Printed Pages: 4 **NEC - 031**

**(Following Paper ID and Roll No. to be filled in your Answer Books)**

**Paper ID : 2289468** **Roll No.** | | | | | | | | | |

# B.TECH

## Regular Theory Examination (Odd Sem-VII), 2016-17

## INFORMATION THEORY AND CODING

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

### SECTION - A

**1. Attempt all parts. All parts carry equal marks. Write answer of each part in short. (10×2=20)**

a) Define channel capacity.

b) What is information rate?

c) Relate the amount of information provided and probability of occurrence of events.

d) Why we use logarithmic function to measure information?

e) Describe Extension of Discrete memoryless source.

f) List out the properties of Entropy.

g) Define source coding theorem.

h) Define Kraft inequality.

i) Define coding and decoding

j) Given the (5,4) Even parity block code. Find the code words corresponding to $i_1$= (1011) & $i_2$=(1010)

## SECTION - B

**Note: Attempt any 5 questions from this section(5×10=50)**

**2.** a) Explain the maximum likelihood decoding and Viterbi decoding algorithms of a convolution encoder.

b) Derive an expression for channel capacity of the binary symmetric channel

c) For a discrete memory less source there are three symbols with probability P1=*a* & P2=P3. Determine the entropy of the source & sketch its variation for different values of *a* .

d) i) Explain the Shannon fano dias coding procedure.

ii) Construct binary code word for the following table using Shannon fano dias coding procedure. Find entropy & code length.

| $X_1$ | $X_2$ | $X_3$ | $X_4$ |
|---|---|---|---|
| 0.25 | 0.5 | 0.125 | 0.125 |

e) Explain Log Sum inequality theorem with mathematical proof and explain its application

f) Consider the (3,1,2) convolutional code with $g^{(1)} = (1,0)$. $g^{(2)} = (101)$ & $g^{(3)}$ (111)

i) Draw the encoder block diagram

ii) Find generates matrix

iii) Find the code word corresponding to the information source (11101) using time domain & transform doman approach

**g.** a) For a (5,2) LBC, the generate matrix is of from $[I_k : P]$ where [P] is given by

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

find i) Generates matrix

ii) Parity check matrix

iii) All possible code vectors.

iv) Find the $d_{min}$

b) Explain the significance of product code & Repetition codes.

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## SECTION - C

**Note: Attempt any 2 Questions from this section.(2×15=30)**

**3.** a) Define

i) Discrete entropy H(X) and joint entropy H(X,Y) and

ii) Mutual information I(X,Y).

b) Show that I(X:Y) = H(X)+H(Y)-H(X,Y).

**4.** a) For a given channel matrix, compute the mutual information I(X:Y) with $P(x_1)$½ & $P(x_2)$=½

$$P(y/x)=\begin{bmatrix} 2/3 & 1/3 & 0 \\ 0 & 1/6 & 5/6 \end{bmatrix}$$

b) List out the properties of Matual information prove any two properties.

**5.** Compare the Huffman coding and Shannon-fano coding algorithm for data compression. For a discrete memory less source 'X' with six symbols $x_1, x_2, \ldots x_6$. Find a compact code for every symbol if the probability distribution is as follows:

$P(x_1) = 0.3$, $P(x_2) = 0.25$, $P(x_3) = 0.2$, $P(x_4) = 0.12$, $P(x_5) = 0.08$ and P(x6) = 0.05 Calculate entropy of the source average length of the code, efficiency and redundancy of the code.