

7 JAN 2023

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

Fifth Semester

Electronics and Communication Engineering
20ECPC501 - DIGITAL COMMUNICATION

(Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

- | | <i>Marks,</i>
<i>K-Level,CO</i> |
|--|------------------------------------|
| 1. Sketch the structure of a binary symmetric channel. | 2,K2,CO1 |
| 2. Define entropy of a discrete memory less source. | 2,K2,CO1 |
| 3. What are the demerits of delta modulation? | 2,K2,CO3 |
| 4. Sketch the Polar RZ line coded signal for the binary sequence 101100. | 2,K3,CO3 |
| 5. What is eye pattern in digital communication? | 2,K2,CO4 |
| 6. An ideal band-pass channel 500 Hz - 2500 Hz is deployed for communication. A modem is designed to transmit bits at the rate of 2000 bits/s. Determine the roll-off factor of a pulse with a raised cosine spectrum that utilizes the entire frequency band. | 2,K3,CO4 |
| 7. Differentiate between coherent and non-coherent detection techniques. | 2,K2,CO5 |
| 8. Sketch the constellation diagram of a 16-QAM signal. | 2,K2,CO5 |
| 9. What is Hamming distance? Give an example. | 2,K2,CO6 |
| 10. The generator matrix of a (6,3) linear block code is | 2,K3,CO6 |

$$G = \left[\begin{array}{cccccc|ccc} 1 & 0 & 0 & 0 & 1 & 1 & & & \\ 0 & 1 & 0 & 1 & 0 & 1 & & & \\ 0 & 0 & 1 & 1 & 1 & 0 & & & \end{array} \right]$$

Find the parity check matrix.

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) (i) State and prove the properties of mutual information. 7,K2,CO1
- (ii) Explain BSC and derive the Channel Capacity For Binary Symmetric Channel. 6,K2,CO1

OR

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

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- b) The channel transition matrix of a communication channel is given by 13,K3,CO

$$P(Y / X) = \begin{bmatrix} 2/5 & 2/5 & 1/5 \\ 1/5 & 2/5 & 2/5 \\ 2/5 & 1/5 & 2/5 \end{bmatrix}. \text{ Draw the channel model.}$$

The source emits symbols with probabilities $p(X) = [1/8, 1/4, 5/8]$.
Compute the mutual information $I(X;Y)$.

12. a) Derive the expression for the power spectral density of NRZ unipolar signal. 13,K3,CO

OR

- b) (i) Explain in detail the delta modulation technique with neat block diagram and illustration. 6,K3,CO2

(ii) Let a sinusoidal signal of 4 kHz frequency is applied to a delta modulator. The sampling rate and step-size Δ of the delta modulator are 30,000 samples per second and 0.1 V, respectively. What should be the maximum amplitude of the sinusoidal signal (in Volts) to prevent slope overload? 7,CO3

13. a) State and prove the Nyquist first criterion for zero ISI. 13,K2,CO4

OR

- b) Explain in detail the principle of correlation filter and matched filter. 13,K2,CO4

14. a) Describe the generation and detection of a DPSK signal. 13,K2,CO5

OR

- b) Derive the probability of error of a binary phase shift keying system. 13,K2,CO5

15. a) The generator polynomial of a (7,4) cyclic code is $D^3 + D + 1$. Determine the correct code word transmitted if the received code word is 1011011. 13,CO6

OR

- b) A rate 1/3 convolutional encoder with constraint length of 3 uses the following generator sequence. 13,K3,CO6

$$G1 = (1 \ 0 \ 0), G2 = (1 \ 0 \ 1), G3 = (1 \ 1 \ 1).$$

Draw the encoder diagram, state diagram of the encoder. Evaluate the encoder output if the input is 10010110.

PART - C (1 × 15 = 15 Marks)

16. a) A discrete memory less source has an alphabet of seven symbols *15,K3,CO2*
whose probabilities of occurrence are as described below

Symbol :	s0	s1	s2	s3	s4	s5	s6
Prob :	0.125	0.0625	0.25	0.0625	0.125	0.125	0.25

Compute the Huffman code and Shannon Fano coding for this source.
Also calculate average code word length and the efficiency of the source encoder.

OR

- b) A discrete memory less source has an alphabet of five symbols. *15,K3,CO2*
Compute the Huffman code and Shannon Fano coding for this source. Also calculate average code word length and the efficiency of the source encoder

Symbols :	X1	X2	X3	X4	X5
Probability :	0.2	0.2	0.1	0.1	0.4