

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.



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.

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- (c) What is the effect of multiplying a sequence of impulses with a lowpass 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) Shannon'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 Shannon'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.

(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.

