CBCS SCHEME

USN | | | | | | | | | | | **18EC61**

Sixth Semester B.E. Degree Examination, July/August 2022
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. 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 $(-\infty, \infty)$. **(08 Marks)**

b. For a binary sequence 0 1 0 0 0 0 0 0 0 1 0 1 1 construct :
i) RZ Bipolar format ii) Manchester format iii) B3ZS format iv) B6ZS format
v) HDB3 format. **(08 Marks)**

c. Define Pre-envelope of a real valued signal. Given a band pass signal S(t), sketch the amplitude spectra of signal S(t), Pre-envelope $S_+(t)$ and Complex envelope $\tilde{S}(t)$. **(04 Marks)**

OR

2 a. Express Bandpass signal S(t) in canonical form. Also explain the scheme for deriving the in-phase and quadrature components of the band pass signal S(t). **(08 Marks)**

b. Derive the expression for the complex low pass representation of band pass systems. **(08 Marks)**

c. Write a note on HDBN signaling. **(04 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. Explain the Correlation receiver using product integrator and matched filter. **(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. **(12 Marks)**

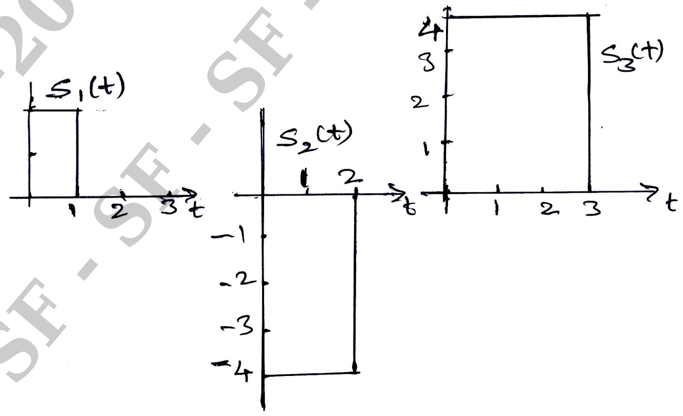

Fig. Q4(a)

b. Show that for a noisy input, the mean value of the j^{th} correlator output X_j depends only on S_{ij} and all the correlator outputs X_j , j = 1, 2, ……N have a variance equal to the PSD $N_0/2$ of the additive noise process W(t). **(08 Marks)**

Module-3

5 a. Derive the expression for error probability of binary PSK using coherent detection. **(06 Marks)**

b. Explain the generation and optimum detection of differential phase – shift keying, with neat block diagram. **(08 Marks)**

c. A binary data is transmitted over a microwave link at a rate of 10^6 bits/sec and the PSD of noise at the receiver is 10^{-10} watts/Hz. Find the average carrier power required to maintain an average probability of error $P_e \leq 10^{-4}$ for coherent binary FSK. What is the required channel bandwidth? (Given erf (2.6) = 0.9998). **(06 Marks)**

OR

6 a. With a neat block diagram, explain the non – coherent detection of binary frequency shift keying technique. **(08 Marks)**

b. In a FSK system, following data are observed. Transmitted binary data rate = 2.5×10^6 bits/second PSD of zero mean AWGN = 10^{-20} Watts/Hz. Amplitude of received signal in the absence of noise = 1μV. Determine the average probability of symbol error assuming coherent detection. (Given erf (2.5) = 0.99959). **(08 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. With a neat block diagram, explain the digital PAM technique through band limited base band channels. Also obtain the expression for inter symbol interference. **(08 Marks)**

b. State and prove Nyquist condition for zero ISI. **(08 Marks)**

c. With neat diagram and relevant expression, explain the concept of adaptive equalization. **(04 Marks)**

OR

8 a. For a binary data sequence $\{d_n\}$ given by 1 1 1 0 1 0 0 1. Determine the precoded sequence, transmitted sequence, received sequence and the decoded sequence. **(06 Marks)**

b. Draw and explain the time – domain and frequency domain of duo – binary and modified duo binary signal. **(08 Marks)**

c. With neat diagram, explain the timing features pertaining to eye diagram and its interpretation for base band binary data transmission system. **(06 Marks)**

Module-5

9 a. Explain the model of a Spread Spectrum digital Communication system. **(08 Marks)**

b. Explain the effect of dispreading on a narrow band interference in Direct Sequence Spread Spectrum System (DSSS). A DSSS signal is designed to have 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 minimum value of processing gain. **(08 Marks)**

c. What is a PN sequence? Explain the generation of maximum length (ML – Sequence). What are the properties of ML sequences? **(04 Marks)**

OR

10 a. With a neat block diagram, explain frequency Hopped Spread Spectrum Technique. Explain the terms Chip rate , Jamming Margin and Processing gain. **(10 Marks)**

b. With a neat block diagram, explain the CDMA System based on IS - 95. **(10 Marks)**

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