

CBCS SCHEME

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18EC61

Sixth Semester B.E. Degree Examination, Dec.2024/Jan.2025 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. Define Hilbert transform. What are the applications of Hilbert transform? Prove that a signal $g(t)$ and its Hilbert transform $\hat{g}(t)$ are orthogonal over the entire time interval $(-\infty, \infty)$. (10 Marks)
- b. Derive the expression for the complex low pass representation of band pass system. (10 Marks)

OR

- 2 a. Express bandpass signal $s(t)$ in canonical form. Also explain the scheme for deriving the inphase and quadrature components of the bandpass signal $s(t)$. (10 Marks)
- b. For a binary sequence 0100000001011 construct:
(i) RZ bipolar format (ii) Manchester format (iii) B3ZS format
(iv) B6ZS format (v) HDB3 format (10 Marks)

Module-2

- 3 a. Explain the geometric representation of set of M energy signals as linear combination of N orthonormal basis functions. Illustrate for the case $N = 2$ and $M = 3$ with necessary diagrams and expressions. (10 Marks)
- b. Obtain the maximum likelihood decision rule for the signal detection problem. (10 Marks)

OR

- 4 a. Apply Gram-Schmidt procedure to obtain an orthonormal basis for the signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ as shown in Fig.Q4(a). Also express each of these signals in terms of the set of basis functions.

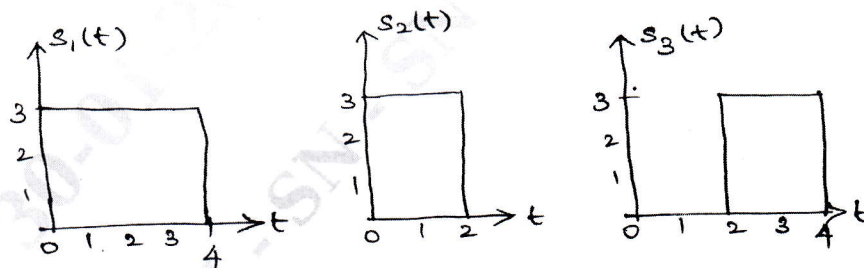


Fig.Q4(a)

- b. Explain the correlation receiver and matched filter receiver with relevant diagrams. (10 Marks)

Module-3

- 5 a. Derive the expression for average probability of error for FSK using coherent detection. Explain transmitter and coherent receiver of FSK. (10 Marks)
- b. With a neat block diagram, explain the generation and optimum detection of DPSK signals. (10 Marks)

OR

- 6 a. Using block diagram, explain the generation and detection of QPSK signal. (10 Marks)
 b. Derive the expression for error probability of binary PSK using coherent detection. (06 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. (04 Marks)

Module-4

- 7 a. State and prove Nyquist condition for zero ISI. (08 Marks)
 b. Explain the digital PAM transmission system. Also derive the expression for Inter Symbol Interference (ISI). (08 Marks)
 c. With neat diagram and relevant expression, explain the concept of adaptive equalization. (04 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 need for precoder in a duobinary signaling. The binary data 001101001 are applied to the input of a duobinary system. Construct the duo binary coder output and corresponding receiver output. Assume that precoder is used. (08 Marks)
 c. Write a note on eye diagram. (04 Marks)

Module-5

- 9 a. Explain the model of a spread spectrum digital communication system. (06 Marks)
 b. Illustrate the working of direct sequence spread spectrum transmitter and receiver with block diagram, waveforms and expressions. (10 Marks)
 c. What is a PN sequence? What are the properties of maximum length sequences? (04 Marks)

OR

- 10 a. Explain frequency hop spread spectrum with neat block diagram. (10 Marks)
 b. Illustrate the CDMA system forward link based on IS-95. (10 Marks)
