CBCS SCHEME

USN

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 Hibert transform of rectangular pulse :

$$\text{rect}(t) = \begin{cases} 1 & -\frac{1}{2} \le t \le \frac{1}{2} \\ 0, & \text{otherwise} \end{cases}$$
(04 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 $s_{+}(t)$ 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 interms of the set of basis functions.

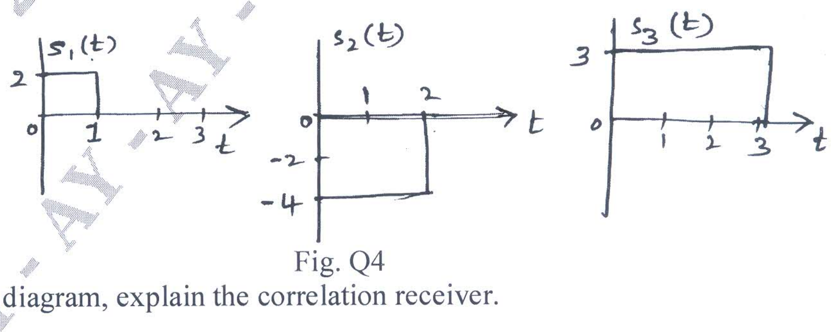

Fig. Q4 **(10 Marks)**

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

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 black 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 PR/PN 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 bock 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 law detectability signal transmission as an application of DSSS. **(04 Marks)**

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