

Time: 3 Hours

Marks: 80

- NB.
1. Question No. 1 is compulsory.
 2. Attempt any three out of remaining five questions.
 2. Figures to right indicate full marks.
 3. Assume data wherever required and state it clearly.

Q1 20

- a) Stating the relationship between PDF and CDF, give the properties of PDF.
- b) Define Entropy of an information source? When is the entropy maximum?
- c) Over a long transmission line draw the following data format for the binary sequence 10011101011.
 - i) Unipolar NRZ ii) Polar RZ iii) Manchester
 Select the best and justify the answer.
- d) Explain the role of Hamming distance in error detection & correction?
- e) For impulse responses $g^1 = \{1, 1, 0\}$, $g^2 = \{0, 1, 0\}$, $g^3 = \{1, 1, 1\}$ design the state diagram.

Q2 10

a) A discrete memoryless source has an alphabet of six symbol with their probabilities as shown:

Symbol	M ₁	M ₂	M ₃	M ₄	M ₅	M ₆
Probability	0.3	0.25	0.15	0.12	0.08	0.10

- i) Determine the Minimum Variance Huffman code-words and average code-word length and hence find Entropy of the system.
 - ii) Verify the average code-word length using Shannon Fano.
 - iii) Compare and comment on the results of both
- b) A convolution encoder has a constraint length of 3 and code rate of 1/3. The impulses for each are $g^1 = 100$ $g^2 = 101$ $g^3 = 111$. Draw 10
- i) encoder
 - ii) state diagram
 - iii) code transfer function

Q3 10

a) State and prove the Conditional Probability. 10

b) Draw the signal space diagram for 16-PSK and 16-QAM and find their error probability. Also draw their PSD and determine bandwidth. 10

Q4 10

a) A parity check matrix of a (7,4) Hamming code is given as follows: 10

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

- i) Find Generator matrix, using which find out the code-words of 1100 and 0101 ,
- ii) Determine the error detecting and correcting capability of system,
- iii) Draw the encoder for the above block code.

b) Sketch the encoder and syndrome calculator for the generator polynomial 10

71272

$g(x)=1+x^2+x^3$ and obtain the syndrome for the received code-word 1101011.

Q5

- Discuss the problem of inter symbol interference (ISI). Explain the measures to be taken to reduce ISI. How to study ISI using eye pattern?
- Consider a convolution encoder with the constraint length $K=3$ and $g^1 = \{1,0,1\}$ and $g^2 = \{0,1,1\}$. Find the code vector for the message stream 11010 using time domain approach. Verify the code vector using transform approach.

Q6

Explain with the required diagrams (Any Three):

- Modified duo-binary encoder
- Shannon Hartley Theorem for Channel Capacity
- Need for error control codes.
- Define the following terms and give their significance
(i) Mean (ii) Central moment (iii) Variance (iv) Standard deviation
