

- N. B. : (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions out of remaining **six** questions.
 (3) Assumptions made should be **clearly** stated.
 (4) Illustrate answers with **sketches** wherever **required**.

1. Attempt any four :—

20

- (a) Consider the probability density $f(x) = ae^{-b|x|}$, where x is a random variable whose allowable value ranges from $x = -\infty$ to $x = +\infty$. Find the relationship between a and b . Also find the probability that the outcome x lies between 1 and 2.
- (b) Enlist atleast five major sources of signal loss and noise in a communication link.
- (c) Explain the importance of Central Limit theorem.
- (d) Derive the condition of maximum entropy of a source. How entropy varies with probability ?
- (e) Compare MSK and QPSK on five major points.

2. (a) What is binary symmetric channel ? Explain optimum receiver algorithm for binary symmetric channel. 10

(b) The output of a sinusoidal generator is given by $A\cos\omega t$. The output is sampled randomly. Let the sampled output be assigned a random variable 'X', which can take any value in the range $(-A, A)$. Determine the mean and variance of the sampled output X. 10

3. (a) What are the parameters we should examine before choosing a PCM waveform for a particular application ? 5

(b) Explain granular noise and slope overload distortion. 5

(c) For the following random binary sequence sketch the various PCM waveforms. 10

10110001

(i) NRZ - L

(ii) Bipolar - RZ

(iii) RZ AMI

(iii) Manchester Coding

(iv) Delay Modulation

[TURN OVER

4. (a) What is Matched Filter ? Find out its Impulse Response for maximum output signal to Noise ratio. 6
- (b) Explain how 'Duo-binary Signalling' introduces controlled Intersymbol Interference [ISI]. Also derive Duobinary Transfer function and sketch the pulse shape. 6
- (c) Explain 'Integrate and Dump' receiver and derive an expression for the probability of error. 8
5. (a) Draw and explain the block diagram of "Offset QPSK" transmitter and receiver. Show that BPSK and QPSK have same error probability. 10
- (b) State the properties of Hamming Codes. An error control code has the following parity check matrix. 10

$$H = \begin{bmatrix} 1 & 0 & 1 & : & 1 & 0 & 0 \\ 1 & 1 & 0 & : & 0 & 1 & 0 \\ 0 & 1 & 1 & : & 0 & 0 & 1 \\ \vdots & & & & & & \end{bmatrix}$$

- (i) Determine the generator matrix.
- (ii) Find the codeword for the message vector [101].
- (iii) Decode the received codeword 110 110. Comment on the error detection and correction capability of the code.
6. (a) A (7, 4) cyclic code is generated using $x^3 + x + 1$. 10
- (i) What would be the generated codeword for the data sequence 1000 and 1100.
- (ii) Draw the circuit to generate this code and show how parity bits are generated for the data 1000.
- (b) The generator sequences $g_1 = [1 \ 1 \ 1]$ and $g_2 = [1 \ 0 \ 1]$ describe a convolution encoder. Draw the encoder and explain in detail. 10
- (i) Code Tree
- (ii) Trelli's Diagram
- (iii) State Diagram
- w.r.t. the convolution code encoder.

7. Write short notes on (any two) :— 20
- (a) Signature authentication using public key crypto system.
- (b) Link budget analysis for communication system.
- (c) Image and data compression.