

M. E. Electronics & Telecommunication Engineering Examination 2025
(1st Year, 1st Semester)
Data Communication Networks

Time: 3 Hours

Full Marks: 100

Answer all the parts of a question in the same place

Group-I [Answer question no. 1 (1×10) = 10] CO1

1. a) Briefly describe the functions of data link layer and application layer of OSI model.
- b) What are the key protocols used in each layer of TCP/IP?
- c) For 20 devices in a network, what is the number of cable links required for a mesh, ring, bus, and star topology?

(5+3+2)

Group-II [Answer any four questions (4×15) = 60] CO2

2. a) Derive a channel utilization expression for selective repeat ARQ scheme.
- b) What is the purpose of MAC addressing? How does it differ from IP addressing?
- c) Explain the concept of subnetting and supernetting.
- d) How does the network layer ensure host-to-host delivery?

(5+4+3+3)

3. a) How does a VLAN reduce network traffic?
- b) What is flooding? Why flooding technique is not commonly used for routing?
- c) With a neat sketch briefly describe the function of a NAT router.
- d) What is congestion? Explain the effects of congestion on network performance.

(2+4+5+4)

[Turn over

4. a) What are the (i) exposed station and (ii) hidden station problems in 802.11 Ethernet MAC sublayer protocol?
 b) Illustrate the routing procedure in mobile host.
 c) A network with one primary and four secondary stations uses polling. The size of a data frame is 1000 bytes. The size of the poll, ACK, and NAK frames are 32 bytes each. Each station has 5 frames to send. How many total bytes are exchanged if there is no limitation on the number of frames a station can send in response to a poll?
 (5+6+4)
5. a) Write the key components and performance metrics of a queuing system.
 b) What do you mean by Markov process?
 c) Write the advantages of slotted ALOHA over pure ALOHA protocol and derive an analytical expression for expected number of retransmission per frame transmission time for slotted ALOHA protocol, considering Poisson distribution for frame generation.
 d) Explain the concept of inter-domain and intra-domain routing.
 (4+2+6+3)
6. a) Suppose a TCP connection is transferring a file of 6000 bytes. The first byte is numbered 1001. What are the sequence numbers for each segment if data are sent in four segments, each carrying equal number of bytes?
 b) Write the technique of transferring urgent data in TCP?
 c) Using a flow diagram briefly describe the connection termination in TCP using three-way handshaking. What is half close option during connection termination?
 (4+4+7)

Group-III [Answer *any one* question (1×15) = 15] CO3

7. a) What do you mean by one-time pad? Write the advantage of stream cipher over block cipher.
 b) Explain the working principle of stream cipher RC4. Why RC4 is not suitable for WEP protocol?
 c) Write different threats associated with wireless data communication.
 (5+7+3)

8. a) Describe the properties of cryptographic hash function. How it is used to verify the integrity of a message?
- b) How does IPSec provide confidentiality, integrity, and authentication?
- c) What do you mean by public key certificate? How it helps to reduce delay during exchange of public keys?

(6+5+4)

Group-IV [Answer any one question (1×15) = 15] CO4

9. a) Explain the concept of dynamic frequency selection (DFS) and transmit power control (TPC) in WLAN?
 - b) Write the applications of open-loop and closed-loop power control techniques.
 - c) Write the key features of TCP. How it operates over wireless networks?
- (5+2+8)
10. a) Explain different factors which determine the wireless channel gain. Write the frequency bands used for Wi-Fi communication.
 - b) Write the characteristics of Wi-Fi 5. What are the key differences between Wi-Fi 6 and Wi-Fi 5.
 - c) What role does MIMO play in cellular broadband evolution?

(7+5+3)