

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Use of calculator is ~~not~~ allowed

Q.No	Question	CO	Marks
Q1	(a) How many point-to-point WANs are needed to connect n LANs if each LAN should be able to directly communicate with any other LAN? Design a neat and clean diagram for (b) $n=3$ and (c) $n=4$.	CO1	[1x3=3]
Q2	A communication channel has a bandwidth of 4 MHz. Solve the following: (i) Assuming the channel is perfectly noiseless and uses a digital transmission scheme with 16 discrete voltage levels, calculate the maximum achievable data rate using the Nyquist theorem. (ii) Now consider the same channel has a Signal-to-Noise Ratio (SNR) of 15 dB. Calculate the theoretical maximum data rate using the Shannon theorem. (iii) Compare both results and comment on which value represents the actual practical upper bound for this system and why.	CO1	1x3=3
Q3	(a) Consider an 8-bit input sequence of 10110010. Draw the signal waveform of the following "line coding" schemes: (i) Polar NRZ-I, (ii), Manchester and (iii) Differential Manchester. (b) Consider a communication network with a bandwidth of 1 Mbps. A message of size 1000 bytes is to be transmitted using packet switching. Each packet carries a 100-byte header in addition to the message data. If the message can be divided into 5 packets, determine into how many packets the message should be divided so that the total transmission time is	CO1	1.5x2=3

	minimum. Assume that the packets are transmitted sequentially and that the processing and propagation delays are negligible. (Assume a network topology consisting of one source, one destination, and two intermediate switches connected in series: Source → Switch 1 → Switch 2 → Destination.)		
Q4	A sender wants to transmit the 8-bit dataword 11010110 using Cyclic Redundancy Check (CRC). The generator polynomial is: $G(x)=x^4+x^3+1$ The corresponding binary divisor is 11001. Show detailed computation of the following. - Determine the CRC remainder. - Construct the final transmitted codeword by appending the CRC bits to the original dataword. - At the receiver, verify the transmitted codeword using the same generator 11001.	CO2	1x3=3
Q5	A sender is transmitting data frames over a link with the following specifications: Data rate = 1 Mbps Propagation delay = 25 μs Frame size = 1000 bytes Acknowledgment (ACK) size is negligible Processing time at both ends is negligible - For Stop-and-Wait protocol, calculate the link utilization (efficiency) and the maximum throughput. - If the sender uses Go-Back-N protocol with a window size of 7 frames, calculate the new link utilization. Assume no errors occur. - Briefly explain why Selective Repeat would provide higher efficiency than Go-Back-N under error-prone conditions, even if the window size remains the same. For example, when the third frame is lost. Assume the timeout value = one RTT (2Tp).	CO2	1x3=3