum Frame Size}(bits) = 2 times text{Propagation Time} times text{Bandwidth}$$

Example: Network with 100 Mbps bandwidth and 25.6 μs propagation delay

$$= 2 times 25.6 times 10^{-6} times 100 times 10^{6} = 5120 text{ bits} = 640 text{ bytes}$$

2. CRC Error Detection

Steps:

1. Append (r-1) zeros to data (where r = degree of polynomial + 1)
2. Divide by generator polynomial using modulo-2 division
3. Remainder is the CRC code
4. Append CRC to original data

Example: Data = 10011101, Generator = $x^3 + 1$ (1001)

- Append 3 zeros: 10011101000
- Divide by 1001, remainder = 100
- Transmitted data = 10011101100

3. Hamming Code

Formula for parity bits:

$$2^r geq m + r + 1$$

where m = data bits, r = parity bits

Example: For 4 data bits (1010)

- $2^r geq 4 + r + 1$ → r = 3
- Total bits = 7 (positions 1,2,3,4,5,6,7)
- Parity bit positions: 1, 2, 4 (powers of 2)
- Data bit positions: 3, 5, 6, 7

For even parity with data 1010:

- P1 (checks 1,3,5,7): positions contain D1,D2,D4 = 1,0,0 → P1=1
- P2 (checks 2,3,6,7): positions contain D1,D3,D4 = 1,1,0 → P2=0
- P4 (checks 4,5,6,7): positions contain D2,D3,D4 = 0,1,0 → P4=1

Result: 1010010 (P1 P2 D1 P4 D2 D3 D4)

4. Subnetting

Formula:

- Number of subnets = 2^n (n = borrowed bits)
- Hosts per subnet = $2^h - 2$ (h = host bits)

Example: Class C network 192.168.10.0/24 with mask 255.255.255.192

- Original: 24 network bits, 8 host bits
- New mask: 26 network bits (borrowed 2 bits)
- Number of subnets = $2^2 = 4$
- Hosts per subnet = $2^6 - 2 = 62$

Subnet Details:

1. **Subnet 1:** 192.168.10.0/26
   - First host: 192.168.10.1
   - Last host: 192.168.10.62
   - Broadcast: 192.168.10.63
2. **Subnet 2:** 192.168.10.64/26
   - First host: 192.168.10.65
   - Last host: 192.168.10.126
   - Broadcast: 192.168.10.127

5. ALOHA Throughput

Pure ALOHA:

$$S = Gtimese^{-2G}$$

Maximum throughput at G=0.5: $S_{max} = 0.184$ (18.4%)

Slotted ALOHA:

$$S = Gtimese^{-G}$$

Maximum throughput at G=1: $S_{max} = 0.368$ (36.8%)

Important Diagrams to Practice

Must-Know Diagrams:

1. ✓ OSI Reference Model (7 layers with protocols)
2. ✓ TCP/IP Model (4 layers with protocols)
3. ✓ Sliding Window Protocol (Go-Back-N and Selective Repeat)
4. ✓ SDN Architecture (Control Plane, Data Plane, Management Plane)
5. ✓ TCP Three-Way Handshake (SYN, SYN-ACK, ACK)
6. ✓ TCP Connection Release (Four-way handshake)
7. ✓ Network Topologies (Bus, Star, Ring, Mesh, Tree)
8. ✓ Cisco Hierarchical Model (Core, Distribution, Access)
9. ✓ Cisco SONA Architecture (3 layers)
10. ✓ IPv4 Header Format (all fields labeled)
11. ✓ Transmission Media Types (Coaxial, Twisted Pair, Fiber)

12. ✓ CSMA/CD Flow Diagram

Comparison Tables to Memorize

1. TCP vs UDP

Parameter	TCP	UDP
Connection	Connection-oriented	Connectionless
Reliability	Reliable	Unreliable
Ordering	Guaranteed	Not guaranteed
Speed	Slower	Faster
Error Checking	Yes (extensive)	Yes (basic checksum)
Flow Control	Yes	No
Congestion Control	Yes	No
Header Size	20-60 bytes	8 bytes
Applications	HTTP, FTP, SMTP	DNS, DHCP, Video streaming

2. IPv4 vs IPv6

Feature	IPv4	IPv6
Address Size	32 bits	128 bits
Address Format	Dotted decimal (192.168.1.1)	Hexadecimal (2001:0db8::1)
Header Size	20-60 bytes	40 bytes (fixed)
Checksum	Yes	No
Security	Optional (IPSec)	Mandatory (IPSec)
Address Space	4.3 billion	340 undecillion
Fragmentation	Routers and hosts	Only hosts

3. Circuit vs Packet Switching

Feature	Circuit Switching	Packet Switching
Connection	Dedicated path	No dedicated path
Resource Allocation	Fixed	Dynamic
Bandwidth	Guaranteed	Shared
Setup Time	Required	Not required
Delay	Fixed	Variable
Efficiency	Low (idle time)	High

Feature	Circuit Switching	Packet Switching
Example	Telephone	Internet

4. OSI vs TCP/IP Layers

OSI Model	TCP/IP Model	Protocols
Application	Application	HTTP, FTP, SMTP, DNS
Presentation	Application	-
Session	Application	-
Transport	Transport	TCP, UDP
Network	Internet	IP, ICMP, ARP
Data Link	Network Access	Ethernet, WiFi
Physical	Network Access	-

Key Definitions

Network Layer:

1. **LAN (Local Area Network):** Limited geographical area (building, campus), high speed, low error rate
2. **MAN (Metropolitan Area Network):** City-wide coverage, medium speed
3. **WAN (Wide Area Network):** Large geographical area (countries), lower speed, higher error rate

Protocols:

1. **DNS:** Translates domain names to IP addresses
2. **DHCP:** Automatically assigns IP addresses (DORA process)
3. **NAT:** Translates private IP to public IP
4. **FTP:** File transfer protocol (port 20, 21)
5. **SMTP:** Email sending protocol (port 25)
6. **Telnet:** Remote login (port 23)

SDN Components:

1. **Control Plane:** Makes forwarding decisions
2. **Data Plane:** Forwards packets based on control plane decisions
3. **Management Plane:** Configuration and monitoring

Study Schedule Recommendation

Week 1-2: Core Topics

- Day 1-2: OSI and TCP/IP models
- Day 3-4: Sliding Window Protocols
- Day 5-6: Error Detection (CRC, Hamming)
- Day 7-8: IP Addressing and Subnetting

- Day 9-10: CSMA/CD and ALOHA
- Day 11-12: Routing Algorithms
- Day 13-14: Practice numerical problems

Week 3: Advanced Topics

- Day 1-3: SDN Architecture
- Day 4-5: NOX and POX Controllers
- Day 6-7: Cisco Architectures (PPDIOO, SONA, Hierarchical)
- Day 8-9: TCP Connection Management
- Day 10-11: Application Layer Protocols
- Day 12-14: Practice diagrams and short notes

Week 4: Revision & Practice

- Day 1-3: Solve Practice Paper 1
- Day 4-6: Solve Practice Paper 2
- Day 7-9: Solve Practice Paper 3
- Day 10-12: Solve Predicted Paper 2025
- Day 13-14: Final revision of top 30 questions

Exam Day Tips

Time Management:

- **Q1 (20 marks):** Allocate 35-40 minutes
- **Each 10-mark question:** Allocate 25-30 minutes
- **Reserve 15 minutes** for final review

Answer Writing Strategy:

1. **For 10-mark questions:**
   - Introduction (1 mark)
   - Main explanation with diagram (7-8 marks)
   - Conclusion/Example (1 mark)
2. **For 5-mark questions:**
   - Definition (1 mark)
   - Explanation (3 marks)
   - Example/Diagram if applicable (1 mark)
3. **For numerical problems:**
   - Write given data (0.5 mark)
   - Write formula (1 mark)
   - Show step-by-step calculation (7 marks)
   - Write final answer with units (1.5 marks)

Scoring Tips:

- Draw neat diagrams with labels
- Underline important points
- Use bullet points for clarity
- Write legibly
- Attempt all parts of a question
- If stuck, move to next question

Common Mistakes to Avoid

1. ✕ Not drawing diagrams when asked for "with neat diagram"
2. ✕ Missing units in numerical answers
3. ✕ Not showing step-by-step calculations
4. ✕ Writing same content for different questions
5. ✕ Spending too much time on Q1
6. ✕ Not attempting all questions
7. ✕ Poor time management
8. ✕ Not reading question carefully (compare vs explain)

Quick Revision Checklist

Before Exam (1 day before):

- [ ] Revise all formulas
- [ ] Practice 5 key diagrams
- [ ] Go through comparison tables
- [ ] Solve one complete paper
- [ ] Revise top 10 important questions
- [ ] Sleep well

On Exam Day:

- [ ] Reach 30 minutes early
- [ ] Bring calculator, ruler, pencil
- [ ] Read paper completely first (5 minutes)
- [ ] Mark questions you'll attempt
- [ ] Start with Q1
- [ ] Attempt your strongest question from Q2-Q6 first
- [ ] Leave some space if you want to add more later
- [ ] Review your paper before submission

Good luck with your preparation!

Remember: Consistency is key. Study smart, not just hard. Focus on understanding concepts rather than rote memorization.