CBCS SCHEME

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
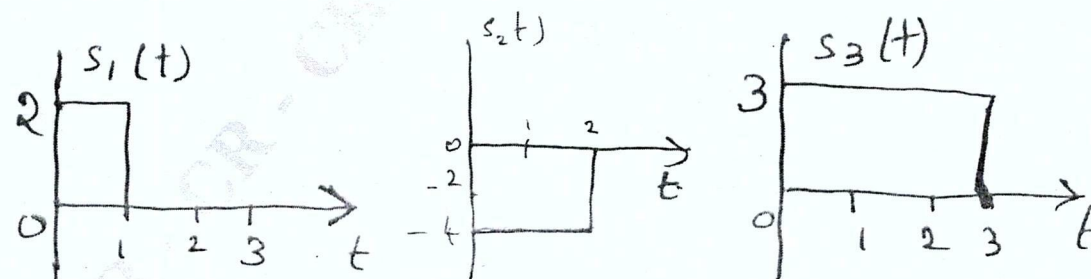each of the signals interms of the set of basis functions.

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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