USN | | | | | | | | | | 06EC61

Sixth Semester B.E. Degree Examination, December 2011
Digital Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Explain the natural sampling, with relevant waveforms. Give all the time-domain and frequency domain equations. **(08 Marks)**

b. Show that the shifted Sinc functions $\text{sinc}(2f_m t - n)$, used in the reconstruction of sampled signal are mutually orthogonal. **(06 Marks)**

c. Consider the signal $x(t) = 5\cos(2000\pi t) + 10\cos(6000\pi t)$.
   - i) What is the Nyquist rate and Nyquist interval?
   - ii) Assume that, if we sample the signal using sampling frequency $f_s = 5000$ Hz, what is the resulting discrete-time signal?
   - iii) Draw the spectrum of the sampled signal when $f_s = 5000$Hz. **(06 Marks)**

2 a. What are the advantages of digital representation of analog signals? **(04 Marks)**

b. What is the need for non-uniform quantization? Explain the μ-law compounding. **(09 Marks)**

c. Derive an expression for the SNR of a PCM system. **(07 Marks)**

3 a. With block diagrams, explain the adaptive delta modulation system. **(07 Marks)**

b. Determine the PSD of polar quaternary format of NRZ type based on natural code. Assume statistically independent and equally likely message bits. **(07 Marks)**

c. Consider a speech signal with maximum frequency of 3.4 kHz and maximum amplitude of 1V. This speech signal is applied to a delta modulator whose bit rate is 20 kbps. Discuss the choice of appropriate step size for the modulator. **(06 Marks)**

4 a. Explain the basic elements of a baseband binary PAM system. **(08 Marks)**

b. The binary data 001101001 are applied to the input of a duobinary system.
   - i) Construct the duobinary coder output and corresponding receiver output, without a precoder.
   - ii) Suppose that due to error during transmission, the level at the receiver input produced by the second digit is reduced to zero. Construct the new receiver output. **(08 Marks)**

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

PART – B

5 a. With block diagrams, explain the QPSK transmitter and receiver. **(08 Marks)**

b. Explain the coherent binary FSK system, with the help of a signal space diagram. Indicate the decision boundary. **(06 Marks)**

c. A binary sequence 101101 is transmitted over a communication channel, using the differential phase-shift keying (DPSK). The channel introduces a phase shift of 180°.
   - i) Sketch the transmitted signal, using an initial bit of '0'.
   - ii) Assume that the channel is noise free, show that the DPSK detector in the receiver produces the original binary sequence despite 180° phase reversal in the channel. **(06 Marks)**

6 a. i) Using the Gram-Schmidt orthogonalization procedure, find a set of orthonormal basis functions to represent the three signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ as shown in Fig.Q6(a).

ii) Express each of these signals in terms of the set of basis functions found in part (i).

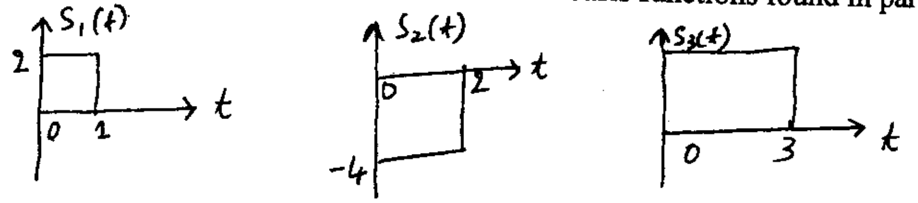

Fig.Q6(a) **(12 Marks)**

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 output x_j , j = 1, 2, ……N, have a various equal to the PSD No/2 of the additive noise process w(t). **(08 Marks)**

7 a. List the properties of a matched filter receiver. **(08 Marks)**

b. Explain the non-coherent quadrature receiver, using correlators. **(06 Marks)**

c. Explain the maximum likelihood detector. **(06 Marks)**

8 a. Explain the slow frequency hopping spread spectrum system. **(10 Marks)**

b. Define the processing gain and jamming margin. **(04 Marks)**

c. Consider the PN sequence 000100110101111. Demonstrate the properties of the PN sequence. **(06 Marks)**

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