

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5723

L

Unique Paper Code : 2344000020

Name of the Paper : Computer Networks

Name of the Course : **Generic Elective (GE - Common Program)**

Semester : VI

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. The paper has **two** sections. **All** questions in **Section A** are compulsory.
3. Attempt any **four** questions from **Section B**.
4. Parts of a question must be attempted together.

Section A

- Q1 (a) Define a Computer Network. Distinguish between a LAN and a WAN based on geographical scale and ownership. 3
- (b) In the context of the OSI model, which layer is responsible for: 3
- (i) Physical transmission of bits.
 - (ii) Ensuring end-to-end delivery of messages.
 - (iii) Managing user sessions?
- (c) What mechanism in HTTPS websites maintains user login session across multiple pages? 3
- (d) Briefly explain how fiber optic cables transmit data. Why are they preferred for long-distance communication? 3
- (e) What is the purpose of following flag bits with respect to the TCP header? 3
- (i) SYN
 - (ii) ECE
 - (iii) URG
- (f) Write the formula for the number of connections required in a full-mesh network with n devices. How many devices are there in the network if a full mesh network has 45 connections? 3
- (g) Compare the Virtual Circuit approach and Datagram Network. 3
- (h) A link uses Frequency Division Multiplexing for 8 channels, each with 3 kHz bandwidth and a 100 Hz guard band. Find the total bandwidth required. 3
- (i) A device is assigned the address 2001:db8::1. Identify the IP version and explain one advantage of it. 3
- (j) A channel uses four signal levels and has a bandwidth of 150 KHz. What is the maximum data rate achievable using the Nyquist formula? 3

P.T.O.

Section B

- Q2 (a) The following character encoding is used in a data link protocol: 7
A: 01000111 B: 11100011 FLAG: 01111110 ESC: 11100000
Show the bit sequence transmitted (in binary) for the four-character frame
A B ESC FLAG when each of the following framing methods is used:
(i) Byte count.
(ii) Flag bytes with byte stuffing.
(iii) Starting and ending flag bytes with bit stuffing.
- (b) Construct a Hamming code for the data 1010101 using even parity. Clearly 8
show:
(i) Number of parity bits
(ii) Position of parity bits
(iii) Final codeword
(iv) The received codeword is 10101000101. Detect and correct the error,
and write the correct data bits.
- Q3 (a) Discuss the advantages and disadvantages of allowing browsers to be 7
extended using plug-ins and helper applications. Can a single-threaded web
server handle multiple client requests at the same time? Justify your answer
with reasons related to server architecture and performance. Describe the
role of multithreading in improving Web server throughput
- (b) An organization is assigned the IP address 192.168.10.0/24. The network 8
administrator needs to create one subnet to accommodate at least 120
hosts.
For the required subnet, determine:
(i) The required subnet mask in dotted-decimal notation
(ii) The number of usable host IP addresses available
(iii) The network address and broadcast address
(iv) The range of usable IP addresses
- Q4 (a) Given the following weighted graph, apply Dijkstra's Algorithm to find 7
the shortest path from source node A to all other nodes.
Edges:
A $\rightarrow$ B = 4
A $\rightarrow$ C = 2
B $\rightarrow$ C = 5
B $\rightarrow$ D = 10
C $\rightarrow$ D = 3
C $\rightarrow$ E = 4
D $\rightarrow$ E = 1

- (i) Show step-by-step execution of Dijkstra's algorithm.
 - (ii) Write the final shortest distances from A to all nodes.
 - (iii) Draw the sink tree.
- (b) A network uses Carrier Sense Multiple Access. 8
Stations A, B, and C attempt to transmit data simultaneously:
A senses channel idle and transmits immediately
B waits for a random time before transmitting
C continuously senses before transmission
- (i) Identify which CSMA type each station is using (1-persistent, non-persistent, or p-persistent).
 - (ii) Explain what happens when two stations transmit at the same time.
- Q5 (a) Write short notes on the following: 8
(i) Address Resolution Protocol
(ii) Internet Control Messaging Protocol
(iii) Piggybacking
(iv) Domain Name System
- (b) A sender uses Go-Back-N ARQ with a window size of 4. The sender 7
transmits frames 1, 2, 3, and 4. Frame 2 is lost during transmission.
- (i) Show, with proper reasoning, which frames will be retransmitted in Go-Back-N ARQ.
 - (ii) Explain how Go-Back-N ARQ handles acknowledgements after frame loss.
 - (iii) Explain how Selective Repeat ARQ would handle the same situation differently. Which frames are retransmitted, and how does buffering work at the receiver end?
- Q6 (a) Explain the TCP/IP Reference Model as a layered architecture in Computer 7
Networks. Write the layers in the correct order. For each layer, mention any two functions. Also, briefly explain the concept of encapsulation and decapsulation in data transmission.
- (b) Explain simplex, half duplex, and full duplex transmission modes with a 8
suitable example. Also mention one advantage and one limitation of each mode.
- Q7 (a) Explain the role of the following network devices in a computer network: 6
(i) Router
(ii) Switch
(iii) Hub

- (b) Answer the following in one word: 4
- (i) Which theorem gives the maximum theoretical data rate of a channel?
 - (ii) Name the error detection technique that uses polynomial division
 - (iii) Name the protocol used to map a MAC address to an IP address
 - (iv) Ethernet addressing is based on which type of address?
 - (v) Name the type of network that connects computers across countries.
 - (vi) Name the transmission medium that uses light pulses in glass or plastic cables.
 - (vii) The OSI layer responsible for end-to-end delivery of messages.
 - (viii) Which multiplexing technique divides a channel into time slots?
- (c) Compare the Twisted Pair Cable, Coaxial Cable and Fiber Optic Cable in terms of data rate, cost, and transmission distance. 5