Sixth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Digital Communication

Time: 3 hrs.   Max. Marks:100

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

PART – A

1 a. With a block diagram, explain the generation and reconstruction of quadrature sampling of band pass signal. **(08 Marks)**

   b. The signal $g(t) = 4\cos(4\pi t)\cos(400\pi t)$ is sampled at the rate of 500 sample/sec.
      i) Determine the spectrum of the resulting sampled signal.
      ii) What is the Nyquist rate for g(t)?
      iii) What is the cut-off frequency of ideal reconstruction filter? **(08 Marks)**

   c. List the advantages of digital communication over analog communication. **(04 Marks)**

2 a. Derive an expression for output SNR of the quantizer and show that $(SNR)_0 = 1.8 + 6n$ in decibels if a sinusoidal signal is quantized. **(08 Marks)**

   b. For a binary PCM signal, determine 'L' if the compression parameter $\mu = 100$ and the minimum $[SNR]_{0,dB} = 45$ dB. Determine the $[SNR]_{0,dB}$ with this value of L. **(04 Marks)**

   c. What is the necessity of non-uniform quantization? Explain two compounding methods used in practice. **(08 Marks)**

3 a. What is slope overload distortion and granular noise in delta modulation and how it can be reduced? **(08 Marks)**

   b. A binary data sequence is 0110011.... Sketch the waveform for the following formats:
      i) NRZ unipolar
      ii) RZ polar
      iii) NRZ bipolar **(06 Marks)**

   c. Obtain an expression for power spectral density of NRZ polar waveform. **(06 Marks)**

4 a. What is ISI? Derive an expression for Nyquist pulse shaping criterion for distortionless baseband binary transmission. **(08 Marks)**

   b. Discuss the performance of the data transmission using eye pattern. **(06 Marks)**

   c. What is the necessity of equalization in digital transmission? What is adaptive equalization? **(06 Marks)**

PART – B

5 a. Derive an expression for the average probability of symbol error of coherent binary FSK system. **(10 Marks)**

   b. With a block diagram, explain noncoherent differential phase shift keying transmitter and receiver and give that the average probability of error for DPSK is $P_e = \frac{1}{2}\exp\left(-\frac{E_b}{N_o}\right)$. **(10 Marks)**

6 a. Write a short note on Gram-Schmidt orthogonalization. **(06 Marks)**

  b. Three signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ are as shown in Fig.Q6(b). Apply Gram-Schmidt orthogonalization to obtain orthonormal basis functions for signals. Express the signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ in terms of orthonormal basis functions.
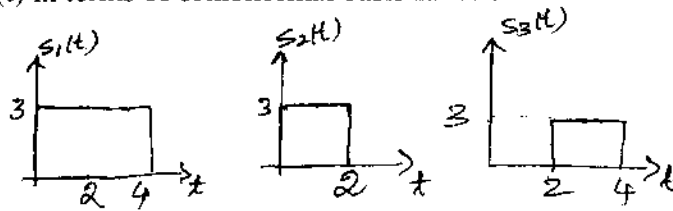

Fig.Q6(b)   **(06 Marks)**

  c. With necessary illustration, explain the geometric representation of signals for the case when N = 2 and M = 3. **(08 Marks)**

7 a. Show that the probability of bit error of a matched filter is given by $P_e = \dfrac{1}{2}\text{erfc}\sqrt{\dfrac{E_b}{N_o}}$.

(08 Marks)

  b. Write a note on correlation receivers. **(08 Marks)**

  c. A binary data is transmitted using ASK. Over a AWGN channel at a rate of 2.4 Mbps. The carrier amplitude at the receiver is 1 mV. The noise spectral density $\dfrac{N_o}{r} = 10^{-15}$ Watt/Hz. Find average probability of error if the detection is coherent (where erfc(5) = 3 × 10⁻⁶). **(04 Marks)**

8 a. What is spread spectrum? Explain the principle of direct sequence spread spectrum system. **(08 Marks)**

  b. The direct sequence spread spectrum communication system has following parameters:
  Data sequence bit duration, T_b = 4.095 ms
  Pin chip duration, T_c = 1 µs
  $\dfrac{E_b}{N_o} = 10$ for average probability of error less than 10^{-5}.
  Calculate processing gain and jamming margin. **(04 Marks)**

  c. Explain the principle of slow frequency hopping, and list advantages and disadvantages of FH-SS system. **(08 Marks)**

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2 of 2