Roll No. .... Total Pages : 03

BT-5/D-23 **45245**

INFORMATION THOERY AND CODING

EC-307A

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. (a) Two dice are thrown. The sum of the points appearing on the two dice is a random variable X. Find the values taken by X and the corresponding probabilities. 8

   (b) Explain Shannon's noiseless coding theorem. 7

2. (a) Find the mean square and the variance of the Gaussian RV with the PDF as : 8

$$p_x(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-m)^2/2\sigma^2}$$

   (b) Define Entropy. List and explain its various types. 7

Unit II

3. (a) List and explain various types of codes. 8

(b) Explain Shannon's noisy coding theorem. **7**

4. (a) State and discuss Kraft inequality. **8**

(b) A typical communication channel has a bandwidth of 3.1 kHz (300 Hz – 3400 Hz) and S/N as 30dB. Calculate the maximum channel capacity. **7**

Unit III

5. (a) Consider a discrete memoryless source (DMS) with source probabilities {0.35, 0.25, 0.20, 0.15, 0.05}. Determine the Huffman code for this source. **8**

(b) Define and explain Mutual Information and its various properties. **7**

6. (a) Discuss Shannon's first theorem. **8**

(b) Differentiate between A priori and A posteriori entropies. **7**

Unit IV

7. (a) Discuss Shannon's second theorem for noisy channels. **8**

(b) For a generator polynomial $g(x)$ for a (7,4) cyclic code, find code vectors for the following data vectors : **1010, 1111, 0001** and **1000**. **7**

8. A linear (6,3) code is generated according to the generating matrix **G** : **15**

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

The receiver receives **r = 100011**. Determine the corresponding data word if the channel is a BSC and the maximum likelihood decision is used.