

CBCS SCHEME

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18EC61

Sixth Semester B.E. Degree Examination, June/July 2023 Digital Communication

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Determine the Hilbert transform of rectangular pulse :

$$\text{rect}(t) = \begin{cases} 1 & -\frac{1}{2} \leq t \leq \frac{1}{2} \\ 0, & \text{otherwise} \end{cases} \quad (04 \text{ Marks})$$

- b. Express band pass signal $S(t)$ in canonical form. Also derive the schemes for obtaining in phase and quadrature components of the band pass signal $S(t)$ and vice-versa. (08 Marks)
- c. Explain with necessary equations, the time-domain procedure for computational analysis of a band pass system driven by a band pass signal. (08 Marks)

OR

- 2 a. Consider a real base band signal $m(t) = 4 \cos(2t) - 6 \sin(3t)$ and a carrier signal $c(t) = \cos(100t)$. Determine a band pass signal $s(t)$, analytic signal $s_c(t)$ and complex envelope $\tilde{s}(t)$. (08 Marks)
- b. Draw the power spectra of :
i) NRZ polar signal
ii) Manchester signal. (04 Marks)
- c. Illustrate HDB3, B8ZS and B3ZS signaling schemes and mention its applications. (08 Marks)

Module-2

- 3 a. Obtain the maximum likelihood decision rule for the signal detection problem. (10 Marks)
- b. Derive the expressions for mean and variance of the correlator outputs. Also show that the correlator outputs are statistically independent. (10 Marks)

OR

- 4 a. Using the Gram-Schmidt orthogonalization procedure, find a set of orthonormal basis functions to represent the three signals $S_1(t)$, $S_2(t)$ and $S_3(t)$ shown in Fig.Q4(a). Also express each of these signals in terms of the set of basis functions.

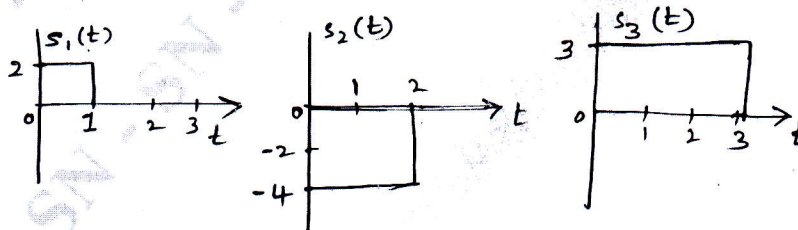


Fig. Q4

- b. With a neat diagram, explain the correlation receiver. (10 Marks)

(10 Marks)

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

- 5 a. With necessary expressions and block diagrams, explain the generation and coherent detection of QPSK signals. Also mention the shortcomings of QPSK and solution for the same. (10 Marks)
- b. Define bandwidth efficiency. Tabulate and comment on the bandwidth efficiency of M-ary PSK signals for different values of M. (04 Marks)
- c. What is the advantage of M-ary QAM over M-ary PSK system? Obtain the constellation of QAM for $M = 4$ and draw signal space diagram. (06 Marks)

OR

- 6 a. Derive an expression for probability of error of BFSK technique. Also draw the block diagrams of BFSK transmitter and coherent BFSK receiver. (10 Marks)
- b. With a neat block diagram, explain the generation and optimum detection of DPSK signals. (10 Marks)

Module-4

- 7 a. With a neat block diagram, explain the digital PAM transmission through band limited base band channels. Also obtain an expression for inter symbol interference. (10 Marks)
- b. Explain the need for precoder in a duobinary signaling. Consider a binary sequence 111010010001101 is given as an input to the pre coder whose output is used to modulate a duobinary transmitting filter. Obtain the pre coded sequence, transmitted amplitude levels, the received signal levels and the decoded sequence. (08 Marks)
- c. State the Nyquist condition for zero ISI. (02 Marks)

OR

- 8 a. What is a zero forcing equalizer? With a neat block diagram, explain the operation of linear transversal filter. (08 Marks)
- b. Explain the design of band limited signals with controlled ISI. (08 Marks)
- c. Write a note on eye diagram. (04 Marks)

Module-5

- 9 a. With a neat diagram, explain the model of a spread spectrum digital communication system. (08 Marks)
- b. Explain the generation and demodulation of direct sequence spread spectrum signals with necessary equations and block diagram. (08 Marks)
- c. A direct sequence spread – spectrum signal is designed so that the power ratio P_R/P_N at the intended receiver is 10^{-2} . If the desired $E_b/N_0 = 10$ for acceptable performance, determine the maximum value of the processing gain. (04 Marks)

OR

- 10 a. With a neat block diagram, explain the frequency hopped spread spectrum. (06 Marks)
- b. With a neat diagram, explain the IS – 95 reverse link. (10 Marks)
- c. Write a note on low detectability signal transmission as an application of DSSS. (04 Marks)
