Question Paper

Exam Date & Time: 09-Dec-2023 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

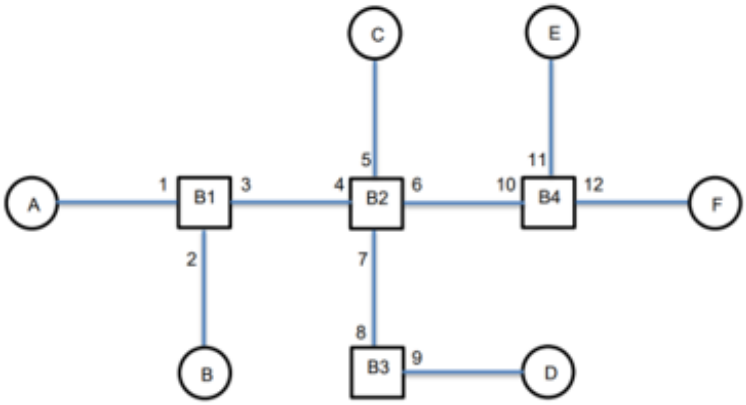
THIRD SEMESTER B.TECH. DEGREE EXAMINATIONS - NOVEMBER / DECEMBER 2023
SUBJECT: ICT 2124- PRINCIPLES OF DATA COMMUNICATION

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1A)	Consider a channel with a 1-MHz capacity and an SNR of 63. i) If a periodic signal has a bandwidth of 100KHz is sent through the channel with its lowest frequency as 60 KHz. What is the highest frequency of the channel? ii) What is the upper limit to the data rate that the channel can carry? iii) The result of part (b) is the upper limit. However, as a practical matter, better error performance will be achieved at a lower data rate. Assume we choose a data rate of 2/3 the maximum theoretical limit. How many signal levels are needed to achieve this data rate?	(5)
1B)	Elaborate on the significance of viewing signals as functions of time and frequency in the context of communication systems. Provide a concise example to highlight this dual perspective.	(3)
1C)	Distinguish any four technical differences between twisted pair and coaxial cable.	(2)
2A)	Assume a telephone channel is equalized to allow bandpass data transmission over a frequency range of 500 to 3500 Hz. Assume a telephone channel is equalized to allow bandpass data transmission over a frequency range of 500 to 3500 Hz. i) Suppose the related to technique r =0.5, multilevel PSK signaling M = 8. Compute the required bandwidth for 4800 bps and evaluate whether the given bandwidth is adequate. ii) Calculate the maximum number of bits that can be transmitted for a given bandwidth, r = 0 and the type of modulation is 16 QAM technique. iii) Draw the constellation diagram for ASK, with peak values of 1 and 3. iv) Compute the baud rate for 2000 bps, r =1, and the type of modulation is MFSK =16	(5)
2B)	Discuss the merits of the end-to-end versus hop-by-hop approaches to providing a constant transfer delay for information transformed from a sending end system to a receiving end system.	(3)
2C)	Demonstrate the communication system employing Vertical Redundancy Check (VRC) for error detection, encode the ASCII character 'E' using the VRC technique.	(2)
3A)	Consider a Hamming code with parameters (7, 4). A data word, D, is represented by the bits 1101. Encode the data word using the Hamming code. If a single bit error occurs during transmission, demonstrate how the Hamming code can be used to detect and correct the error. Show all necessary steps in the process.	(5)
3B)	A system utilizes the Stop-and-Wait ARQ Protocol. If each frame carries 500 bits of data, how long does it take to send 1 million bits of data if the distance between the sender and receiver is 3000 km, and the propagation speed is 2 x 108 m? Ignore transmission, waiting, and processing delays. We assume no data or control frame is lost or damaged.	(3)

3C)	Why is multiplexing so cost-effective? Compare why a statistical time division multiplexer is more efficient than a synchronous time division multiplexer.	(2)
4A)	A system uses the Stop-and-Wait ARQ Protocol. If each packet carries 1000 bits of data, how long does it take to send 1 million bits of data if the distance between the sender and receiver is 5000 Km and the propagation speed is 2 x 108 m? Ignore transmission, waiting, and processing delays. We assume no data or control frame is lost or damaged.	(5)
4B)	Compare and Contrast PPP and HDLC.	(3)
4C)	Consider hosts A, B, C, D, E, F and learning bridges B1, B2, B3, B4, with their corresponding port numbers marked as shown. Assume the forwarding tables are empty for all the bridges. Also assume that entries added to each forwarding table do not have timeout.	(2)



If the following sequence of steps is followed, for each step, list all the bridges that receive each message.
Host A sends a message to Host B
Host E sends a message to Host A
Host D sends a message to Host B
Host F sends a message to Host D
Host C sends a message to Host F.
Fill the forwarding table for bridge B1, after the above 5 4messages have been sent.

5A)	i) A group of N stations shares a 56-kbps pure ALOHA channel. Each station outputs a 1000-bit frame on an average of once every 100 sec, even if the previous one has not yet been sent (e.g., the stations can buffer outgoing frames). What is the maximum value of N? ii) Consider building a CSMA/CA (Carrier Sense Multiple Access with Collision Detection) network running at 1 Gbps over a 1-km cable with no repeaters. The signal speed in the cable is 200,000 km/sec. What is the minimum frame size?	(5)
5B)	Station A uses 32-byte packets to transmit messages to station B using a sliding window protocol. The round-trip delay between A and B is 80 msec and the bottleneck bandwidth on the path between A and B is 128 Kbps. What is the optimal window size that A should use?	(3)
5C)	Compare and Contrast MAC sublayer and LLC sublayer.	(2)

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