CBCS SCHEME

USN | | | | | | | | | | |

15EC61

Sixth Semester B.E. Degree Examination, July/August 2022
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. What are its applications? List the properties and prove that a signal g(t) and its Hilbert Transform $\hat{g}(t)$ are orthogonal over the interval $(-\infty,+\infty)$. **(08 Marks)**

b. For a binary sequence 01000000001011, construct lines codes for the following: HDB3, B3ZS, B6ZS **(08 Marks)**

OR

2 a. Derive an expression for power spectral density of Bipolar NRZ format and plot the same with respect to frequency. **(08 Marks)**

b. Derive an expression for the complex low pass representation of bandpass system. **(08 Marks)**

Module-2

3 a. Explain Gram-Schmidt orthogonalization procedure. **(08 Marks)**

b. Derive an expression for maximum output SNR for matched filter receiver. **(08 Marks)**

OR

4 a. Explain the conceptual model of digital communication system with the aid of block diagram. **(08 Marks)**

b. Explain the geometric representation of signals. Show that energy of the signals is equal to the squared length of the vector representing it. **(08 Marks)**

Module-3

5 a. Derive an expression for probability of error for a BPSK modulated signal. **(08 Marks)**

b. Binary data are transmitted at a rate 10^6 Bps over a microwave link. Assuming channel noise is AWGN with zero mean and power spectral density at the receiver input is 10^{-19} watts/Hz. Compute the average carrier power required to maintain an average probability of error $P_e \leq 10^{-4}$ for coherent binary FSK. Compute the minimum channel bandwidth required. (Take u = 2.7 for erf(u) = 0.9998) **(08 Marks)**

OR

6 a. Describe the FSK signal with its signal space characterization, with relevant block diagram. Explain the generation and detection of FSK signal. **(08 Marks)**

b. A binary sequence 101101 is transmitted over a communication channel using DPSK transmitter. Assume the channel introduces a phase reversal of 180 degrees.

(i) Sketch the transmitted DPSK waveform assuming an initial bit of 1. What is the effect of changing the initial bit to 0?

(ii) Assuming the channel is noise free, show that the DPSK detector in the receiver produces the original binary sequence, deposit the 180 degrees phase reversal in the channel. For demonstration, take DPSK waveform with initial bit of 1. **(08 Marks)**

Module-4

7 a. Explain digital PAM transmission through band limited baseband channels with a neat block diagram. Obtain the expression for inter symbol interference. **(08 Marks)**

b. What is eye pattern? Explain with an example. Interpret the eye pattern for a baseband data transmission system, highlighting timing features. **(08 Marks)**

OR

8 a. Explain the operation of zero forcing linear equalizers with a relevant diagram and equations. **(08 Marks)**

b. Explain the raised cosine spectrum solution to reduce ISI with relevant graphs and expressions. **(08 Marks)**

Module-5

9 a. Explain the transmitter and receiver of frequency hop spread spectrum with necessary equations and block diagram. **(08 Marks)**

b. Illustrate the properties of maximum length sequences for an output sequences 0011101. **(08 Marks)**

OR

10 a. Explain the generation and demodulation of direct sequence spread spectrum signals with relevant equations and block diagram. **(08 Marks)**

b. Calculate Bit rate, PN sequence length. Bandwidth of PN sequence and processing gain of a DSSS system having the following parameters :
Bit duration = 4 ms
Chip duration = 2 μs **(08 Marks)**

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