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 interms of the set of basis functions.

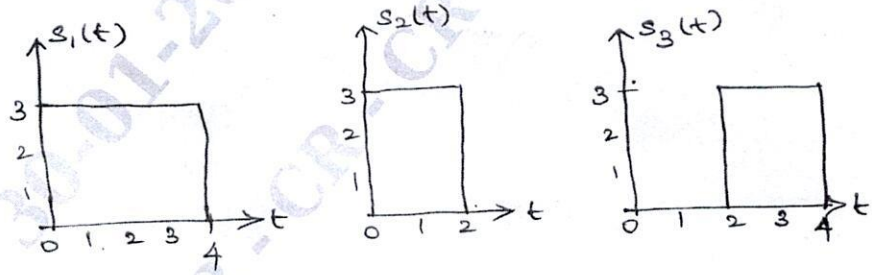


Fig.Q4(a) **(10 Marks)**

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)**

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