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**Question Paper Code : 90187**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019  
Fifth Semester  
Electronics and Communication Engineering  
EC 8501 – DIGITAL COMMUNICATION  
(Regulations 2017)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. Define mutual information  $I(X;Y)$  between two discrete random variables X and Y.
2. What is the capacity of the channel having infinite bandwidth ?
3. What is meant by slope-overload distortion in delta modulation system ? How can it be avoided ?
4. Draw the line encoding waveforms for the binary data 10110001 using (i) Unipolar NRZ and (ii) bipolar NRZ.
5. What is meant by Inter-Symbol Interference (ISI) ? How does ISI occur in digital transmission ?
6. What are the essential requirements of an equalizer ?
7. In a BPSK system, the bit rate of a bipolar NRZ data sequence is 1 Mbps and carrier frequency of the transmission is 100MHz. Determine the bandwidth requirement of the communication channel and symbol rate of transmission.
8. What do you understand by non-coherent detection ?
9. What are the desirable properties of linear block code ?
10. What is the unique characteristic of convolutional codes which makes it different from linear block codes ?



## PART - B

(5×13=65 Marks)

11. a) Prove that the maximum value of the entropy,  $H(X)$ , of the discrete source  $X$  is  $\log_2(M)$ , where  $M$  is the number of messages emitted by the discrete source. (13)
- (OR)
- b) Define channel capacity and derive the channel capacity of a binary symmetric channel with error probability 'p'. Plot and discuss the variation of channel capacity with error probability 'p'. (13)
12. a) Draw the block diagram of DPCM transmitter and receiver with predictor and explain. What are the advantages of using a predictor in DPCM? (13)
- (OR)
- b) Derive the expression for the power spectral density of bipolar NRZ data format and list its properties. (13)
13. a) What is meant by an eye pattern? What are the parameters observed from the eye pattern? Explain with the help of suitable illustration. (13)
- (OR)
- b) Draw the block diagram of correlator receiver and explain its working. (13)
14. a) Discuss the generation and demodulation of binary FSK and give their advantages and disadvantages. (13)
- (OR)
- b) i) Compare conventional QPSK, offset-QPSK and  $\pi/4$ -QPSK with respect to their constellation diagrams. (4)
- ii) What is meant by carrier synchronization? Draw the block diagram of Costas-loop carrier synchronization and explain. (9)



15. a) Consider a (6,3) linear block code with generator matrix

$$G = \begin{bmatrix} 1 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$

Determine :

- i) Parity check matrix (3)
- ii) All the code words and (3)
- iii) Minimum distance of the code (3)
- iv) How many errors can be detected and corrected ? (4)

(OR)

b) A rate  $\frac{1}{2}$  convolutional encoder with constraint length of 3 uses the generator sequences:  $g_1 = (1\ 1\ 1)$  and  $g_2 = (1\ 0\ 1)$ . (i) Draw the encoder and state diagram of the code and (ii) determine the output sequence for the message sequence of 10011. (13)

PART - C

(1×15=15 Marks)

16. a) Consider a discrete source that emits the symbols  $\{x_1, x_2, x_3, x_4, x_5, x_6, x_7\}$  with corresponding probabilities  $\{0.08, 0.2, 0.12, 0.15, 0.03, 0.02, 0.4\}$ . Construct a binary optimal code using Huffman procedure for this source. What is the efficiency of the code ? (15)

(OR)

- b) The generator polynomial of a (7,4) cyclic code is given  $g(X) = 1 + X + X^3$ .
- i) Find the generator matrix and parity check matrix of the code in systematic form (5)
  - ii) Draw the encoder circuit for this code. (2)
  - iii) Find the code word for message (1011). (8)