

Total No. of Questions : 6]

SEAT No :

P183

APR -17/ TE/Insem.-19

[Total No. of Pages :2

T.E. (E & TC)

INFORMATION THEORY & CODING TECHNIQUES

(2012 Course) (Semester - II)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6.
- 2) Use of calculator is allowed.
- 3) Assume suitable data if necessary.

Q1) a) Find entropy $H(x)$, $H(y)$ and Mutual information of channel where channel matrix is given as

$$P(y/x) = \begin{bmatrix} 0.7 & 0.3 \\ 0.3 & 0.7 \end{bmatrix}$$

Take $P(x_1) = 0.4$, $P(x_2) = 0.6$. [6]

b) Why we need source coding techniques explain with example. [4]

OR

Q2) a) Derive channel capacity of binary symmetric channel and find capacity of channel if $P(y_1/x_1) = 0.5$. [5]

b) Encode the following source using Huffman coding techniques & calculate code efficiency.

$$\text{Probability of symbols} = \left[\frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{4}, \frac{1}{16}, \frac{1}{18} \right]. [5]$$

Q3) a) A Gaussian channel has 2MHz bandwidth. Calculate the channel capacity if the signal power to noise spectral density ratio is 10^{-5} Hz. Also find the maximum information rate at which information can be transmitted. [4]

P.T.O.

- b) For a (6,3) LBC, following generator matrix is used [6]

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

- i) Find error correction & detection capability of the code.
- ii) Is this a perfect code? Justify.

OR

- Q4)** a) Explain information capacity theorem. [4]

- b) For a systematic LBC, the three parity check digits C_4 , C_5 and C_6 are given by [6]

$$C_4 = d_1 \oplus d_2 \oplus d_3$$

$$C_5 = d_1 \oplus d_2$$

$$C_6 = d_1 \oplus d_3$$

- i) Construct generator matrix.
- ii) Construct code generated by this matrix.
- iii) Determine error correcting capability.

- Q5)** a) Find primitive elements using primitive polynomial $f(x) = x^4 + x + 1$ which defines a finite field $GF(2^4)$. [6]

- b) Draw the encoder for a (7, 4) cyclic Hamming code generated by the generator polynomial $G(x) = 1 + x + x^3$. [4]

OR

- Q6)** a) Find minimal polynomial of $GF(8)$ whose trans field is $GF(2)$ with primitive polynomial $x^3 + x + 1$. [6]

- b) For a (7, 4) cyclic code find out the generator matrix if $G(x) = 1 + x + x^3$. [4]

