Total No. of Questions : 6]

SEAT No. : ____

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TE/Insem./APR - 30
T.E. (E & TC Engineering)
304187 : INFORMATION THEORY CODING AND COMMUNICATION NEWORKS
(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 $P(Y/X) = \begin{bmatrix} 0.8 & 0.2 \\ 0.2 & 0.8 \end{bmatrix}$. Calculate all entropies. **[5]**

b) Find the Huffman code for a source alphabet of {A, B, ... H} with probabilities ½, 1/4, 1/16, 1/16, 1/32, 1/32, 1/32, 1/32. Also calculate the average code length **[5]**

OR

Q2) a) Determine the Lempel-Ziv code for the following bit stream: **[5]**
0100111110010100000101010110011000 0
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)
$C = 1 + p\log_2 p + (1-p)\log_2 (1-p)$ where p is a transition probability. **[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 0010110

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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