

**COMPUTER NETWORKS  
(IOT2103)**

**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) Which type of network topology requires a central controller or hub?  
(a) Bus (b) Ring  
(c) Star (d) Mesh
- (ii) Which layer of the OSI model is responsible for error detection and correction?  
(a) Transport (b) Data Link  
(c) Network (d) Physical
- (iii) If a single-bit error occurs in a data frame, which method is the simplest to detect it?  
(a) Hamming Code (b) CRC  
(c) Checksum (d) Parity check
- (iv) For a sliding window of size  $n-1$ , there can be maximum of \_\_\_\_\_ frames sent but unacknowledged.  
(a) 0 (b)  $n - 1$   
(c)  $n$  (d)  $n + 1$
- (v) Which field in an IPv4 packet ensures packets are not forwarded indefinitely?  
(a) Time to Live (TTL) (b) Header Length  
(c) Protocol (d) Checksum
- (vi) What is the role of ICMP in networking?  
(a) Transmitting data packets  
(b) Resolving IP addresses to MAC addresses  
(c) Error reporting and diagnostic functions  
(d) Encrypting IP packets
- (vii) If a network has the IPv4 address 192.168.10.0/24, how many usable host addresses can it support?  
(a) 126 (b) 254  
(c) 510 (d) 1022

- (viii) If a client wants to establish a reliable connection with a web server, which transport layer protocol should it use?  
 (a) UDP (b) TCP  
 (c) ICMP (d) ARP
- (ix) User datagram protocol is called connectionless because \_\_\_\_\_  
 (a) all UDP packets are treated independently by transport layer  
 (b) it sends data as a stream of related packets  
 (c) it is received in the same order as sent order  
 (d) it sends data very quickly
- (x) Which of the following statements best describes the Leaky Bucket algorithm?  
 (a) It maintains a constant output rate and discards excess packets  
 (b) It allows for bursty traffic by accumulating tokens in a bucket  
 (c) It uses a finite queue with a constant output rate for network data  
 (d) It generates tokens at a fixed rate to regulate data flow

*Fill in the blanks with the correct word*

- (xi) The maximum theoretical data rate of a noiseless channel is determined by \_\_\_\_\_ theorem.
- (xii) The process of converting an analog signal into a digital signal is called \_\_\_\_\_.
- (xiii) Sliding Window flow control improves efficiency by allowing multiple frames to be sent \_\_\_\_\_ waiting for an acknowledgment.
- (xiv) In IPv6, the address \_\_\_\_\_ is used as the loopback address, similar to 127.0.0.1 in IPv4.
- (xv) Compared to circuit switching, packet switching is more efficient because it allows \_\_\_\_\_ transmission of data.

### **Group - B**

2. (a) Compare different multiplexing techniques (FDM, TDM, WDM).  
[[CO2] (Analyse/10CQ)]
- (b) A channel has a bandwidth of 1 MHz and a Signal-to-Noise Ratio (SNR) of 20 dB. Calculate the maximum data rate using Shannon's Capacity formula.  
[[CO2] (Analyse/10CQ)]  
**8 + 4 = 12**
3. (a) Compare and contrast different network topologies based on factors such as cost, performance, scalability, and reliability.  
[[CO1] (Analyse/10CQ)]
- (b) A signal with a bandwidth of 5 MHz is modulated using AM (Amplitude Modulation). What is the total bandwidth required for transmission?  
[[CO2] (Apply/10CQ)]  
**9 + 3 = 12**

## Group - C

4. (a) Explain the concept of Stop-and-Wait ARQ in flow control mechanisms of the Data Link Layer. Discuss its advantages and limitations compared to sliding window protocols. *[[CO4] (Understand/IOCQ)]*
- (b) A system uses the Stop-And-Wait ARQ protocol. If each packet carries 1000 bits of data, how long does it take to send 1 million bits of data, if the distance between the sender and the receiver is 5000 km and the propagation speed is  $2 \times 10^8$  m? Ignore transmission, waiting and propagation delay. Assumer no data or control frame is lost or damaged. *[[CO4] (Apply/IOCQ)]*  
**(4 + 4) + 4 = 12**
5. (a) Explain the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol used in LANs. Discuss how it helps in minimizing collisions and improving network performance. *[[CO4] (Understand/LOCQ)]*
- (b) Explain how flooding works as a packet forwarding technique. *[[CO5] (Understand/LOCQ)]*  
**(4 + 4) + 4 = 12**

## Group - D

6. (a) Explain the Link State Routing algorithm in the Network Layer. Discuss its features, including how routers build and maintain a network topology database for efficient routing. *[[CO5] (Understand /LOCQ)]*
- (b) Illustrate the need for fragmentation? *[[CO5] (Remember/LOCQ)]*  
**(4 + 5) + 3 = 12**
7. (a) Illustrate the IP header format and analyse how its fragmentation-related fields (Identification, Flags, Fragment Offset) function, their impact on network performance, and propose improvements to optimize fragmentation handling. *[[CO4] (Understand/LOCQ)]*
- (b) You have a 192.168.1.0/24 network and need subnets for:  
(i) 100 hosts  
(ii) 50 hosts  
(iii) 25 hosts  
Find appropriate subnets. *[[CO4] (Apply/IOCQ)]*  
**(3 + 3 + 2) + 4 = 12**

## Group - E

8. (a) Draw a TCP state transition diagram for connection management. *[[CO6] (Understand/LOCQ)]*
- (b) If IP provides connectionless service. How TCP supports connection-oriented service? *[[CO6] (Understand /LOCQ)]*  
**6 + 6 = 12**

9. (a) A token bucket has a token generation rate of 5 tokens/sec and a bucket size of 20 tokens. How much data can be sent during a sudden burst after being idle for 5 seconds? *[[CO6) (Analyse/IOCQ)]*
- (b) Examine how token bucket parameters (rate and bucket size) affect network performance. *[[CO6) (Remember/LOCQ)]*

**6 + 6 = 12**

---

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	52.08	47.92	0