

**FUNDAMENTALS OF COMPUTER NETWORKS
(CSEN 4143)**

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) When the channel is noisy, the maximum capacity is determined by
(a) Nyquist's formula (b) Shannon's formula
(c) Minimum of Nyquist and Shannon (d) Maximum of Nyquist and Shannon
- (ii) The total no of links required to connect n devices using Mesh topology is
(a) $2n$ (b) $n(n+1)/2$
(c) $n(n-1)/2$ (d) n^2
- (iii) A device is sending out data at the rate of 1000 bps. How long does it take to send a file of 100,000 characters?
(a) 200s (b) 400s
(c) 600s (d) 800s
- (iv) In Go_back_n ARQ, if frames 4, 5, 6 are received successfully then the receiver can send an ACK to the sender
(a) 5 (b) 6
(c) 7 (d) 8
- (v) The length of an Ethernet address is
(a) 16 bits (b) 32 bits
(c) 48 bits (d) 64 bits
- (vi) The address space of IPV4 is
(a) 24 (b) 216
(c) 232 (d) 248
- (vii) In distance vector routing each node periodically shares its routing table with
(a) every other node (b) immediate neighbour
(c) any one neighbour (d) none of the above

- (viii) RIP routing protocol uses the following algorithm
 (a) Dijkstra's Shortest Path (b) Bellman Ford
 (c) Floyd Warshall (d) None of the above
- (ix) Which of the following protocols does not use TCP in general as the transport layer protocol?
 (a) http (b) dns
 (c) smtp (d) Telnet
- (x) The technique in which a congested node stops receiving data from the immediate upstream node or nodes is called as:
 (a) Admission policy (b) Backpressure
 (c) Forward signalling (d) Backward signalling

Fill in the blanks with the correct word

- (xi) Circuit switching takes place at the _____ layer.
- (xii) A digital signal has eight levels, number of bits needed per level is _____.
- (xiii) When IP receives a packet that is erroneous, it _____ the packet.
- (xiv) The bit rate of Manchester coding is _____ the baud rate.
- (xv) The technique of temporarily delaying outgoing acknowledgements so that they can be hooked onto the next outgoing data frame is called _____

Group - B

2. (a) Explain PCM with suitable diagram. [[CO2](Remember/IOCQ)]
 (b) Draw and explain the constellation diagram for Amplitude shift keying, assume any suitable voltage for your diagram. [[CO2](Analyse/IOCQ)]
 (c) Explain the concept of multiplexing in computer networks. Compare and contrast Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM) with suitable diagrams. [[CO2](Understand/IOCQ)]
 (d) What is the role of a TSI (time-slot-interchange) in a Time division multiplexer? [[CO3](Understand/HOCQ)]
4 + 2 + 3 + 3 = 12
3. (a) Explain digital modulation techniques ASK, FSK, and PSK. Draw the modulated signals for binary data "110" using each technique. [[CO2](Apply/LOCQ)]
 (b) What are the propagation time and the transmission time for a 2.5 kbyte message if the bandwidth of the network is 1Gbps? Assume that the distance between the sender and the receiver is 12,000 km and that light travels at 2.4×10^8 m/s. [[CO2](Understand/IOCQ)]
 (c) Explain with a suitable example, how the setup request frame and the acknowledgement frame contribute towards updating the entries in the forwarding tables of the switches in Virtual Circuit Switching. [[CO3](Analyze/IOCQ)]
 (d) How does the number of twists in a twisted pair cable, affect the signal quality? [[CO2](Analyze/LOCQ)]
3 + 3 + 4 + 2 = 12

Group - C

4. (a) Illustrate the Go-Back-N ARQ protocol with suitable diagram. State its advantage over the Selective Repeat ARQ protocol. *[[CO3)(Analyse/IOCQ]]*
- (b) What do you understand by the term 'byte stuffing'? Explain the byte stuffing process with an example showing how special characters are handled at both sender and receiver sides. *[[CO3)(Understand/IOCQ]]*
- (c) A system uses Stop and Wait ARQ Protocol. If the round trip time is 40 ms and each frame transmission time is 10 ms, calculate the efficiency of the protocol. What would be the efficiency if Go-Back-N with window size 4 is used instead? *[[CO3)(Apply/IOCQ]]*
- (3 + 2) + (1 + 2 + 2) + 2 = 12**
5. (a) How is vulnerable time calculated for ALOHA protocol? How does the vulnerability time differ in Slotted ALOHA? *[[CO6)(Remember/HOCQ]]*
- (b) There are four stations sharing a channel and using CDMA for access control. How many orthogonal sequences will be needed? Generate the required orthogonal sequences using Walsh table. *[[CO2)(Understand/IOCQ]]*
- (c) What are the strategies used to avoid collisions in CSMA/ CA protocol. *[[CO2)(Analyze/IOCQ]]*
- (2 + 2) + (2 + 3) + 3 = 12**

Group - D

6. (a) A small block of IP addresses are assigned to a small organization. One of the assigned IP addresses are 192.12.24.34/27. What is the first IP address, last IP address and total number of IP addresses in the block? *[[CO3)(Apply/LOCQ]]*
- (b) An ISP is granted a block of addresses starting with 190.100.0.0/16 and needs to distribute these among 3 groups of customers.
- (i) 64 customers, 256 addresses each
 - (ii) 128 customers, 128 addresses each
 - (iii) 128 customers, 64 addresses each.
- Design the sub blocks and identify the number of unused IP addresses. *[[CO3)(Apply/HOCQ]]*
- (c) Why did the researchers come up with the classless addressing system? *[[CO3)(Understand/LOCQ]]*
- 3 + 7 + 2 = 12**
7. (a) An IP packet is sent from a machine A with IP address 192.168.11.12 in Network 1 to a machine B with IP address 192.168.7.15 in Network 2. Both the networks are LANs attached to the same organizational network. Show the header fields of the IP packet delivered to B from A as well as the response generated from B back to A. You may assume any packet content. *[[CO3)(Analyse/IOCQ]]*
- (b) Describe the steps of Link State routing protocol. Mention one key difference of this protocol with the Distance Vector protocol. *[[CO4)(Apply/HOCQ]]*
- (c) What is the purpose of "Time to live (TTL)" field in the IP header? *[[CO3)(Remember/LOCQ]]*
- 5 + (3 + 1) + 3 = 12**

Group - E

8. (a) What is the silly window syndrome? How does Nagle's algorithm address the issue? [[C03](Remember/LOCQ)]
- (b) Explain TCP's Additive Increase Multiplicative Decrease (AIMD) algorithm with a diagram. [[C03](Understand/IOCQ)]
- (c) Explain with a diagram the meaning and significance of cumulative acknowledgement in the context of TCP. [[C06](Analyse/IOCQ)]
- (2 + 2) + 4 + 4 = 12**
9. (a) Why is TCP referred to as a connection oriented protocol. [[C03](Understand/IOCQ)]
- (b) Explain the 3 way handshaking method in TCP with diagram. [[C03](Understand/LOCQ)]
- (c) Suppose a TCP connection is transferring a file of 4,000 bytes. The first byte is numbered 8,000. If each segment carries a 1000 bytes what will be the sequence numbers of each segment? [[C03](Apply/IOCQ)]
- 3 + 5 + 4 = 12**
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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	22.9	58.3	18.8