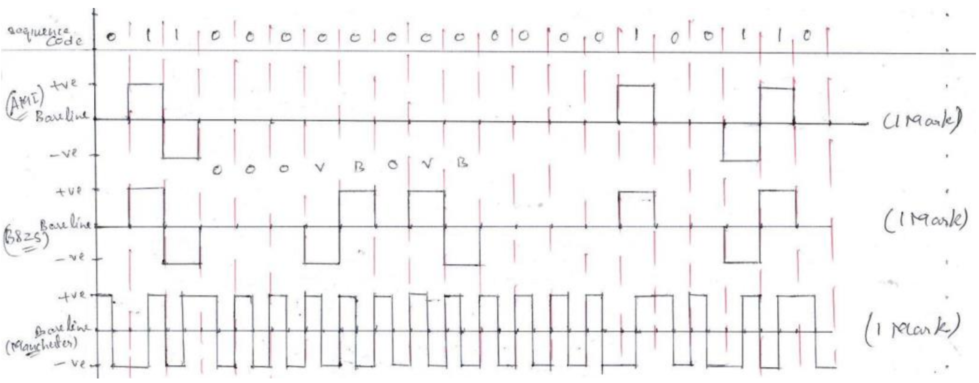
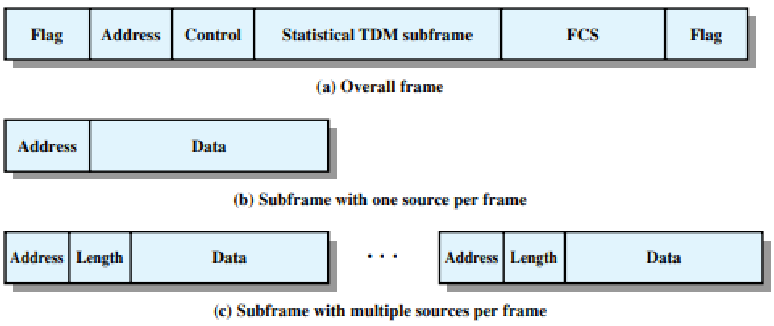
III SEMESTER B.TECH.
(INFORMATION TECHNOLOGY/COMPUTER & COMMUNICATION ENGINEERING)
IN-SEMESTER EXAMINATIONS, DECEMBER 2021
SUBJECT: PRINCIPLES OF DATA COMMUNICATION [ICT 2156]
SCHEME OF EVALUATION
TOTAL MARKS: 20 M

1	a. With respect to the standard HDLC frame format, give the structure of the frame format indicating the individual field size in bits and explain bit stuffing with an example. b. With respect to the error control mechanism, explain the concept of stop and wait ARQ. ans. 1 (a). Flag | Address | Control | Information | FCS | Flag → 1 Ma 8 bit | 8 or 16 bit extended | 8 or 16 bit | Variable | 16 or 32 bit | 8 bit Bit Stuffing → 1 Mark. 1(b). Stop & wait ARQ Complete explanation } → 2 marks.	1+1 2
2	a. Given that the transmitter and receiver antenna height is 50 meters and 20meters respectively, if a man would like to see the receiving antenna which is on the ground level what should be the height of the building on which he should stand? (Assuming there is no obstacles in between). (2a). $d = 3.57\left(\sqrt{\frac{4}{3}\times 50} + \sqrt{\frac{4}{3}\times 20}\right)$ $= 3.57\{8.165 + 5.164\}$ $= 47.58$ Km — 1 Mark. $d = 3.57\sqrt{h_t}$ $h_t = 177.63$ m — 1 Mark. b. What is the channel capacity for a telephone channel with a 2.4 kHz bandwidth and a signal-to-noise ratio of 20 dB, where the noise is white thermal noise?	1+1 0.5+0.5

	2b) Given: $BW = 2.4KHz$ $SNR_{dB} = 20dB$ To find: Channel Capacity (C) Solⁿ: $C = B\log_2(1+SNR)$ $C = 2400 \log_2(1+10^2)$ $C = 2400 * 6.658$ bps $\Rightarrow C = 15979.2$ bps or $\boxed{15.98 \text{ kbps}}$ [0.5M] $\boxed{SNR_{dB} = 10\log_{10} SNR \Rightarrow SNR = 10^{SNR_{dB}/10} \Rightarrow SNR = 6.658}$ [0.5M]	
3	For the bit stream 01100000000000000100110, sketch the waveforms for Manchester, bipolar AMI and B8ZS. Assume that the signal level for the preceding bit for NRZI was high; the most recent preceding 1 bit (AMI) has a negative voltage, and the most recent preceding 0 bit (pseudo ternary) has a negative voltage. 	1+1+1
4	Explain the working of Statistical time-division multiplexing (STDM) and compare with synchronous time division multiplexing by drawing the possible frame format Block Diagram carries 1 marks, Detailed Explanation carries 1 marks and Comparision between Statistical and synchronous time-division multiplexing (TDM) 1 marks  Figure 8.13 Statistical TDM Frame Formats	1+1+1

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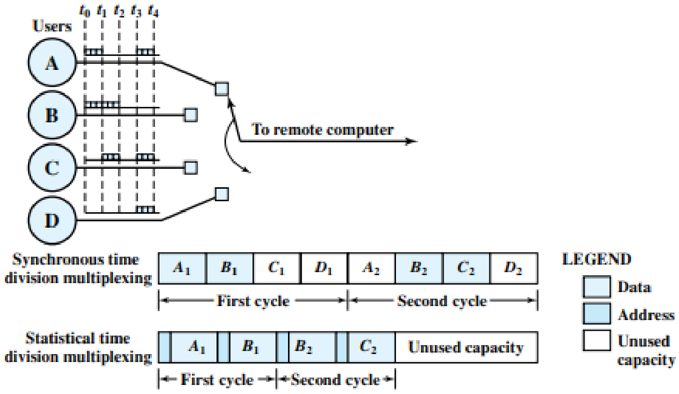

Figure 8.12 Synchronous TDM Compared with Statistical TDM
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What will be the checksum that Alice sends Bob for the following message? Show the steps of working. Verify at the receiver's end as well. Assume n =8 and the equivalent Hexadecimal value of A = 0x41. Message: EVERYTHING

5) Given: Message = EVERYTHING
n=8
To find: a) Checksum
b) Verify

Soln: E: 0100 0101 45
V: 0101 0110 56
E: 0100 0101 45
R: 0101 0010 52
Y: 0101 1001 59
T: 0101 0100 54
H: 0100 1000 48
I: 0100 1001 49
N: 0100 1110 4E
G: 0100 0111 47
11 0000 0101
11
0000 1000
Sum: 0000 1000
Checksum: 1111 0111 [2M]

Receiver: 11 0000 0101
1111 0111
11 1111 1100
11
Sum: 1111 1111
Checksum: 0000 0000 [1M]
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6	A CRC is constructed to generate FCS for a 12-bit message. The generator polynomial is P(X) = X4 + X2 + X + 1. Draw the shift-register circuit and encode the data bit sequence 1100 1110 0111 using the generator polynomial and generate the codeword. Show the detailed steps of working.	1+2

6) Given: Data bit sequence : 1100 1110 0111

Pattern, $P(X) = X^4 + X^2 + X + 1$ (10111)

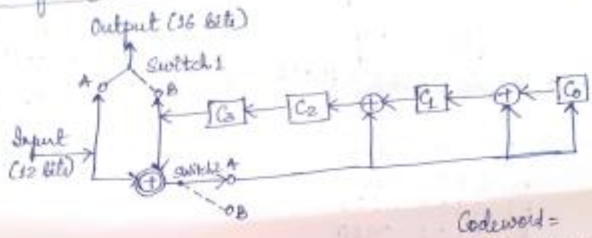
Asked: a) Shift Register Circuit

b) Codeword

Solution:

Shift Register Circuit

n-k = 5 Shift Registers



Codeword =

1100 1110 0111 1010

I = Input	C_3	C_2	C_1	C_0	$C_2 = C_3 \oplus I \oplus C_1$	$C_1 = C_3 \oplus I \oplus C_0$	$C_0 = C_3 \oplus I$
1	0	0	0	0	1	1	1
1	0	1	1	1	0	0	1
0	1	0	0	1	1	0	1
0	0	1	0	1	0	1	0
1	1	0	1	0	1	0	0
1	0	1	0	0	1	1	1
1	1	1	1	1	1	1	0
0	1	1	1	0	0	1	1
0	1	0	1	1	0	0	1
1	0	0	0	1	1	0	1
1	0	1	0	1	1	0	1
1	1	1	0	1			
	1	0	1	0 ← FCS			