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SEAT No :

P183

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APR -17/ TE/Insem.-19

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.

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

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