# BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)
## B.Tech.Sem - VI E & TC : WINTER- 2022
## SUBJECT : INFORMATION THEORY & CODING

Day : Wednesday | Time : 10:00 AM-01:00 PM

Date : 30-11-2022 | **W-13365-2022** | Max. Marks : 60

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**N.B.:**

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.

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**Q.1** **a)** Explain Historical Perspective of Information theory . **(05)**

**b)** A discrete source emits one of five symbols once every milliseconds ($Tb=10^{-3}$) with probability = 0.1, 0.2, 0.3, 0.2, 0.2 respectively. Determine the source entropy and information rate. **(05)**

**OR**

A DMS X has five equally likely symbols **(10)**

a) Construct a Shannon Fano code for X and calculate the efficiency of code.
b) Construct another Shannon Fano code and compare the efficiency of code.
c) Repeat for Huffman code and compare the result.
d) Find information rate if there are 16 outcomes per seconds.

**Q.2** A channel matrix with three input $x_1$, $x_2$ and $x_3$ and three output $y_1$, $y_2$ ,$y_3$ with noise matrix is given below **(10)**

$$P[Y/X]=\begin{bmatrix}0.3 & 0.3 & 0.4\\ 0.4 & 0.4 & 0.2\\ 0.2 & 0.2 & 0.6\end{bmatrix}$$

Calculate H(X), H(Y), H(X,Y), I(X,Y) where $P[x_1]=$ ¼, $P[x_2]=$ 1/8 and $P[x_3]=$ 6/8

**OR**

**Q.2** **a)** Find a channel capacity and mutual information of channel shown in figure. The source of symbol probabilities of $P(x_1)= 0.5$, $P(x_2)= 0.5$ **(08)**

$$P[Y/X]=\begin{bmatrix}0.7 & 0.3\\ 0.3 & 0.7\end{bmatrix}$$

**b)** Write a propriety of mutual information. **(02)**

**Q.3** **a)** A 2KHz channel has signal to noise ratio of 12dB, calculate maximum capacity. **(05)**

**b)** Explain in detail sphere packing problem. **(05)**

**OR**

**a)** Find entropy of source having probability of 2/8, 2/12, 1/8 **(05)**

**b)** Determine the expression of capacity of the following channel, where channel matrix is given by **(05)**

$$P(Y/X)=\begin{bmatrix}(1-p) & p\\ p & (1-p)\end{bmatrix}$$

Draw channel diagram.

P.T.O.

**Q.4** **a)** Write definition of syndrome, also explain its property and decoding technique. **(06)**

**b)** Differentiate systematic and non-systemic code. **(04)**

**OR**

For a (6,3) block code, the receiver code is [111011]. Is this code word is correct? If not then correct it using syndrome decoding, coefficient matric is given below: **(10)**

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

**Q.5** Write and review to use of following code in Information Coding **(10)**

1. Golay Code
2. RS Code

**OR**

**Q.5** **a)** Generate the CRC code for the data word of [110010111]. The devisor is [10111] **(05)**

**b)** Write and overview of BCH Codes **(05)**

**Q.6** Write a short note on- **(10)**

1. Turbo Codes
2. Code Tree

**OR**

A Convolution encoder using rate 1/3 has three generating vectors: **(10)**
G1= [0 1 0] , G2= [1 0 1], G3= [1 1 1]

1. Draw Encoder Diagram
2. Draw Trellis Diagram
3. Draw State Diagram
4. Draw Code Tree Diagram

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