

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, \dots, 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

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

- (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.

