Roll No. ..... Total Pages : 2

BT–5/D-21 **45245**

INFORMATION THEORY AND CODING

Paper–EC-307A

Time Allowed : 3 Hours] [Maximum Marks : 75

Note : Solve any **five** questions.

1. Let $X_1, X_2, \ldots X_N$ are N statistically independent and identically distributed random variables and each has only two values $X_i = 1$ or $X_i = 0$, with probabilities p and 1–p, respectively. Let a random variable Y is defined as 2,4,3,3,3

$$Y = \sum_{i=1}^{N} X_i, \quad i = 1, 2, \ldots N.$$

   (a) Determine the range of Y. (b) Determine CDF of Y.

   (c) Determine PDF of Y. (d) Determine mean of Y.

   (e) Determine variance of Y.

2. Explain the following distribution; obtain expression for their mean and variance also : 7,8

   (a) Rice distribution. (b) Rayleigh distribution.

3. State and prove the following properties of an Entropy function 7,8

   (a) External property. (b) Additivity property.

4. (a) What are Prefix codes ? Explain and prove the properties of a Prefix code. 6

   (b) What is Source coding ? What are different Source coding techniques. 9

5. Obtain channel capacity expression for the following channels : 4,6,5

   (a) Binary erase channel (b) Binary symmetric channel

   (c) Channel with symmetric noise structure.

6. Prove the following expression : 5,5,5

(a) I (X, Y) = H(Y) – H(Y/X) (b) I (X, Y) = H(X) – H(X/Y)

(c) I (X, Y) = H(X) + H(Y) – H(XY).

7. (a) What are Linear block codes ? 3

(b) Explain the error detecting and correcting capabilities of linear block codes. 6

(c) Explain the Syndrome decoding techniques. 6

8. Explain the following in detail : 5,6,4

(a) Maximum likelihood decoding (b) Viterbi algorithm.

(c) Shannon's Second fundamental theorem.

TOPPERWorld