CBCS SCHEME

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15EC61

Sixth Semester B.E. Degree Examination, Jan./Feb. 2023
Digital Communication

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define Hilbert transform. State the properties of it. **(04 Marks)**

b. Determine the pre-envelope and complex envelope of the RF pulse defined by,

$$x(t) = A \ \text{rect}\left(\frac{t}{T}\right)\cos(2\pi f_c t).$$ **(06 Marks)**

c. Explain the time-domain procedure for the complex representation of band-pass signals and systems. **(06 Marks)**

OR

2 a. For a binary sequence 0100000001011, construct,
i) RZBipolar format
ii) Manchester format
iii) B3ZS format
iv) B6ZS format
v) HDB3 format
Also mention the application of B3ZS and B6ZS. **(07 Marks)**

b. Draw the power spectra of NRZ unipolar and NRZ polar format. **(03 Marks)**

c. Explain the canonical representation of band-pass signal. **(06 Marks)**

Module-2

3 a. Explain the correlation receiver using product integrator and matched filter. **(08 Marks)**

b. Obtain the decision rule for maximum likelihood decoding and explain the correlation receiver. **(08 Marks)**

OR

4 a. Three signals $S_1(t)$, $S_2(t)$ and $S_3(t)$ are shown in Fig.Q4(a). Apply Gram-Schmidt procedure to obtain an orthonormal basis for the signals. Express signals $S_1(t)$, $S_2(t)$ and $S_3(t)$ in terms of orthonormal basis functions.

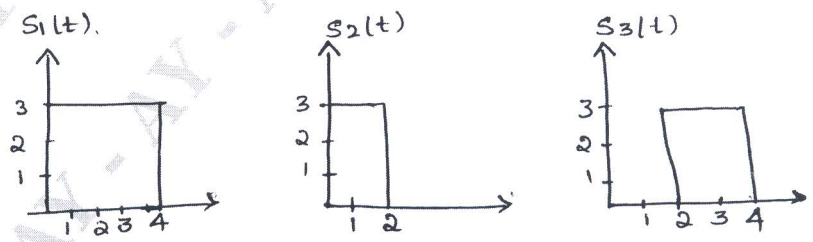

Fig.Q4(a) **(08 Marks)**

b. Show that for a noisy input, the mean value of the j^{th} correlator output X_j depends only on S_{ij} and all the correlators outputs X_j, j = 1, 2, - - - - - , N, have a variance equal to the PSD No/2 of the additive noise process w(t). **(08 Marks)**

Module-3

5 a. Derive the expression for error probability of BFSK. **(08 Marks)**

b. With block diagram, explain generation and detection of DPSK. **(08 Marks)**

OR

6 a. Sketch the QPSK waveform for the sequence 01101000. **(06 Marks)**

b. 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)**

c. An FSK system transmits binary data at rate of 2×10^6 bps. During the source of transmission, AWGN of zero mean and two sided PSD 10^{-20}Watts/Hz is added to the signal. The amplitude of the sinusoidal wave for digit 1 or 0 is 1μv. Determine the average probability of symbol error assuming non-coherent detection. **(04 Marks)**

Module-4

7 a. What is ISI? Obtain the expression of output of a filter with intersymbol interference. **(08 Marks)**

b. What is channel equalization? With a neat diagram, explain the concept of equalization using a linear transversal filter. **(08 Marks)**

OR

8 a. Explain the modified duo – binary signaling scheme, with pre-coding. Illustrate the encoding for the binary sequence "011100101". Assume previous pre-coder outputs as 1. **(08 Marks)**

b. Explain the Nyquist criterion for distortionless basedband binary transmission and obtain the ideal solution for zero ISI. **(08 Marks)**

Module-5

9 a. Explain the working of direct sequence spread spectrum transmitter and receiver with a neat diagram, waveforms and expressions. **(08 Marks)**

b. With a neat block diagram, explain the CDMA system based on IS – 95. **(08 Marks)**

OR

10 a. With a neat diagram, explain the generation of PN sequences and state its properties. **(06 Marks)**

b. Write a note on application of spread spectrum in wireless LANs. **(06 Marks)**

c. A DS spread – spectrum signal is designed so that the power ratio P_R/P_N at the intended receivers 10^{-2}. If the desired $E_b/N_0 = 10$ for acceptable performance, determine the minimum value of the processing gain. **(04 Marks)**

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