Date:                                                    Reg.No:

**Time: Three hours**                                    **Maximum: 100 Marks**
**Answer ALL Questions**
**PART – A (10 x 2 = 20 Marks)**

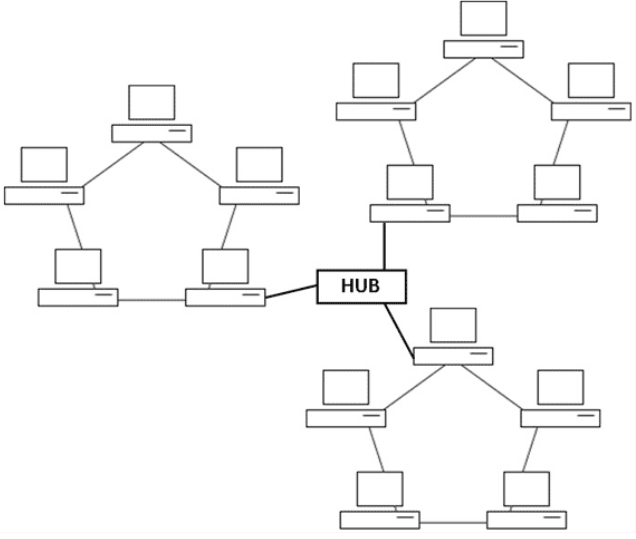| Q.No | Question | Max. Marks | CO-K Level | PO-PI Code |
|---|---|---|---|---|
| 1. | What are the three criteria necessary for an effective and efficient network? <br><br> The most important criteria are performance, reliability and security. <br><br> • Performance of the network depends on number of users, type of transmission medium, the capabilities of the connected h/w and the efficiency of the s/w. <br><br> • Reliability is measured by frequency of failure, the time it takes a link to recover from the failure and the network's robustness in a catastrophe. <br><br> • Security issues include protecting data from unauthorized access and viruses. | 02 | CO1- K2 | 1.3.1 |
| 2. | What is the propagation time if the distance between the two points is 12,000 km? Assume the propagation speed to be $2.4 \times 10^8$ m/s in cable. <br><br> $$\text{Propagation time} = \frac{12{,}000 \times 1000}{2.4 \times 10^8} = 50 \text{ ms}$$ | 02 | CO1- K3 | 2.1.3 |
| 3. | We need to send 265 kbps over a noiseless channel with a bandwidth of 20 kHz. How many signal | 02 | CO1- K3 | 2.1.3 |

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| | levels do we need?<br><br>$$265{,}000 = 2 \times 20{,}000 \times \log_2 L$$<br>$$\log_2 L = 6.625 \qquad L = 2^{6.625} = 98.7 \text{ levels}$$ | | | |
| 4. | For *n* devices in a network, what is the number of cable links required for a mesh, ring, bus, and star topology?<br><br>Mesh: n * (n-1) / 2<br><br>Ring: n<br><br>Bus: n + 1 (n for cables, 1 for backbone)<br><br>Star: n | 02 | CO1- K3 | 2.1.3 |
| 5. | Do we need a multiple access protocol when we use the 1ocalloop of the telephone company to access the Internet? Why?<br><br>We do not need a multiple access method in this case. The local loop provides a dedicated point-to-point connection to the telephone office. | 2 | CO2-K4 | 2.2.3 |
| 6. | Define the type of the following destination addresses:<br>a. 4A:30:10:21:1O:1A<br>b. 47:20:1B:2E:08:EE<br>c. FF:FF:FF:FF:FF:FF<br>Solution<br>To find the type of the address, we need to look at the second hexadecimal digit from the left. If it is even, the address is unicast. If it is odd, the address is multicast. If all digits are Fs, the address is broadcast.<br>a. This is a unicast address because A in binary is 1010 (even).<br>b. This is a multicast address because 7 in binary is 0111 (odd).<br>c. This is a broadcast address because all digits are Fs in hexadecimal. | 2 | CO2-K3 | 2.2.3 |
| 7. | List out the sublayers of DLL and also define the purpose of it.<br>The data link layer is further divided into two sub-layers, which are as follows:<br><br>• Logical Link Control (LLC): | 2 | CO2-K2 | 2.2.4 |

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| | This sublayer of the data link layer deals with multiplexing, the flow of data among applications and other services, and LLC is responsible for providing error messages and acknowledgments as well.<br><br>• Media Access Control (MAC):<br><br>MAC sublayer manages the device's interaction, responsible for addressing frames, and also controls physical media access. | | | |
| 8. | Analyze the reason for moving from the Stop-and-Wait ARQ Protocol to the Go-Back-N ARQ Protocol.<br><br>"Go-Back-N ARQ is more efficient than Stop-and-Wait ARQ. The second uses pipelining, the first does not. In the first, we need to wait for an acknowledgment for each frame before sending the next one. In the second we can send several frames before receiving an acknowledgment." | 2 | CO2-K4 | 2.2.3 |
| 9. | What is the difference between connectionless and connection-oriented services? Which type of service is provided by IPv4? Which type of service is provided by IPv6?<br><br>| S.NO | Connection-oriented Service | Connection-less Service |<br>|---|---|---|<br>| 1. | Connection-oriented service is related to the telephone system. | Connection-less service is related to the postal system. |<br>| 2. | Connection-oriented service is preferred by long and steady communication. | Connection-less Service is preferred by bursty communication. |<br>| 3. | Connection-oriented Service is necessary. | Connection-less Service is not compulsory. |<br>| 4. | Connection-oriented Service is feasible. | Connection-less Service is not feasible. |<br>| 5. | In connection-oriented Service, Congestion is not possible. | In connection-less Service, Congestion is possible. |<br>| 6. | Connection-oriented Service gives the guarantee of reliability. | Connection-less Service does not give a guarantee of reliability. |<br>| 7. | In connection-oriented Service, Packets follow the same route. | In connection-less Service, Packets do not follow the same route. |<br><br>IPv6 is connection-oriented<br>IPv4 is connection-less | 2 | CO3-K4 | 2.2.4 |
| 10. | Change the following IPv4 addresses from binary notation to dotted-decimal notation.<br>a. 10000001 00001011 00001011 11101111<br>b. 11000001 10000011 00011011 11111111<br>Solution<br>We replace each group of 8 bits with its equivalent | 2 | CO3-K3 | 2.2.3 |

| | decimal number and add dots for separation.<br>a. 129.11.11.239<br>b. 193.131.27.255 | | | |

**PART – B (5 x 13 = 65 Marks)**

| Q.No. | Question | Max.<br>Marks | CO-K<br>Level | PO-<br>PI<br>Code |
|---|---|---|---|---|
| **11 (a)** | Illustrate the Layered architecture of OSI model in detail. Dialog control and synchronization are two responsibilities of the session layer in the OSI model. Which layer do you think that it is responsible for these duties in the internet model?<br><br>- Layered architecture of OSI model – 7 layers(10)<br><br>- Application layer in internet model (3) | 13 | CO1- K4 | 2.2.3 |
| | (Or) | | | |
| **(b)** | (i) For each of the following four networks, discuss the consequences if a connection fails.<br><br>a. Five devices arranged in a mesh topology<br><br>b. Five devices arranged in a star topology (not counting the hub)<br><br>c. Five devices arranged in a bus topology<br><br>d. Five devices arranged in a ring topology<br><br>a. No major setback to the complete network, if one connection fails, others will continue to work.<br><br>b. Connection to that particular device is lost, others can communicate<br><br>c. If the backbone connection fails, then all communication is over.<br><br>d. One failed connection will disable the entire network<br><br>(ii) Draw a hybrid topology with a star backbone and three ring networks | 8+5 | CO1- K4 | 2.2.3 |

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| **12 (a)** | (i) Compare and contrast the various guided media used for transmission.<br><br>- Fiber optic (3)<br><br>- Coaxial cable (3)<br><br>- Twisted pair (3)<br><br>(ii) Performance is inversely related to delay. When you use the Internet, which of the following applications are more sensitive to delay?<br><br>   - Sending an e-mail<br>   - Copying a file<br>   - Surfing the Internet<br><br>a. Sending an e-mail : Not highly sensitive to delay, once a message is sent, it remains in the inbox for a while<br>b. Copying a file : Not very sensitive to delay either.<br>c. Surfing the Internet : It is sensitive to delay, as it is an interactive application and users demand immediate results. | [9+4] | CO1- K4 | 2.2.4 |
| | (Or) | | | |
| **(b)** | Analyze the working concept of various types of Switching in detail with diagrams.<br><br>- Circuit switching (4)<br><br>- Packet switching (5)<br><br>Message switching (4) | 13 | CO1- K2 | 1.3.1 |
| **13(a)** | Describe in detail about the general protocol that can be used for both point-to-point and multipoint | 13 | CO2-K2 | 1.3.1 |

| | communications. | | | |
|---|---|---|---|---|
| | - HDLC | | | |
| | -→ I-, S-, U- frame (7) | | | |
| | → HDLC frame format (6) | | | |
| | (Or) | | | |
| **(b)** | Among the standards IEEE 802.3 and IEEE 802.11, which one can be referred as WiFi? Also explain its architecture. <br><br> - IEEE 802.11 <br><br> ➔ BSS and ESS (5) <br><br> ➔ Station types (4) <br><br> MAC sublayers-DCF,PCF (4) | 13 | CO2-K4 | 2.2.4 |
| **14a)** | List the drawbacks of IPv4. Describe how to overcome it. <br><br> - Deficiencies of IPv4 (5) <br><br> - IPv6 (8) | 13 | CO3-K2 | 1.3.1 |
| | (Or) | | | |
| **(b)** | Explain the datagram format of IPv4. <br><br> - Diagram (7) <br><br> - Description (8) | 13 | CO3-K2 | 1.3.1 |
| **15 (a)** | (i) Find the error, if any, in the following IPv4 addresses. <br><br> a. 111.56.045.78 <br><br> b. 221.34.7.8.20 <br><br> c. 75.45.301.14 <br><br> d. 11100010.23.14.67 <br><br> Solution <br><br> a. There must be no leading zero (045). <br><br> b. There can be no more than four numbers in an IPv4 address. <br><br> c. Each number needs to be less than or equal to 255 (301 is outside this range). <br><br> d. A mixture of binary notation and dotted-decimal | 8+5 | CO3-K3 | 2.2.3 |

| | notation is not allowed<br><br>(ii) Find the class of each address.<br><br>a. 00000001 00001011 00001011 11101111<br><br>b. 14.23.120.8<br><br>a. The first bit is 0. This is a class A address (2)<br><br>b. The first byte is 14 (between 0 and 127); the class is A. (3) | | | |
|---|---|---|---|---|
| | (Or) | | | |
| **(b)** | An IPv4 datagram has arrived with the following information **in** the header (in hexadecimal):<br><br>Ox45 00 00 54 00 03 58 50 20 06 00 00 7C 4E 03 02 B4 OE OF 02<br><br>a. Is the packet corrupted?<br><br>b. Are there any options?<br><br>c. Is the packet fragmented?<br><br>d. What is the size of the data?<br><br>e. How many more routers can the packet travel to?<br><br>f. What is the identification number of the packet?<br><br>g. What is the type of service?<br><br>Ans:<br><br>a. Since HLEN is 5, there is no option<br>b. The packet is not fragmented because the offset value is 0 and the flags value is 0<br>c. The size of the data is 54 − 20 = 34 bytes<br>d. No checksum is used<br>e. The packet can travel to 20 more routers<br>f. The identification number of this packet is 0003<br>g. The type of service is normal (0)<br><br><table><tr><td>Ver: 4</td><td>HLN: 5</td><td>DS: 00</td><td colspan="2">Total Length:0054</td></tr><tr><td colspan="3">Identification :0003</td><td>Flags :00</td><td>Offset :00</td></tr><tr><td>TTL : 20</td><td colspan="2">Protocol :06</td><td colspan="2">Header Check Sum: 0000</td></tr><tr><td colspan="5">Source IP: 7C4E0302</td></tr><tr><td colspan="5">Destination IP: B40E0F02</td></tr></table><br>Source Address: 0x7C4E0302 = 124.78.3.2 Destination Address: 0xB40E0F02 = 180.14.15.2 | 15 | CO3-K4 | 2.2.3 |

## PART – C (1 x 15 = 15 marks)

| Q.No. | Question | Max. Marks | CO-K Level | PO-PI Code |
|---|---|---|---|---|
| | | | | |

| 16 (a) | Suppose we want to transmission the message 1011 0010 0111 and protect it from errors using the CRC polynomial $X^4+X^2+1$.<br><br>Use polynomial long division to determine the message that should be transmitted.<br><br>Suppose the leftmost bit of message is inverted due to noise on the transmission link. What is the result of the receiver's CRC calculation? How does the receiver know that an error has occurred?<br><br>- Message (8)<br><br>Receiver's CRC calculation, error (7) | 15 | CO2-K3 | 2.2.4 |
|---|---|---|---|---|
| (Or) | | | | |
| (b) | Analyze the design procedure for simple, stop and wait, Go-back-N, Selective Repeat .<br><br>- Simplest (3)<br><br>- Stop and wait (4)<br><br>- Go-back-N (4)<br><br>- Selective Repeat (4) | 15 | CO2-K4 | 2.2.4 |

**Bloom's Taxonomy Level wise Marks and Course Outcome wise Marks Distribution Analysis:**

| Competence level | Blooms' Taxonomy | Question No. | Marks | BTL Contribution in % | Course Outcome | Marks | CO Contribution in % |
|---|---|---|---|---|---|---|---|
| K1 | Remember | | | | CO1 | 60 | 33.3 |
| K2 | Understand | **1,7,12b, 13a, 14a, 14b** | **56** | **31.1** | CO2 | 64 | 35.6 |
| K3 | Apply | **2,3,4,6,10,15a ,16a** | **38** | **21.1** | CO3 | 56 | 31.1 |
| K4 | Analyse | **5,8,9, 11a, 11b, 12a, 13b. 15b, 16b** | **86** | **47.8** | CO4 | | |
| K5 | Evaluate | | | | CO5 | | |
| K6 | Create | | | | | | |
| Total | | | **180** | **100** | | **180** | **100** |

**Prepared By**                    **Verified By**                    **Approved By**