**III SEMESTER B.TECH. (INFORMATION TECHNOLOGY / COMPUTER AND COMMUNICATION ENGINEERING)**

**GRADE IMPROVEMENT/MAKEUP EXAMINATION, JULY 2021**

SUBJECT: PRINCIPLES OF DATA COMMUNICATION [ICT 2156]

**REVISED CREDIT SYSTEM**

**(30/07/2021)**

Time: 3 Hours MAX. MARKS: 40

**Instructions to Candidates:**

- Answer **ANY FOUR** questions.
- Missing data, if any, may be suitably assumed.

**1A** Explain the key factors that affects the channel capacity. Consider a transmission over 2 MHz and a SNR of 127, for a data rate of 60% of the maximum theoretical limit, what is the number of bits required for coding? **6**

**1B** For a 12 bit binary string 010011000110, draw and calculate the number of transitions for the following encoding schemes.

a) NRZI
b) Bipolar
c) Manchester
d) Differential Manchester

**4**

**2A** Explain BFSK with suitable example. Give carrier frequency assignments for the 8FSK system which uses fc = 250 kHz and a bit duration of 6.67 µsec. **6**

**2B** Explain the transmission characteristics of the following guided transmission media in detail using suitable diagrams.

a) Twisted pair cable
b) Coaxial cable

**4**

**3A** What is antenna gain. Give the relationship between antenna gain and effective area. A microwave transmitter has an output of 0.2 W at 2 GHz. Assume that this transmitter is used in a microwave communication system where the transmitting and receiving antennas are parabolas, each 1.4 m in diameter.

a) What is the gain of each antenna in decibels?
b) Taking into account antenna gain, what is the effective radiated power of the transmitted signal?
c) If the receiving antenna is located 20 km from the transmitting antenna over a free space path, find the available signal power out of the receiving antenna in dBm units.

**6**

**3B** The following code words 000000, 010101, 101010, 110110 are selected for a communication.

a) Compute the hamming pairwise distance for the above codewords.
b) If these code words together (24bits) in the same order were transmitted as data, compute the parity bits needed to be added so that it forms a Hamming code.
c) How many bit errors can be detected and corrected in the above 2 cases?

**4**

**4A** Using the CRC-digital logic technique, find the transmitted code word for a message consisting of a 0 followed by eight 1's, if polynomial $P(X) = X^5 + X^4 + X^2 + 1$. Assuming error free transmission occurs, show how the receiver checks for error **6**

using polynomial division method and interprets the message from received codeword.

**4B** Explain Stop and Wait ARQ error control protocol. No mention was made of reject (REJ) frames in the stop-and-wait ARQ discussion. Why is it not necessary to have REJ0 and REJ1 for stop-and-wait ARQ? **4**

**5A** Sender 'A' and Receiver 'B' are connected through an unreliable network which has smaller bandwidth-delay product and noisy channel. Justify why Selective Reject ARQ is a preferred error control protocol for this network. Draw the sender and receiver windows using vertical time line diagram for the given scenario where a 3 bit sequence field is used with maximum window size when:

a) Frame 0 is sent; Frame 0 is acknowledged.
b) Frames 1 and 2 are sent; Frames 1 and 2 are acknowledged.
c) Frames 3, 4, and 5 are sent; Frames 3 and 4 are acknowledged; Timer for Frame 5 expires.
d) Frames 5, 6, and 7 are sent; Frames 5 through 7 are acknowledged. **6**

**5B** Assume that source 1 sends the message 'MANIPAL' starting from time instant $t_0$ = 0s. Source 2 sends the message 'IS A PLACE' starting from time instant $t_1$ = 1s (The space between characters represents the silent period of the source.) Depict the transmission of these messages using Synchronous and Statistical Time Division Multiplexing technique. State the drawbacks of Synchronous TDM over Statistical TDM **4**

**6A** The LAN in the figure Q.5A is interconnected using source routing bridges. Assume that the bridges 3 and 4 are not part of the initial spanning tree.

a) Show the single route broadcast frames when S1 wants to learn the route to S2.
b) Show the path to all routes broadcast frames returned by S2.
c) List all possible routes from S1 to S2 from part (2).
d) How many LAN frames are required to learn the possible routes

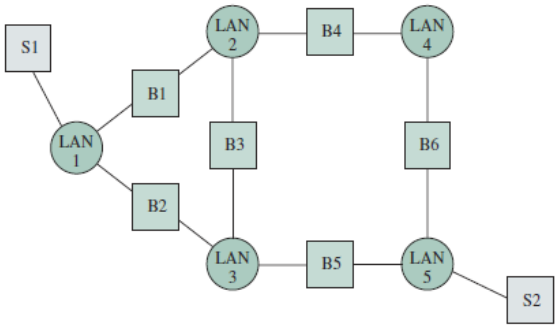


Figure Q.5A **6**

**6B** Explain CSMA/CD. Consider a CSMA/CD network with a data rate of 90 Mbps. The maximum distance between the stations is 7000m and the propagation speed is $2*10^8$ m/s.

a) What is the minimum size of the frame?
b) If the data rate is decreased from 90 Mbps to 80 Mbps and the maximum distance between the stations is 6000m, then what should be the minimum frame size? **4**