# Sixth Semester Examination – 2011

## DIGITAL COMMUNICATION TECHNIQUE

**Full Marks – 70**

**Time : 3 Hours**

***(Students are required to give their answer any one Set according to the Syllabus)***

**SET – I**

*Answer Question No. **1** which is compulsory and any **five** from the rest. The figures in the right-hand margin indicate marks.*



1. Answer the following questions : 2 ×10

(a) What is the criteria to judge the quality of a digital communication technique, justify.

(b) Define Basis function.

(c) What are multi dimensional signal ?

(d) Define modulation with memory.

(e) Compare the advantages of QAM over ASK and PSK signals.

(f) What is the significance of pseudo noise sequence ?

(g) Draw the rectangular as well as circular constellation for 16-QAM

(h) Find the maximum value of entropy for a binary symmetric channel.

(i) How Markov process helps in communication engineering ?

(j) Differentiate matched filter and correlator.

2. Determine the autocorrelation function of the MSK & offset QPSK modulated signals based on the assumption that the information sequence for each of the signals are uncorrelated and zero mean. 10

3. (a) Briefly explain the MSK signaling scheme. 7

   (b) Why it is called CPFSK ? 3

4. (a) What is Matched filter receiver ? Explain the frequency domain interpretation. 5

   (b) Compare different digital signaling methods with respect to bandwidth and dimension. 5

5. (a) How will you achieve channel capacity in orthogonal signals ? 5

   (b) What is Nyquist criteria for zero ISI ? With this explain raised cosine filter concept. 5

6. (a) Compare and contrast MLSE and MSE criterion. 5

   (b) What is decision feedback equalizer, explain. 5

7. (a) Explain DS-CDMA system with neat diagram. 5

   (b) What is the effect of Pulsed interference on DS spread spectrum system ? 5

8. Write short notes on any **four** : 2.5×4

   (a) Simplex Signalling

   (b) Optimal Reception

   (c) $P_e$ for ASK

   (d) Lempel-Ziv Algorithm

   (e) Shanon's theorem.

## SET – II

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
*The figures in the right-hand margin indicate marks.*

1. Answer the following questions : 2×10

   (a) An analog signal is sampled at the Nyquist interval of $T_s$ seconds and quantized into L levels. The time duration of one bit of binary encoded signal is how much ?

   (b) How will you improve interpolation by using first-order hold filter ?

   (c) Show that for each additional bit used in quantization, the signal to quantization noise ratio is quadrupled.

   (d) What is scrambling ?

   (e) Draw the spectrum and find out the Nyquist Rate for "sinc $(50\pi t)$ sinc $(100\pi t)$".

   (f) If $m(t)=A \tanh(\beta t)$, where A and $\beta$ are constants, determine minimum step size $\delta$ for delta modulation of this signal to avoid slope overload.

   (g) What are the properties of line codes ?

   (h) It is required to transmit 90 MHz signal in 20 MHz bandwidth, which digital modulation technique would you consider and why ?

   (i) Give the signal space representation of 8 PSK.

   (j) Define the term Minimum in MSK, justify your view giving at least two points.

2. A signal band limited to 1 MHz is sampled at a rate 50% higher than the Nyquist rate and quantized into 256 levels using $\mu$-law quantizer with $\mu=255$. 3+7

   (a) Determine the SNR.

   (b) The SNR found in previous section was unsatisfactory. It must be increased at least by 10 dB. Is it possible to obtain the desired SNR without increasing the transmission bandwidth if it was found that a sampling rate 20% above the Nyquist rate is adequate ? If so explain how and find out the maximum SNR in this way.

3. (a) Calculate the signal to thermal noise power ratio of a PCM signal corrupted by white noise. Assume the maximum permissible error per word is one bit. 6

   (b) Discuss the comparison of PCM Vs DM with respect to SNR, BW and draw the necessary plots. 4

4. (a) Explain Nyquist criterion for Zero ISI. 4

   (b) A received signal is either +2V or −2V held for a time T. the signal is corrupted by white Gaussian noise of power spectral density $10^{-4}$ volt$^2$/Hz. If the signal is processed by an integrate and dump receiver, what is the minimum time T during which a signal must be sustained if the probability of error is not to exceed $10^{-4}$. 6

5. (a) The terminal of a computer used to enter alphanumeric data is connected to the computer through a voice grade telephone line having a usable band width of 3 KHz & an output SNR of 10 dB. Determine
   (i) The capacity of the channel
   (ii) The maximum rate at which data can be transmitted from the terminal to the computer without error.

   Assume that the terminal has 128 characters and the data sent from the terminal consists of independent sequence of characters with equal probability. 6

   (b) What is coding efficiency ? Explain source coding helps improving coding efficiency. 4

6. (a) What is a correlator ? Show that the performance of Matched filter and correlator is identical. 5

   (b) Compare the Euclidean distance and band width of different digital modulation techniques such as QPSK, 16PSK, BFSK, MSK. Assume $E_b = 0.5$, $f_b = 3$ KHz. 5

7. (a) Explain the optimum threshold for a detector if the apriori probabilities are unequal. 5

   (b) Find the Shanon Fano codes for the 8 messages with the probabilities 0.1, 0.25, 0.15, 0.05, 0.15, 0.1, 0.05, 0.15. 5

8. Write short notes on any **four** : 2.5×4
   (a) Eye diagram
   (b) Adaptive delta modulation
   (c) $P_e$ for PSK
   (d) T1 digital systems
   (e) Bandwidth – S/N Trade off