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Question Paper Code : X 10365

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
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. A discrete memoryless source produces four symbols whose probabilities are in the ratio of 0.25 : 0.5 : 0.75 : 1. What is the entropy of the source ?

2. What is the channel capacity of a Gaussian channel with 1 MHz bandwidth and signal power to noise power spectral density ratio is 10^4 Hz ?

3. What is meant by granular noise in a delta modulation system ? How can it be avoided ?

4. What are line codes ? List 4 popular line codes.

5. What is meant by correlative coding ?

6. What is a matched filter ?

7. For the binary sequence 1100, sketch the waveform of QPSK together with in-phase and quadrature components waveforms.

8. What are the three levels of synchronization needed for coherent bandpass signaling system ? Which is not necessary for non-coherent system ?

9. What is meant by systematic block code ?

10. What is the meaning and the significance of minimum distance of a block code ?

PART – B **(5×13=65 Marks)**

11. a) Consider that two sources X and Y emit symbols $\{x_1, x_2, x_3\}$ and $\{y_1, y_2, y_3\}$ with the joint probability p(X, Y) as given below in matrix form :

$$p(X,Y) = \begin{array}{c} \\ x_1 \\ x_2 \\ x_3 \end{array} \begin{array}{c} \begin{array}{ccc} y_1 & y_2 & y_3 \end{array} \\ \begin{bmatrix} \frac{3}{40} & \frac{1}{40} & \frac{1}{40} \\ \frac{1}{20} & \frac{3}{20} & \frac{1}{20} \\ \frac{1}{8} & \frac{1}{8} & \frac{3}{8} \end{bmatrix} \end{array}$$

Calculate the entropy H(X), H(Y), H(Y/X) and H(X, Y).

(OR)

b) Consider a discrete source that emits the symbols $\{x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8\}$ with probabilities {0.48, 0.15, 0.1, 0.1, 0.07, 0.05, 0.03, 0.02}. Construct a binary code using Shannon-Fano technique. Compute the efficiency of the code ?

12. a) Draw the block diagram of adaptive delta modulation system transmitter and receiver with continuously variable step size and explain.

(OR)

b) Derive the expression for the power spectral density of unipolar RZ data format.

13. a) What is modified duo-binary signaling scheme ? Draw the block diagram of this signaling scheme and explain.

(OR)

b) Draw the block diagram of adaptive equalizer and explain with adaptive algorithm.

14. a) Derive the expression for probability of a bit-error for coherent binary FSK system.

(OR)

b) Discuss the generation and detection of coherent QPSK signals with neat block diagrams.

15. a) The generator polynomial of a (7, 4) cyclic linear block code is given $g(X) = 1 + X + X^3$. Determine the code word in systematic form for the following messages :
    i) 1011 and
    ii) 1111.

(OR)

b) For the rate ½ convolutional encoder with $G(D) = [1 \;\; 1 + D + D^3]$
    i) Draw the encoder diagram.
    ii) Determine the generator matrix.
    iii) For the input sequence u = 1011, find the code polynomial and code sequence.

PART – C **(1×15=15 Marks)**

16. a) The parity check bits v_0, v_1 and v_2 of a (7, 4) block code are given by

$v_0 = u_0 + u_2 + u_3$

$v_1 = u_0 + u_1 + u_2$

$v_2 = u_1 + u_2 + u_3$

Where u_0, u_1, u_2 and u_3 are the message bits.
    i) Find the generator and parity check matrices for this code in systematic form.
    ii) Find the error correcting capabilities of this code.
    iii) Construct encoder circuit for this code.

(OR)

b) An analog signal having 4 kHz bandwidth is sampled at 1.5 times the Nyquist rate and each sample is quantized into one of the 512 equally likely levels. Assume that the successive samples are statistically independent.
    i) Find the information rate of the source.
    ii) Determine the minimum SNR required to transmit the output of this source without error over an additive white Gaussian noise channel with a bandwidth of 10 kHz.
    iii) Find the bandwidth required for an additive white Gaussian noise channel to transmit the output of this source without error if the SNR is 20dB.

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