Sixth Semester Examination – 2007

DIGITAL COMMUNICATION TECHNIQUES

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any ***five*** *from the rest.*

The figures in the right-hand margin indicate full marks for the questions.

1. Answer the following in brief : 2×10

   (a) What is the need of an anti aliasing filter ?

   (b) If you wish to increase the data rate of a communication system, what considerations should be given to the system bandwidth ? Justify.

P.T.O.

(c) What is the effect of multiplying a sequence of impulses with a lowpasss signal ? Explain mathematically.

(d) If the data transmission rate is R of a communication system, how much bandwidth is required if you use BPSK modulation ?

(e) What is the basic function of a matched filter ? What is the meaning of "matched" here ?

(f) What is white noise ? Where is it encountered ?

(g) The probability of bit error is same for BPSK and QPSK. Justify.

(h) Why pulse shaping is done ? Is it a base band or pass band operation ?

(i) Shanon's capacity formula is valid for any kind of noise. Justify.

(j) What is the advantage of channel coding ?

2. (a) Draw the signal space representation of BPSK and QPSK. By drawing the spectrum of a BPSK signal, estimate the bandwidth required by both types of signals. What information do you obtain from this spectrum ? Which is spectrally efficient ? 5

(b) For what kind of modulation, can you employ envelope detection ? Justify by drawing necessary transmitter and receiver block diagrams. What is the advantage of this kind of digital modulation ? 5

3. (a) Derive the expression for the spectrum of a line code that uses Polar signalling. State the assumptions made in deriving this expression. What features are inferred from the spectrum ? Explain by drawing it. 6

(b) What is ISI ? Explain the causes of ISI ? Enumerate methods to take care of it ? Is it detrimental to a communication system's performance ? 4

4. (a) Derive an expression for the output SNR of a signal m(t) that is converted into PCM. What are the sources of error in a PCM signal ? How do you model these two errors ? Explain the significance of the expression that you have derived. 8

(b) What is Gaussian noise ? What is its role in a communication system ? 2

5. (a) Derive the expression for the average probability of bit error for a BPSK signal transmitted through an AWGN channel. State clearly the assumptions you have made to derive this. What is the significance of this result ? 8

(b) Give the signal space representation of BFSK. What is the advantage of BFSK by looking at the signal space diagram ? 2

6. (a) Derive Shanon's channel capacity theorem. What assumptions are made in deriving this expression ? What is the significance of this result ? 8

(b) What happens to the average BER of a receiver if you employ M-PSK signalling instead of binary PSK ? Explain. 2

7. (a) What is Hamming distance ? What information do you obtain from it ? If the Hamming distance of one code is higher than a second code, compare the error probability of both codes. 3

(b) Consider a generator matrix **G** for a (6,3) code :

$$G = \begin{bmatrix} 011101 \\ 111010 \\ 110001 \end{bmatrix}$$

Construct a code for this **G** and show that $d_{min} = 3$ for this code. 7

8. Write short notes on any *three* : 10

(a) Quantization error

(b) Timing recovery

(c) Minimum Shift Keying

(d) Signal reconstruction of a sampled signal

(e) Adaptive delta modulation.

———