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Question Paper Code : 70516

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

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. State the properties of mutual information.

2. What is Binary symmetric channel?

3. Mention the drawbacks of Delta modulation.

4. Express the data 101011 using the Manchester code format.

5. Define Equalization.

6. List the properties of matched filter.

7. Differentiate coherent and Non coherent receivers.

8. Draw the constellation diagram of 8 QAM Modulation.

9. What is the use of error control coding in Digital Communication?

10. How the convolutional codes are different from block codes?

PART B — (5 × 13 = 65 marks)

11. (a) Derive the Shannon's channel capacity theorem and show that the channel capacity is $C = B\log_2\left(1+\frac{P}{N_0 B}\right) b/s$.

Or

(b) A discrete memory less source has an alphabet of seven symbols with probabilities [0.4, 0.14, 0.16, 0.15, 0.05, 0.1]. Compute the Huffman code for this source symbols. Also determine average codeword length and efficiency.

12. (a) Construct and explain Delta modulation system with neat block diagram and waveforms.

Or

(b) (i) Explain the operating principle of Adaptive Delta modulation. Also list its advantages. (7)

(ii) Briefly discuss about the properties of line codes. (6)

13. (a) State and prove Nyquist criterion for distortion less base band binary transmission.

Or

(b) (i) Illustrate the effect of ISI in base-band binary data transmission system. (6)

(ii) Explain the design procedure to obtain the impulse response coefficients of a zero forcing equalizer. (7)

14. (a) Derive the expression for bit error probability of Binary phase shift keying scheme with appropriate signal space diagram.

Or

(b) Construct and explain the generation and detection of coherent QPSK scheme with neat diagrams.

15. (a) (i) Consider the generator polynomial of the cyclic encoder as $g(x) = 1 + x + x^3$. Determine the encoded code word for the message sequence 1011. (7)

(ii) Explain in detail about the syndrome decoding procedure of linear block codes. (6)

Or

(b) Consider the generator polynomial of the Convolutional encoder $g_1(x)=1+x+x^2$; and $g_2(x)=1+x^2$.

(i) Draw the structure of the convolutional encoder. (6)

(ii) Determine the convolution code for the data sequence 101011. (7)

PART C — (1 × 15 = 15 marks)

16. (a) Consider a (6, 3) systematic linear block code in which the three parity check digits are given as $c_4=d_1+d_2+d_3$; $c_5=d_1+d_2$; $c_6=d_1+d_3$.

(i) Construct the appropriate generator matrix for this code. (4)

(ii) Construct all possible code words generated by this matrix. (4)

(iii) Determine the error correcting capability of this code. (4)

(iv) Prepare a suitable decoding table and decode the following received codes 101100, 100110. (3)

Or

(b) The input source to a noisy communication channel is a random variable X over the four symbols a, b, c, d. The output from this channel is a random variable Y over these same four symbols. The joint distribution of these two random variables $p(X,Y)$ is as follows:

$$p(X,Y)=\begin{bmatrix} 0.125 & 0.0625 & 0.0625 & 0.25 \\ 0.0625 & 0.125 & 0.0625 & 0 \\ 0.03125 & 0.03125 & 0.0625 & 0 \\ 0.03125 & 0.03125 & 0.0625 & 0 \end{bmatrix}$$

. Find the Entropy $H(X)$, $H(Y)$, $H(Y/X)$ and $H(X,Y)$.