



**VIT**  
Vellore Institute of Technology  
Vellore, Tamil Nadu, India

**School of Information Technology and Engineering**

**Fall Semester 2022-2023**

**Continuous Assessment Test – I**

**Programme Name & Branch:** MCA

**Course Name & code:** Data Communication and Networking & ITA5003

**Class Number (s):** VL2022230105115, VL2022230105119, VL2022230105114

**Slot:** E1+TE1

**Faculty Name:** Prof K.Santhi, Prof Felicita S A M, Prof Shobana D

**Exam Duration:** 90 Min.

**Maximum Marks:** 50

**Answer all the questions**

Q.No.	Question
1.	With neat sketch show the encapsulation and decapsulation process of OSI model when you browse a web page on your laptop.
2.	<p>a) Distinguish between port address, logical address and a physical address. Identify which layer functionality for the following services.</p> <p style="text-align: right;">(6 marks)</p> <p>i) Provides independence from differences in data representation. ii) Error correction and retransmission iii) Ensures reliable transmission of data</p> <p>b) Let us assume that source node sends a message to destination node via LAN1, router R1, and LAN2. Depict this scenario as diagram. Show the contents of the packet and frames at the network and data link layer for each hop interfaces.</p> <p style="text-align: right;">(4 marks)</p>
3.	<p>i) Given the following information, find the minimum bandwidth required for the path: FDM multiplexing five devices, each requiring 4000 Hz. 200 Hz guard band for each device.</p> <p style="text-align: right;">(5 Marks)</p> <p>ii) Four channels, two with a bit rate of 200 Kbps and two with a bit rate of 150 kbps, are to be multiplexed using multiple-slot TDM with no synchronization bits. Answer the following questions:</p> <p style="text-align: right;">(5 Marks)</p> <p>i. What is the size of a frame in bits? ii. What is the frame rate? iii. What is the duration of a frame iv. What is the data rate?</p> <p style="text-align: right;">25000 + 4000 10800 Hz</p>

4.	<p>a) Show the contents of the five output frames for a synchronous TDM multiplexer that combines four sources sending the following characters. Note that the characters are sent in the same order that they are typed. The third source is silent. (5 Marks)</p> <p>I. Source 1 message: HELLO  II. Source 2 message: HI  III. Source 3 message:  IV. Source 4 message: BYE</p> <p>b) A signal that can be decomposed into five sine waves with frequencies at 0, 20, 50, 100 and 200 Hz? All peak amplitudes are the same i) what is the bandwidth for this signal? ii) Draw the frequency spectrum, assuming the maximum amplitude for all components is 5V. (5 Marks)</p>
5.	<p>a) What is the total delay (latency) for a frame of size 5 Million bits that is being sent on a link with 10 routers each having a queuing time of <math>2\mu s</math> and a processing time of <math>1\mu s</math>. The length of the link is 2000 Km. The speed of light inside the link is <math>2 \times 10^8</math> m/s. The link has a bandwidth of 5 Mbps. Which component of the total delay is dominant? Which one is negligible? (7 Marks)</p> <p>b) Given a channel with an intended capacity of 20 Mbps. The bandwidth of the channel is 3 MHz. Assuming white thermal noise, what signal-to-noise ratio is required in order to achieve this capacity? (3 Marks)</p>

Nyquist bit rate :-  

$$\text{bit rate} = 2 \times \text{bandwidth} \times \log_2 L$$
→ no. of signal levels.

Noisy channel : Shannon capacity

$$\text{Capacity} = \text{bandwidth} \times \log_2 (1 + \text{SNR})$$

$$\star \text{ dB} = 10 \log_{10} \frac{P_2}{P_1}$$

$$\star \text{ bit length} = \text{propagation speed} \times \text{bit duration}$$

$$\star \text{ SNR}_{dB} = 10 \log_{10} \text{SNR} \Rightarrow \underline{\text{SNR}} = 10^{\text{SNR}_{dB}/10}$$

$$\star C = B \log_2 (1 + \text{SNR})$$

$$C = B \times \frac{\text{SNR}_{dB}}{3} \Rightarrow \underline{\text{SNR}_{dB}} = \frac{(3 \times C)}{B}$$



**VIT**Vellore Institute of Technology  
Approved by the University Grants Commission, New Delhi, India**School of Information Technology and Engineering****Fall Semester 2022-2023****Continuous Assessment Test - II****Programme Name & Branch: MCA****Course Name & Code: Data Communication and Networking & FA5003****Class Number (s): VL2022239105115, VL2022239105119, VL2022239105114****Sem: EI+TEI****Faculty Name: Prof K.Santhi, Prof Felicita S A M, Prof Shobana D****Exam Duration: 90 Min.****Maximum Marks: 50****Answer all the questions**

Q.No.	Questions	Max Marks
1.	<p>Define the following parameters for a switching network.</p> <p><math>N</math> = number of hops between two given end systems</p> <p><math>L</math> = message length in bits</p> <p><math>B</math> = data rate in bits per second (bps), on all links</p> <p><math>P</math> = packet size</p> <p><math>H</math> = overhead (header) bits per packet</p> <p><math>S</math> = call setup time (circuit switching or virtual-circuit) in seconds</p> <p><math>D</math> = propagation delay per hop in seconds</p> <p>For <math>N=5</math>, <math>L=6400</math>, <math>B=50000</math>, <math>P=2048</math>, <math>H=16</math>, <math>S=0.3</math>, <math>D=0.004</math>, compute the end-to-end delay for circuit, virtual-circuit, and packet switching. Assume there are no acknowledgements, and no queuing delay.</p>	10
2.	<p>i) A slotted aloha network transmits 500-bit frame on a shared channel of 100 Mbps what is the throughput if the system (all station together) produces 2000 frames/sec. (Marks 5)</p> <p>ii) A 4km long broadcast LAN <math>10^7</math>Gbps bandwidth and use CSMA/CD. The signal travels along the wire are <math>6 \times 10^6</math>M/Sec. What is minimum packet size that can be used on this network? (Marks 5)</p>	10
3.	<p>i) If the message sequence is 1010000 and the generator polynomial is <math>G(x)=x^3+1</math>, calculate the transmitted frame. Also, check if the data is accepted at the receiver side. (Marks 5)</p>	10

	ii) Calculate the 16 bits-checksum of the following hexadecimal numbers 00FE C523 FDA1 D68A AF02 Note that the answer should be in hexadecimal without spaces. (Marks 5)	
4.	Suppose a 7-bit data word stored in memory is 0111001. Using the Hamming algorithm, determine check bits that would be stored in memory with the data word. Show how the redundancy bits are to be found. Consider if data bit 3 sustains an error due to transmission error, identify the location of the errored bit.	10
5.	<p>i) Illustrate the sender side and receiver side window configuration for the following scenario for Selective Repeat ARQ flow control algorithm for a window size of 8. Let's assume both forward channel and the reverse channel is reliable.</p> <p>[5 Marks]</p> <ul style="list-style-type: none"> <li>• Frame 0,1, and 2 are sent; ACK is delayed</li> <li>• Frames 3,4,and 5 are sent ;ACK is lost</li> <li>• Frames 3,4,and 5 are sent; Frame 4 lost</li> <li>• Frames 4,5,6,and 7 are sent; Frame 6 is damaged</li> </ul> <p>ii) Station A needs to send a message consisting of 10 packets to Station B using a sliding window (window size 4) and go-back-n error control strategy. All packets are ready and immediately available for transmission. If every 5<sup>th</sup> packet that A transmits gets lost (but no acks from B ever get lost), then what is the number of packets that A will transmit for sending the message to B?</p> <p>[5 Marks]</p>	10





**KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS TREATED AS EXAM MALPRACTICE**

**Answer ALL Questions**

**(10 X 10 = 100 Marks)**

1. Discuss the functionalities of the protocols used in each layer of the OSI model and illustrate the communication between two end systems with a neat sketch.
2. We need to use synchronous TDM and combine 20 digital sources each of 100 Kbps. Each output slot carries 1 bit from each digital source but one extra bit is added to each frame for synchronization.
  - a) What is the size of an output frame in bit?
  - b) What is output frame rate?
  - c) What is duration of the output frame?
  - d) What is output data rate?
  - e) What is efficiency of the system?
3.
  - a) If the baud rate of the signal is 600 baud/sec and each signal unit carries 6 bits. Find the bit rate of the signal. [5]
  - b) A network bandwidth of 10Mbps can pass only an average of 12000 frames per minute with each frame carrying average of 10,000 bits what is throughput of this network? [5]
4. A path in a digital circuit-switched network has a data rate of 1 Mbps. The exchange of 1000 bits is required for the setup and teardown phases. The distance between two parties is 5000 km.  
Answer the following questions if the propagation speed is  $2 \times 10^8$  m:
  - i. What is the total delay if 1000 bits of data are exchanged during the data-transfer phase?
  - ii. What is the total delay if 100,000 bits of data are exchanged during the data-transfer phase?
  - iii. What is the total delay if 1,000,000 bits of data are exchanged during the data-transfer phase?
  - iv. Find the delay per 1000 bits of data for each of the above cases and compare them. What can you infer?

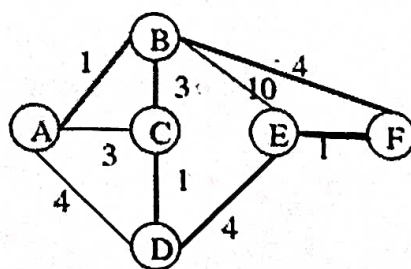


5. Five equal-size datagrams belong to the same message leave for the destination one after another. However, they travel through different path as shown in the following table.

Datagram	Path Length	Visited Switches
1	3200 km	1,3,5
2	11,700 km	1,2,5
3	12,200 km	1,2,3,5
4	10,200 km	1,4,5
5	10,700 km	1,4,3,5

We assume that the delay for each switch (including waiting and processing) is 3, 10, 20, 7 and 20 ms respectively. Assuming that the propagation speed is  $2 \times 10^8$  M/S. Find the order the datagram arrive at the destination and the delay for each ignore any other delays in transmission.

6. a) A slotted aloha network transmits 200-bit frame on a shared channel of 200 Mbps. What is the throughput if the system (all station together) produces 3000 frames/sec. [5]  
 b) A network has data transmission bandwidth 20 Mbps. It uses CSMA/CD in the MAC layer. The max signal propagation time from one node to another node is 40 microsecond. What is minimum size of a frame in the network represent in bytes. [5]
7. a) One of the addresses in a block is 110.23.120.14/20. Find the number of addresses, the first address, and the last address in the block. [5]  
 b) A datagram is carrying 2000 bytes of data. If there is no option information, what is the value of the header length field and what is the value of total length field? [5]
8. Consider the network shown below. Show the operation of Distance vector routing algorithm for computing the least cost path from F (the rightmost node in the figure below) to all destinations. Also explicitly list all the shortest path routes from F to all destinations that are the result of the algorithm's computation. Depict all the steps through diagram.



9. a) Elaborate in detail about the UDP datagram format. [5]  
 b) TCP opens a connection using an initial sequence number (ISN) of 14,534. The other party opens the connection with an ISN of 21,732. Show the three TCP segments during the connection establishment. [5]
10. Explain the following:
- a) Remote login protocols [5]  
 b) SNMP [5]

