[Total No. of Questions - 8] [Total No. of Printed Pages - 2] (2125)

15390

M. Tech 1st Semester Examination

Information Theory and Random Signals (NS)

EC-105

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt any five questions. All questions carry equal marks.

1. (a) Define random variable. Discuss the transformation function of random variables? (10)

   (b) A random variable z is uniformly distributed having a PDF

   $$f_z(z) = \frac{1}{2} \qquad -1 \le z \le 1$$

   = 0, otherwise

   Show that random variable x=z and $y=z^2$ are uncorrelated despite of the fact that they are statistically dependent. (10)

2. (a) Explain Gaussian and Poisson process in detail. (10)

   (b) Explain the measurement of mutual information and derive the expression for channel capacity. (10)

3. (a) A discrete memory source 'x' have five equally likely symbols. Construct the Huffman code and calculate the efficiency of code. (15)

   (b) Discuss shannon binary encoding. (5)

[P.T.O.]

4. (a) Explain with examples, how block codes are used to detect errors and correct errors. (10)

   (b) Write the principle of convolutional codes. (10)

5. The parity check matrix of a particular (7,4) linear block code is given by

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

   (a) Find the generator matrix.

   (b) List all code vectors.

   (c) What is the minimum distance between the code vectors?

   (d) How many errors can be detected and corrected? (20)

6. (a) Explain the block diagram of cryptography system along with the basic components involved. (10)

   (b) What is Markov sources? Discuss briefly. (10)

7. (a) How can the parity test detect a damaged data unit? How the simple parity check is related to two dimensional parity check? (10)

   (b) Explain maximum likelihood decoding for convolutional codes. (10)

8. Explain the following:

   (a) Viterbi decoding algorithm.

   (b) Probability distributions. (10×2=20)