Registration No:

Total Number of Pages : 01   **M.TECH**
AR-17
M.TECH 1ST SEMESTER EXAMINATIONS(BACK), NOV/DEC 2019
Branch: ECE, MECPC1020
INFORMATION THEORY AND CODING
Time: 3 Hours   **Max Marks : 70**
The figures in the right hand margin indicate marks.
PART-A   (10 X 2=20 MARKS)
1. Answer the following questions.
   a. Define information and Write the properties of information.   **2×10**
   b. State Shannon's channel coding theorem.
   c. What is Hamming distance?
   d. What is meant by linear code?
   e. What is meant by constraint length and free distance for convolution code?
   f. Differentiate: Uncertainty, Information and Entropy
   g. What is Syndrome?
   h. Why are cyclic codes extremely well suited for error detection?
   i. What are conventional codes? How are they different from block codes?
   j. State the principle of Turbo coding.
PART-B   (5 X 10=50 MARKS)
Answer any five questions from the following.
2. a. A discrete source emits one of five symbols once every milliseconds with probabilities
       1/2, 1/4, 1/8, 1/16 and 1/16. Find the source entropy and information rate.
   b. State and explain Shannon Hartley theorem.
3. Consider that two sources emit messages x_1, x_2, x_3 and y_1, y_2, y_3 with the joint probabilities
   p (X, Y) as shown in the matrix form:

$$p(X,Y) = \begin{bmatrix} 3/40 & 1/40 & 1/40 \\ 1/20 & 3/20 & 1/20 \\ 1/8 & 1/8 & 3/8 \end{bmatrix}$$

a) Calculate the joint and conditional entropies, H (X,Y), H (X/Y), H(Y/X)
   between X and Y.
b) Calculate the average mutual information I(X;Y).
4. a) With a block diagram, explain the working of JPEG encoder and decoder.
    b) Define (i) Discrete entropy H (X) and joint entropy H (X,Y) and
    c) Mutual information I(X;Y).
5. a. Show that I (X;Y) = H (X)+ H (Y) - H (X,Y).
   b. With a block diagram, explain the MPEG algorithm for video encoding.
6. Consider a (6,3) linear block code whose generator matrix is given by

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

    a) Find the parity check matrix and Find the minimum distance of the code.
    b) Draw the encoder and syndrome computation circuit.
7. a) A (7, 4) cyclic code has a generator polynomial: $g(X) = X^3 + X + 1$.
           (i) Draw the block diagram of encoder and syndrome calculator.
           (ii) Find generator and parity check matrices in systematic form.
    b) Write down the steps involved in syndrome decoding in linear block codes.
   8. (a) How to find the parity check matrix?
    (b) Give the syndrome decoding algorithm
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