CBCS SCHEME

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18EC61

Sixth Semester B.E./B.Tech. Degree Examination, June/July 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. What are the applications of Hilbert transform? Prove that a signal g(t) and its Hilbert transform $\hat{g}(t)$ are arthogonal over the entire time interval $(-\infty, \infty)$. **(08 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. Draw the power spectra of : i) Bipolar RZ and ii) NRZ polar. **(04 Marks)**

OR

2 a. Explain with necessary equations, the time-domain procedure for computational analysis of a band pass system driven by a band pass signal. **(08 Marks)**

b. For the binary sequence 01101001 construct :
i) Unipolar NRZ
ii) Unipolar RZ
iii) Polar RZ
iv) Bipolar RZ
v) Manchester code **(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)**

Module-2

3 a. Explain the correlation receiver using product integrator and matched filter. **(10 Marks)**

b. 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)**

OR

4 a. Derive the expression for mean and variance of the correlator outputs. Also show that the correlator outputs are statistically independent. **(10 Marks)**

b. Using the Gram–Schmidt orthogonalizaton procedure, find a set of orthonormal basis functions to represent the three signals $S_1(t)$, $S_2(t)$ $S_3(t)$ shown in Fig.Q4(b). Also express each of the signals interms of the set of basis functions.

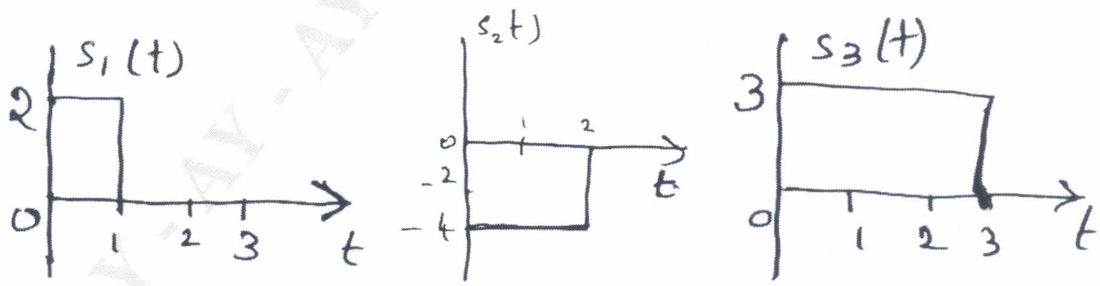

Fig.Q4(b) **(10 Marks)**

Module-3

5 a. Derive an expression for probability of error of PSK technique. Also draw the block diagrams of PSK transmitter and coherent PSK receiver. **(10 Marks)**

b. Explain the generation and optimum detection of differential phase-shift keying, with neat block diagram. **(10 Marks)**

OR

6 a. A binary FSK system transmits data at a rate of 10^6 bPS over an AWGN channel. Noise PSD is 10^{-10} Watts/Hz. Find the average carries power required to maintain an average probability of error $P_e \leq 10^{-4}$ for non coherent binary FSK. Determine the channel bandwidth required. **(10 Marks)**

b. With necessary expressions and block diagrams, explain the generation and coherent detection of QPSK signals. Also mention the short coming of QPSK and solution for the same. **(10 Marks)**

Module-4

7 a. Explain the design of band limited signals with controlled ISI. **(08 Marks)**

b. With a neat block diagram, explain the digital PAM transmission through band limited base band channels. Also obtain an expression for inter symbol interference. **(08 Marks)**

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

OR

8 a. The binary data stream 001101001 is applied to the input of a duobinary system. Construct the duobinary encodes output and corresponding reviver output, without precoder. **(08 Marks)**

b. What is a zero forcing equalizer? With a neat block diagram, explain the operation of linear transversal filter. **(08 Marks)**

c. Write a note on eye diagram. **(04 Marks)**

Module-5

9 a. With a neat block diagram, explain frequency hopped spread spectrum technique. Explain the terms Chiprate, Jamming Margin and Processing Gain. **(10 Marks)**

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

OR

10 a. With a neat diagram, explain the model of a spread spectrum digital communication system. **(08 Marks)**

b. Explain the effect of despreadin on a narrow band interference in DSSS. A DSSS signal is designed to have the power ratio PR/PN at the inteneded receiver is 10^{-2}. If the desired $E_B/N_0 = 10$ for acceptable performance, determine the minimum value of processing gain. **(04 Marks)**

c. What is a PN sequence? Explain the generation of maximum length (ML–sequence). What are the properties of ML sequences? **(08 Marks)**

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