(b) What is the basic difference in Token Bucket and Leaky Bucket approaches for traffic shaping? A certain system employing Token Bucket has an initial token capacity of 1 M. Tokens are generated at the rate of 1 M per second. How long can this system handle a bursty traffic of 20 Mbps?

(c) Assume the MSS (Maximum Segment Size) is 1 kB. For TCP, Receiver window size is 18 kB. Threshold is 16kB initially. Initially the congestion window size is equal to one MSS.
Show in a figure, the congestion window size vs the transmission number for 10 transmissions. Explain your computation.

3 + (2 +2) + 5 = 12

9. (a) Mention two parameters for QoS (Quality of Service) in networks and describe each very briefly.

(b) How is the timeout of retransmission timer calculated?

(c) Suppose you want to make UDP a reliable and connection oriented protocol just like TCP. What are the design changes or additions you should include in UDP for this purpose?

(d) Suppose you have a telnet terminal using a TCP connection to another machine. You type in a character and send it over the telnet connection. The receiver acknowledges this character (essentially a byte). What is the overhead here assuming standard TCP header is used? Is there any way to more efficiently use the TCP send / ACK mechanism here?

2 + 4 + 3 + 3 = 12

COMPUTER NETWORKS
(CSEN 3201)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) (I) IP (x) Network Layer
(II) ARP (y) Link Layer
(III) DHCP (z) Application Layer.
Which of the following gives the best match between left and right sides?
(a) I-x, II-y, III-z (b) I-x, II-z, III-x
(c) I-y, II-z, III-x (d) I-z, II-y, III-x.

(ii) Which of the following is not suitable for satellite communication?
(a) Go-Back-N (b) Selective Repeat
(c) Stop and Wait (d) none of the above.

(iii) Which of the following does not address the IPv4 address scarcity problem?
(a) Proxy ARP (b) Reverse ARP
(c) NAT (d) Private Addresses.

(iv) The total number of links required to connect *n* devices using Mesh topology is
(a) 2^n (b) n^2 (c) n(n+1)/2 (d) n(n-1)/2.

(v) In selective repeat ARQ sliding window protocol, the receiver window size is
(a) one (b) 2^m-1 (c) 2^{m-1} (d) 2^m.

(vi) Digital signal has eight levels. How many bits are needed per level?
(a) 0 (b) 4 (c) 3 (d) 8.

(vii) In TCP
(a) the initial congestion window size equals the maximum segment size (MSS)
(b) the initial segment size equals the receiver window size
(c) during the slow start phase, congestion window increases linearly at a slow pace
(d) the threshold is initially set to MSS.

(viii) Process to Process delivery is the function of..... layer
(a) physical layer (b) data link layer
(c) transport layer (d) network layer.

(ix) The length of the sequence number in a sliding window protocol depends on all the parameters below except:
(a) Distance between stations (b) RTT
(c) Retransmission timeout (d) Channel capacity.

(x) NAT (Network Address Translation) is a problem child in the otherwise very robust Internet protocol architecture, because:
(a) it violates the strict protocol hierarchy requirement
(b) it increases the packet processing delay
(c) it is a security headache
(d) it adds fuel to the IPv4 address scarcity problem.

Group - B

2. (a) A station is sending a bit sequence 1010... repeatedly over a wired channel. What is the ideal bandwidth requirement of the channel?

(b) Assume that the channel is noiseless. The bit interval is 10 nanosecond. What is the bandwidth requirement of the channel? Is it different from that in case (a)? Comment why.

(c) The more the number of twists in a twisted pair cable, the better is signal quality. Explain why.

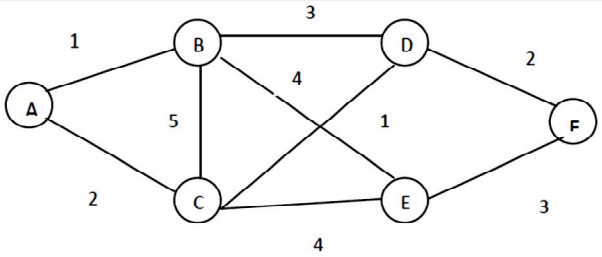
(d) Show the Manchester and Differential Manchester (DM) encodings for the following bit stream: 10111100. What is the relationship between Baud Rate and Bit Rate in DM?

2 + (2 + 1) + 2 + (3 + 2) = 12

3. (a) Compare between Circuit Switching and Virtual Circuit technologies.

(b) You want to transfer a huge file (say 100 GB) between a store and the headquarter (HQ) containing sales records in the store. There

7. (a)



The above graph represents a certain network. Edges represent link cost between various nodes (stations).
Assume Distance Vector protocol is used.
Initially every node knows the distance to its neighbours. The initial routing table for the node C is shown below:

Destination	Distance	Next Hop
A	2	A
B	5	B
C	-	-
D	1	D
E	4	E
F	Infinity	-

Show the updated routing table for C after three rounds of distance metric exchanges among its neighbours.

(b) Now assume Link State protocol is used.
(i) Show the link state packets from various nodes to C. Verify that the graph constructed at node C is indeed the graph given in the above figure.

(ii) Starting from C, construct a shortest path following the standard algorithm to all destination nodes. Is the routing table constructed same as in case of Distance Vector?

6 + (3 + 3) = 12

Group - E

8. (a) Why is two way handshaking sufficient for connection termination whereas a three way handshaking is required for connection establishment?

are a number of hops between the store and HQ. Will you choose message switching or packet switching?

(c) You have a chat client application running on a machine (say A) with the NW interface address 192.168.12.12 sending a message "Hello" to the chat server machine (192.168.12.1) (say S). Show the header and payload information for this message for all the layers on the A and S (you just need to how the address fields in the header in each layer). The chat client and server is talking over the port number 5000. You are free to make any more assumptions as required.

(d) A new type of T1 line, called T11 is created. It can carry traffic from 300 Hz to 3 kHz. T11 can operate in a noiseless environment. Assume three samples every time period are required to reconstruct the signal at the receiver end. The number of bits per sample is six. What is the maximum data rate supported by T11 if all other parameters remain as it is with respect to the T1 case? T1 channels combine 24 voice channels.

2 + 2 + 4 + 4 = 12

Group - C

4. (a) To increase reliability redundant links can be used between bridges. However, that poses a problem as well. What is the problem and how does spanning tree bridge solve the problem?

(b) A network implementing CDMA needs orthogonal chip sequences for it's six stations. Generate the required number of chip sequences. Also mention the properties of orthogonal chip sequences.

(c) A number of 10 Mbps Ethernet stations are attached in a bus configuration network. The maximum distance between any two stations in the network is 3 km. Assume signal propagation speed is 3×10^8 m/sec. What is the minimum time after which a station can be sure of no collision in this network?

(d) If all the 10 Mbps Ethernet stations are replaced by 10 Gbps stations, what will be the minimum frame size required to detect a collision? Suppose the smallest frame that is possible in the faster network carries 20 bytes of data. Assuming all other Ethernet header fields remain unchanged, how many such smallest frames need to be combined before the minimum frame size requirement is satisfied?

3 + 3 + 3 + 3 = 12

5. (a) Assume for a CRC scheme, the generator polynomial is $1+ x + x^4$. The message to be sent is 10101100. Compute the modification to be made to this message to enable use of the CRC scheme.

(b) If the message to be sent is 11 bits long, what will be the length of its corresponding Hamming Code? Can this code be used to correct any error or just be used for error detection only?

(c) Why is it essential to have a 1-bit sequence number for the Stop and Wait protocol to work properly?

(d) A certain sliding window protocol uses 3 bit sequence number. Consider the following cases:

Case 1: Go-Back-N Protocol. The sender chooses a window size of seven. What could be a possible Receiver window size? With these window sizes, show how the sender and receiver windows slide, when the sender sends frames 0 through 7, the receiver receives all of them properly but none of the ACKs make it back to the sender.

Case 2: Selective Repeat. The sender chooses a window size of four. What could be a possible Receiver window size? With these window sizes, show how the sender and receiver windows slide, when the sender sends frames 0 through 3, the receiver receives all of them properly but none of the ACKs make it back to the sender.

3 + 3 + 2 + (2 + 2) = 12

Group - D

6. (a) Explain why classfull addressing became inadequate and how classless addressing the issue.

(b) An organization is granted a block of addresses with the beginning address 14.24.74.0/24. The organization needs to have three subblocks of addresses to use in its three subnets: one subblock of 10 addresses, one subblock of 60 addresses, and one subblock of 120 addresses. Design the subblocks.

(c) What is a loop back address and why is it needed?

(d) Mention the importance of the following fields in an IP packet: fragmentation offset, TTL and source / destination addresses.

3 + 2 +(4+ 3) = 12