

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

- 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)
 - 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)
 - Draw the power spectra of : i) Bipolar RZ and ii) NRZ polar. (04 Marks)

OR

- Explain with necessary equations, the time-domain procedure for computational analysis of a band pass system driven by a band pass signal. (08 Marks)
 - For the binary sequence 01101001 construct :
 - Unipolar NRZ
 - Unipolar RZ
 - Polar RZ
 - Bipolar RZ
 - Manchester code(08 Marks)
 - 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

- Explain the correlation receiver using product integrator and matched filter. (10 Marks)
 - 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

- Derive the expression for mean and variance of the correlator outputs. Also show that the correlator outputs are statistically independent. (10 Marks)
 - Using the Gram-Schmidt orthogonalization 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 in terms of the set of basis functions.

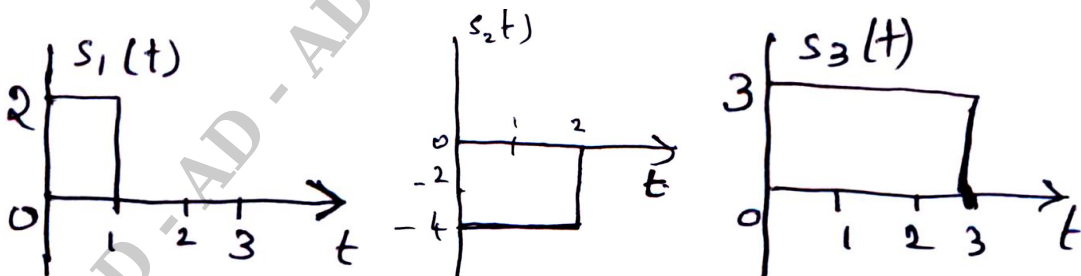


Fig.Q4(b)
1 of 2

(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 carrier 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 receiver 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 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)

OR

- 10 a. With a neat diagram, explain the model of a spread spectrum digital communication system. (08 Marks)
- b. Explain the effect of despreading on a narrow band interference in 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. (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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