

Sr. No. of Question Paper:10392

Unique Paper Code: 6333490008

Name of the Paper: DATA COMMUNICATION AND NETWORKING

Name of the Course: Bachelor of Vocation (B.Voc). (NEP-UGCF)

Semester: VII

Duration: 3 Hours

Maximum Marks: 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A (Question No. 1)** is compulsory.
3. Attempt any *four* questions from Section B (Questions 2 to 7).
4. Parts of a question must be answered together.

Section A

- 1 (a) Differentiate between Simplex, Half Duplex, and Full Duplex with one example each. (3)
- (b) Define IP address and subnet mask. Give one example (3)
- (c) Differentiate between Guided and Unguided Transmission Media with examples. (3)
- (d) Find the minimum bandwidth needed if 5 channels (each 500 kHz wide) are multiplexed with 10 kHz guard bands between them (3)
- (e) Write three differences between OSI and TCP/IP Model. (3)
- (f) Given the data bit stream 01111101111110111101111, Add Flag bits and perform bit stuffing. Write the final transmitted bit stream. The flag bits is 01111110. (3)
- (g) Which layer(s) in the OSI Model performs the following operations? (3)
 - i) Synchronization
 - ii) Encryption
 - iii) Mail Services

- (h) Explain the difference between synchronous and asynchronous transmission. (3)
- (i) What is frequency division multiplexing (FDM)? Explain its working. (3)
- (j) What is CSMA/CD and how does it work in Ethernet? (3)

Section B

- 2 (a) Calculate the original 8-bit data from the received 12-bit Hamming code: 101101011110 (odd parity assumed; max one-bit error). (5)
- (b) Consider a communication system with a bandwidth of 5 kHz and a signal-to-noise ratio (SNR) of 31 dB. Using Nyquist's Theorem, calculate the maximum data rate (in bps) that can be transmitted over the channel without any error. (5)
- (c) Consider a situation where a company needs a network with high reliability and fault tolerance. Which topology would you recommend? Draw the network topology and discuss its advantages and disadvantages? What is the key difference between bus and star topology? (5)
- 3 (a) Given a data word 10101101 and a generator polynomial $x^4 + x + 1$, compute the transmitted CRC code. (5)
- (b) Differentiate between Circuit switching and packet switching. Why is packet switching more resilient to network failures compared to circuit switching? (5)
- (c) Briefly explain the following CSMA protocols: (5)
 - (i) 1-persistent
 - (ii) p-persistent
- 4 (a) The following character encoding is used in a data link protocol: (5)

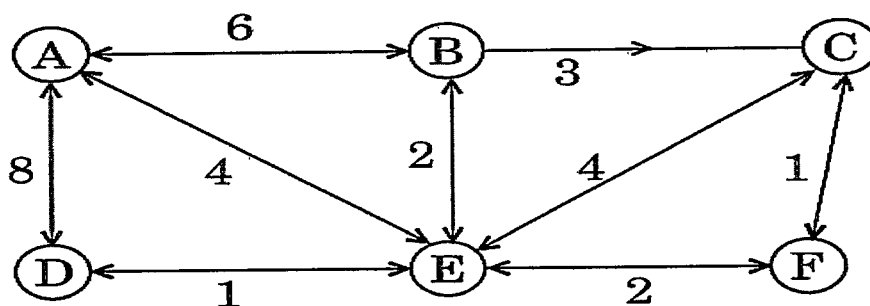
A: 01000111 ; B: 11100011 ; Flag: 01111110 ; ESC: 11100000

show the bit sequence transmitted (in binary) for the four-character frame: A B ESC FLAG A ESC

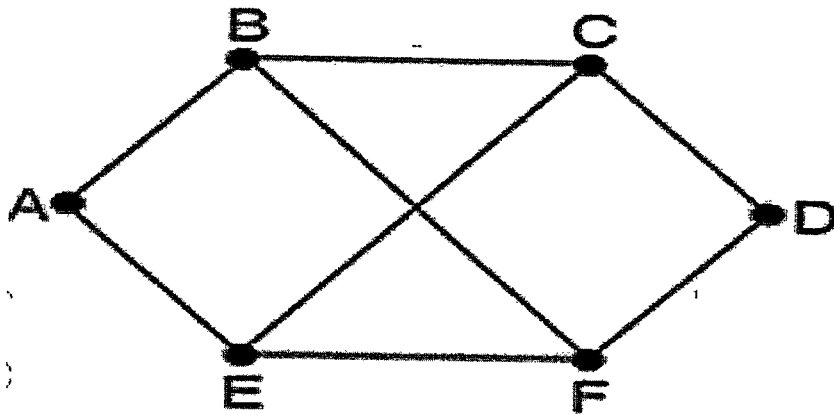
when each of the following framing methods are used:

 - i. Character Count
 - ii. Flag bytes with Byte Stuffing
 - iii. Starting and ending flag bytes, with bit stuffing
- (b) Draw and explain the full architecture of the OSI reference model. Describe the function of each layer in OSI reference model. (5)

- (c) Consider the following network with the indicated link cost. Using shortest path Algorithm, find the shortest path from source node A to all other nodes: (5)



- 5 (a) I. Consider a noiseless channel with a bandwidth of 3000 Hz transmitting a signal with four signal levels. Calculate the maximum bit rate of the channel. (2+3)
- II. Define the term 'bandwidth' in the context of network communication. If a periodic signal is decomposed into five sine waves with frequencies of 100, 200, 400, 600, and 700 Hz, what is its bandwidth?
- (b) Find the class and the sub-network address of the following IP addresses (5)
- I. IP Address – 124.13.12.26 & Mask- 255.255.128.0
- II. IP Address – 147.17.86.12 & Mask- 255.255.255.0
- (c) Explain the use of STOP and WAIT Automatic Repeat Request^F (ARQ) method, with the help of a suitable diagram. (5)
- 6 (a) Consider the following subnet. Distance vector routing is used, and the following vectors have just come in to router F: from B: (5, 0, 8, 12, 6, 2); from D: (16, 12, 6, 0, 9, 10); and from E: (7, 6, 3, 9, 0, 4). The measured delays BC, CD, and CE, are 9, 6, and 3, respectively. What is F's new routing table? (5)



- (b) Differentiate between Repeaters, Hubs, switches and Bridges with respect to ISO-OSI model, name the layers in which these devices operate? (5)
- (c) Draw and explain the structure of a TCP packet header. Also explain the difference between UDP and TCP. (5)
- 7 Explain the following concepts: (3*5=15)
- i) Piggybacking
 - ii) Count to infinity problem
 - iii) Principle of Optimality
 - iv) Dijkstra's Algorithm
 - v) CSMA/CD with Binary Exponential Backoff