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Question Paper Code : 50494

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 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 source coding theorem with necessary equation.
2. How do you define the information contained in a symbol S_k that occurs with probability P_k?
3. What is slope overload distortion?
4. What is the expression for the zero-frequency value of power spectral density of a stationary process?
5. Define inter symbol interference.
6. Find the impulse response of a filter that is matched to a pulse signal g(t) of duration T.
7. What is Gray coding? Show the QPSK constellation with Gray coded bit mapping.
8. Write the bit error rate expression of coherent BPSK.
9. State the channel coding theorem.
10. What is a linear block code?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Find the entropy of a binary memoryless source as a function of P_0 (probability of occurrence of symbol-0). Find the entropy for (1) $p_0=0$, (2) $p_0=1$. Derive the value of p_0 for which the entropy is maximized. With these values, plot the entropy. (8)

(ii) What is a source encoder? State source-coding theorem. (5)

Or

(b)

x_i	x_1	x_2	x_3	x_4	x_5	x_6
$P(x_i)$	0.30	0.25	0.20	0.12	0.08	0.05

(i) Find the Huffman encoding of the source given in Table 1. (8)

(ii) Find the entropy, average code length, and the code efficiency of the code from Huffman encoding. (5)

12. (a) For the delta modulation (DM):

(i) Illustrate the DM process with staircase approximation waveform $m_q(t)$. (3)

(ii) Explain the transmitter and receiver of delta modulator with block diagrams. (8)

(iii) Illustrate granular noise in delta modulation. (2)

Or

(b) Draw and explain the line coding waveform and its power spectrum for:

(i) Unipolar nonreturn-to-zero (NRZ) signaling (3)

(ii) Polar nonreturn-to-zero (NRZ) signaling (2)

(iii) Unipolar return-to-zero (RZ) signaling (3)

(iv) Bipolar return-to-zero (BRZ) signaling (2)

(v) Manchester code signaling (3)

13. (a) (i) What is the Nyquist criterion for distortion less baseband transmission? (8)

(ii) Show an ideal pulse shape that satisfies Nyquist criterion. (5)

Or

(b) Derive the impulse response of receiver filter that maximizes the receiver SNR. Assume the received pulse signal g(t) is corrupted by additive white Gaussian noise w (t) at the receiver. (13)

14. (a) Draw and explain the following:

(i) Differential phase shift keying transmitter. (7)

(ii) Differential phase shift keying receiver. (6)

Or

(b) (i) Draw and explain the generation of coherent QPSK signal. (7)

(ii) Illustrate and describe the detection of coherent QPSK signal. (6)

15. (a) (i) With block diagrams and equations, explain the use of generator matrix and parity check matrix in systematic codes. (8)

(ii) How do you generate syndrome for the systematic codes? Write the properties of syndrome. (5)

Or

(b) (i) What are cyclic codes? (2)

(ii) State the two properties of cyclic codes. (3)

(iii) Prove the cyclic property of cyclic codes. (8)

PART C — (1 × 15 = 15 marks)

16. (a) Consider a binary symmetric channel with $P(x_1) = \alpha$ and transition probability p.

(i) Find the mutual information I(X;Y) in terms of H(Y) and p. (8)

(ii) Calculate I(X;Y) for $\alpha = 0.5$ and $p = 0.1$ (4)

(iii) Repeat (ii) for $\alpha = 0.5$ and $p = 0.5$ and comment on the result. (3)

Or

(b) A rate $1/2$ convolutional encoder with constraint length of 3 uses the generator sequences : $g_1 = (111)$ and $g_2 = (101)$.

(i) Sketch encoder diagram. (3)

(ii) Draw the state diagram for the encoder. (4)

(iii) Determine the d_{free} distance of the encoder. (8)

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