COMPUTER NETWORKS
(CSBS 3101)

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) Assume that Source S and Destination D are connected through an intermediate router R. How many times a packet has to visit the network layer and data link layer during a transmission from S to D?
(a) Network layer – 4 times, Data link layer – 4 times
(b) Network layer – 4 times, Data link layer – 6 times
(c) Network layer – 2 times, Data link layer – 4 times
(d) Network layer – 3 times, Data link layer – 4 times.

(ii) In CSMA/CD, what happens after a collision is detected?
(a) The transmission is stopped, and the sender immediately retransmits the frame
(b) The transmission is stopped, and the sender waits for a random backoff time before retransmitting
(c) The sender waits for an acknowledgment before retransmitting
(d) The sender continues transmitting while trying to correct the collision.

(iii) Given an IP address is 180.25.21.172 and subnet mask is 225.225.192.0. What is the subnet address?
(a) 180.25.21.0 (b) 180.25.0.0
(c) 180.25.8.0 (d) 180.0.0.0

(iv) Which of the following is true about UDP?
(a) It guarantees delivery of data
(b) It provides connection-oriented communication
(c) It is a connectionless protocol
(d) It provides error correction.

(v) Which of the following QoS techniques is used to regulate traffic by controlling the rate at which packets are sent?
(a) Leaky bucket (b) Token bucket
(c) Traffic shaping (d) Both (a) and (b).

(vi) In Selective Repeat ARQ, what happens when a packet is lost or corrupted?
(a) All subsequent packets are discarded
(b) The sender stops transmitting
(c) Only the lost or corrupted packet is resent
(d) The window size is reduced.

(vii) What is the administrative distance of OSPF?
(a) 90 (b) 100 (c) 110 (d) 120.

(viii) Which one of the following task is not done by data link layer?
(a) Framing (b) Error control
(c) Channel coding (d) Flow control.

(ix) Which device connects different network segments at the Data Link layer?
(a) Gateway (b) Repeater (c) Hub (d) Bridge.

(x) Which of the following is a characteristic of static routing?
(a) Routes are manually configured
(b) Routes are dynamically learned and adjusted
(c) Routes are automatically updated based on network conditions
(d) It does not use routing tables.

Fill in the blanks with the correct word

(xi) In Go-Back-N ARQ, if frames 4, 5, 6 are received successfully then the receiver can send an ACK _____ to the sender.

(xii) BGP is primarily used for _____ routing between different autonomous systems on the Internet.

(xiii) DHCP automatically assigns _____ to devices on a network.

(xiv) The IPv4 header includes a field called the _____ field that specifies the length of the IP header.

(xv) In an Ethernet network with a bus topology, increasing the number of devices connected to the network leads to an increase in _____.

Group - B

2. (a) Let the information sequence is 101110110101010 and the divisor polynomial is x3 + x2 + 1. Find the sent codeword corresponding to the information sequence. Suppose that the codeword has a transmission error in the 4th bit from LSB. What does the receiver obtain when it does its error checking?
[(CO3)(Apply/IOCQ)]

(b) Differentiate between router and switch. *[(CO1)(Understand /LOCQ)]*

(4 + 4) + 4 = 12

3. (a) Which of the following generator polynomial guarantees that a single bit error is caught? Explain your answer.
(i) x4
(ii) 1

(iii) x+1. *[(CO3)(Apply/IOCQ)]*

(b) Three packet-switched networks each contain n nodes. The first network has a star topology with a central switch, the second is a (bidirectional) ring, and the third is fully interconnected. What are the best, average, and worst case transmission paths in hops? *[(CO2)(Analyse/HOCQ)]*

(c) A system has an n-layer protocol hierarchy. Application generates message of length M bytes. At each of the layers, an h byte header is added. What fraction of bandwidth is filled with headers? *[(CO1)(Apply/IOCQ)]*

4 + 4 + 4 = 12

Group - C

4. (a) Explain with suitable diagrams why the receiver window size in selective repeat ARQ protocol should be equal to 2^(m-1). *[(CO3)(Analyse/IOCQ)]*

(b) Explain the working of CSMA/CD protocol with a suitable flowchart. *[(CO3)(Understand/LOCQ)]*

(c) Explain the concept of bit stuffing with suitable examples. *[(CO3)(Understand/LOCQ)]*

3 + 6 + 3 = 12

5. (a) Draw the phase diagram of Point to Point Protocol. *[(CO3)(Understand/LOCQ)]*

(b) The sender has a sliding window size = 3. Go-back-N protocol is used. Discuss the behaviour of the sending & receiving sliding window under the following cases:
Case 1: Frame 2 is lost in transition
Case 2: Frame no. 2 is received by the receiver correctly but ACK is lost. *[(CO3)(Analyse/IOCQ)]*

(c) Draw the control field of HDLC S-frame. *[(CO3)(Remember/LOCQ)]*

4 + 6 + 2 = 12

Group - D

6. (a) Draw the ARP packet header and clearly mentation the importance of each field. *[(CO4)(Understand/LOCQ)]*

(b) An organization needs total 12 subnets divided into following blocks:
2 subnets each with 128 addresses
2 subnets each with 64 addresses
2 subnets each with 32 addresses
3 subnets each with 16 addresses
3 subnets each with 4 addresses
An ISP provides an address 152.56.72.0/22, to them. Design the subnets. Find out how many addresses are still available after this allocation. *[(CO4)(Apply/IOCQ)]*

4 + 8 = 12

7. (a) In an IPv4 datagram, the M/F bit is 0, the value of HLEN is 10, the value of total length is 400 and the fragment offset value is 300. Determine the position of the datagram, the sequence numbers of the first and the last bytes of the payload. *[(CO4)(Apply/IOCQ)]*

(b) A router with IP address 192.168.10.1 (MAC address 45:12:64:A2:CC:4D) has received a ARP request packet from a host with IP address 192.168.20.10 and MAC address 40:21:34:2A:DC:AA. Show the ARP request and reply packets. *[(CO4)(Apply/IOCQ)]*

6 + 6 = 12

Group - E

8. (a) TCP opens a connection using an initial sequence number (ISN) 14,454. The other party opens the connection with an ISN of 21,732. Show the three TCP segments during the connection establishment. *[(CO5)(Apply/IOCQ)]*

(b) A leaky bucket is used to control liquid flow. How many gallons of liquid are left in the bucket if the output rate is 5gal / min? Assume that there is an input burst of 100 gal/min for 12 sec, and there is no input for 48 sec. *[(CO5)(Apply/IOCQ)]*

(c) What do you mean by Jitter in communication? *[(CO5)(Understand/LOCQ)]*

6 + 4 + 2 = 12

9. (a) Assume that the capacity of a token bucket is 250 KB and maximum size of input buffer is 1 MB. Token arrives at a rate allowing output at 2 MB/sec. Maximum speed of the network is 25 MB/sec. Now if 1 MB burst data arrives for 40 msecs, calculate the maximum burst time at the output. *[(CO5)(Apply/IOCQ)]*

(b) State the differences between TCP and UDP. *[(CO5)(Understand/LOCQ)]*

(c) Distinguish between open-loop congestion control and closed-loop congestion control. *[(CO5)(Understand/LOCQ)]*

(d) Why do some applications use UDP protocol? *[(CO5)(Understand/LOCQ)]*

4 + 3 + 3 + 2 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	34.38	61.46	4.17