

Total No. of Questions : 6]

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SEAT No. :

[Total No. of Pages : 2

TE/Insem./APR -30

T.E. (E & TC Engineering)

304187 : INFORMATION THEORY CODING AND

COMMUNICATION NETWORKS

(2015 Pattern) (Semester - II)

Time : 1 Hour]

[Max. Marks : 30

- Instructions to the candidates:
- 1) Answer Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6.
 - 2) Neat diagrams must be drawn wherever necessary.
 - 3) Figures in brackets indicate marks.
 - 4) Use of non programmable calculator is allowed.
 - 5) Assume suitable data, if necessary.

Q1) a) A discrete source transmits message X_1 and X_2 with probabilities 0.6 and 0.4. The source is connected to the channel

$$P(Y/X) = \begin{bmatrix} 0.8 & 0.2 \\ 0.2 & 0.8 \end{bmatrix}. \text{ Calculate all entropies.} \quad [5]$$

b) Find the Huffman code for a source alphabet of $\{A, B, \dots, H\}$ with probabilities $\frac{1}{2}, \frac{1}{4}, \frac{1}{16}, \frac{1}{32}, \frac{1}{32}, \frac{1}{32}, \frac{1}{32}, \frac{1}{32}$. Also calculate the average code length. [5]

OR

Q2) a) Determine the Lempel-Ziv code for the following bit stream: [5]

01001111100101000001010101100110000

Recover the original sequence from the encoded stream.

b) Explain how variable length coding techniques is better than fixed length coding technique with example. [5]

Q3) a) Derive the Channel Capacity of Binary Symmetric Channel (BSC)

$$C = 1 + p \log_2 p + (1 - p) \log_2 (1 - p) \text{ where } p \text{ is a transition probability.} \quad [5]$$

P.T.O.

b) For a systematic linear block code, the three parity check digits are given by: [5]

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

$$C_5 = d_1 \oplus d_2$$

$$C_6 = d_1 \oplus d_3$$

- i) Construct generator matrix
- ii) Construct all valid set of codewords
- iii) Find weight of all codewords
- iv) Find error detection capability
- v) Find error correction capability

OR

Q4) a) Comment whether following code is perfect code or not, with necessary justification. [5]

i) (7, 4) LBC

ii) (6, 3) LBC

b) An ideal communication system with average power limitation and white Gaussian noise has a bandwidth of 1 MHz and S/N ratio of 10. [5]

- i) Determine the channel capacity
- ii) If S/N ratio drop to 5, what band-width is required for the same channel capacity?

Q5) a) Consider a (7, 4) cyclic code generated by $g(x) = 1 + x^2 + x^3$ [5]

Design a syndrome circuit and find syndrome of received vector 00101110

b) Find minimal polynomials for all elements of $GF(2^3)$. Given primitive polynomial is $P(x) = x^3 + x + 1$ [5]

OR

Q6) a) Construct the (7, 4) systematic cyclic code using polynomial method for the generator polynomial $g(x) = 1 + x^2 + x^3$ for the message bits 1001. [5]

b) Explain [5]

i) Galois field

ii) Primitive polynomial

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