CBCS SCHEME

15EC61

Sixth Semester B.E. Degree Examination, Aug./Sept.2020
Digital Communication

Time: 3 hrs.   Max. Marks: 80

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

Module-1

1 a. Define Hilbert transform. State the properties of it. Mention its applications. **(05 Marks)**
   b. What is line coding? For binary stream 101001 sketch the following line codes:
       (i) Polar RZ   (ii) Polar NRZ   (iii) Bipolar NRZ   (iv) Manchester **(05 Marks)**
   c. Derive the expression for the complex low pass representation of band pass systems. **(06 Marks)**

OR

2 a. Derive the expression for power spectral density of Manchester format and draw the spectrum. **(06 Marks)**
   b. Define pre-envelope and complex envelope of a real values signal. Given a band pass signal S(t), sketch the spectral representation of signal S(t), pre-envelope and complex envelope. **(06 Marks)**
   c. Code the binary pattern (i) 11100001011010000000000010 using HDB3 and bipolar NRZ (ii) 011000011 using B3ZS. Draw B3ZS waveform. **(04 Marks)**

Module-2

3 a. Use Gram-Schmidt orthoganalization procedure and find the set of orthonormal basis functions to represent the four signals $S_1(t)$, $S_2(t)$, $S_3(t)$ and $S_4(t)$ shown in Fig.Q3(a). Also express each of these signals in terms of the set of basis functions.
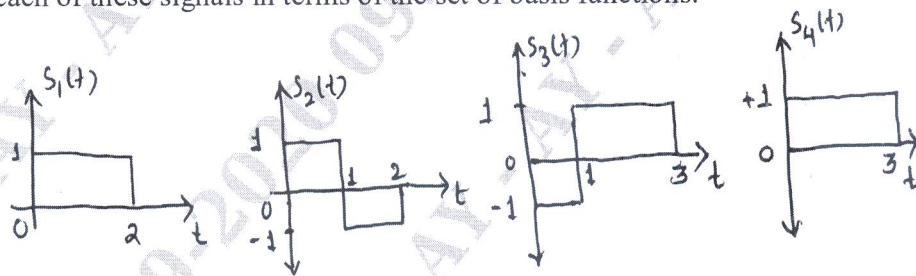

Fig.Q3(a) **(08 Marks)**
   b. Explain the matched filter receiver with the relevant mathematical theory. **(08 Marks)**

OR

4 a. Explain the geometric representation of signals and express energy of the signal in terms of the signal vector. **(08 Marks)**
   b. Explain the operation of correlation receiver with relevant diagrams. **(04 Marks)**
   c. Explain how to convert continuous AWGN channel into a vector channel. **(04 Marks)**

Module-3

5 a. Explain the BPSK signal with its signal space characterization. With a neat block diagram, explain the generation and detection of BPSK signal. **(10 Marks)**
   b. What is difference between BPSK and DPSK? Illustrate the operation of DPSK for the binary sequence 11010101. Assume reference bit as '1'. **(06 Marks)**

OR

6 a. Derive an expression for probability of error of BFSK. (06 Marks)

   b. What is an advantage of M-ary QAM over M-ary PSK system? Obtain the constellation of QAM for M = 4 and draw the signal space diagram. (04 Marks)

   c. With a neat diagram, explain the generation and detection of QPSK signals. (06 Marks)

Module-4

7 a. With a neat block diagram, explain the digital PAM transmission through band limited baseband channels and obtain the expression for ISI. (06 Marks)

   b. State the Nyquist criterion for zero ISI. (02 Marks)

   c. What are adaptive equalizers? Explain linear adaptive equalizer based on MSE criterion. (08 Marks)

OR

8 a. For the binary data sequence 11101001 given as input to the pre-coder. The output of the pre-coder is used to modulate a duo binary transmitting filter. Obtain the :
   (i) Pre-coded sequence   (ii) Transmitted amplitude levels
   (iii) The received signal levels   (iv) Decoded sequence (04 Marks)

   b. Explain the design of band limited signals with controlled ISI. Describe the time domain and frequency domain characteristics of a duo binary signal. (07 Marks)

   c. What is channel equalization? With a neat diagram, explain the concept of equalization using a linear transversal filter. (05 Marks)

Module-5

9 a. Explain the model of a spread spectrum digital communication system. (05 Marks)

   b. With a neat block diagram, explain the CDMA system based on IS-95. (08 Marks)

   c. Write a short note on application of spread spectrum in wireless LAN. (03 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. Also mention its applications. (08 Marks)

    b. Explain the effect of dispreading on a narrow band interference in DSSS systems. A DSSS is designed to have the power ratio P_R/P_N at the intended receiver is 10^{-2}. If the desired $E_b/N_o = 10$ for acceptable performance, determine the minimum value of processing gain. (04 Marks)

    c. Mention the applications of DSSS and explain any one in detail. (04 Marks)

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