Total No. of Questions : 8]   [Total No. of Printed Pages : 3

Roll No ....

MEDC-301(A)
M.E./M.Tech., III Semester
Examination, December 2017
Information Theory and Coding
(Elective-I)

Time : Three Hours

Maximum Marks: 70

Note : i) Attempt any five questions.
ii) All questions carry equal marks.

1. a) Define Entropy. Show that the Entropy is a maximum when all the messages are equi-probable. Assume number of symbols to be 2.   7

b) Explain Lempel-Ziv coding and with suitable example discuss where is it used.   7

2. a) A channel has the following channel matrix.   7

$$\left[p\left(y/x \right) \right] = \begin{bmatrix} 1-p & p & 0 \\ 0 & p & 1-p \end{bmatrix}$$

i) Draw the channel diagram.

ii) If the source has equally likely outputs compute the probabilities associated with the channel outputs for $p=0.2$.

b) Discuss about memory less channels, its applications and efficiency.   7

---

[2]

3. A computer executes four instructions that are designed by the code words (00, 01, 10, 11). Assuming that instructions are used independently with probability $\left(\dfrac{1}{2}, \dfrac{1}{8}, \dfrac{1}{8}, \dfrac{1}{4} \right)$.

Calculate the percentage by which the number of bits used for the instructions may be reduced by the use of an optimum source code. Construct a Huffman code to realize the reduction.   14

4. Compare: 14
a) Shannon's theorem and channel coding theorems.
b) Gaussian and Rayleigh Fading channels.

5. a) Write about Mutual Information and its Mathematical relation with entropy of transmitter and receiver.   7

b) Find the channel capacity for channels shown in the figure below: 7
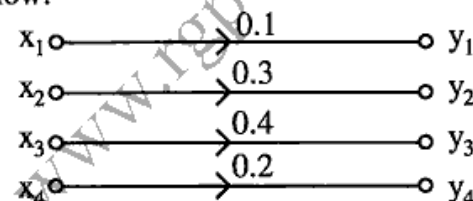
6. a) Write about structure of linear block codes Hamming spheres and perfect codes.   7

b) Consider the (7, 4) Hamming code defined by the generator polynomial $g\left(x \right) = 1 + x + x^3$. The code word 0111001 is sent over a noisy channel producing the received word 0101001 that has a single error. Determine the syndrome polynomial $s(x)$ for this received word. And show that it is identical to the error polynomial $e(x)$.   7

MEDC-301(A)   Contd....

7. a) Explain Cyclic code for error correction and discuss its properties.   7

   b) A Parity check code has a Parity-check matrix: 7

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

   i) Determine the Generator matrix.

   ii) Suppose the received code word is 110110. Decode this received word and find correct word.

8. Write short notes of any two: 7+7

   a) Viterbi algorithm

   b) Reed Muller code

   c) Maximum Likelihood decoding

   d) Syndrome computation and error detection

******