

Registration No: _____

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M.TECH
ETPC102

1st Semester Regular/Back Examination – 2014
INFORMATION CODING & CRYPTOGRAPHY

BRANCH(S): COMMUNICATION ENGINEERING, COMMUNICATION SYSTEMS, ELECTRONICS & COMMUNICATIONS ENGINEERING, ELECTRONICS & TELE COMMUNICATION ENGINEERING, SIGNAL PROCESSING AND COMMUNICATION

Time: 3 Hours
Max Marks: 70

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.



- Q1 Answer the following questions: (2x10)
- a) What is the channel capacity of a binary symmetric channel with error probability 0.017?
 - b) Relate the amount of information provided and probability of occurrence of events.
 - c) Define the terms coding efficiency and redundancy.
 - d) What is source coding? Define code length & code efficiency. Give the relation between them.
 - e) What is conditional entropy? When the entropy function will have its maximum value?
 - f) Define self information and information rate. Mention their units?
 - g) Briefly explain the Shannon first theorem.
 - h) What is trellis? What is code tree?
 - i) Define syndrome polynomial? Give the properties of syndrome polynomial.
 - j) Find the entropy of a discrete memory-less source with source alphabet $Z = \{A, B, C, D, E\}$ with probability
 $P(A) = P_0 = \frac{1}{4}$, $P(B) = P_1 = \frac{1}{16}$, $P(C) = P_2 = \frac{1}{16}$, $P(D) = P_3 = \frac{1}{8}$, $P(E) = P_4 = \frac{1}{2}$
- Q2 a) Derive the expression for conditional entropy, joint entropy. (5)
b) What do you mean by mutual information? Derive the expression of it. (5)
- Q3 Construct (7, 4) cyclic code for the message sequence (1 1 0 1) and the generator polynomial $g(x) = 1+x+x^3$ (10)
i) Using the algorithm and find the codeword
ii) Find the generator matrix and parity check matrix
- Q4 a) A discrete memory less source emits five symbols with probabilities {0.4, 0.1, 0.2, 0.1, 0.2}. Find Huffman code and its length by placing the combined symbol as high as possible. (6)
b) Calculate the channel capacity (C) of DMC when channel input probability $P(x_0) = P(x_1) = 0.5$ (4)
- Q5 a) A voice-Grade channel of network has a band width of 2.4 kHz. Calculate (5)
i. Information capacity of the telephone channel for SNR of 20dB.
ii. The minimum SNR required to support information through the telephone channel at the rate of 9.6 kb/s.
b) Consider a primitive polynomial $f(x) = x^3+x+1$ over $GF(2)$ and construct Extension field $GF(8)$. Find also minimal polynomials. (5)
- Q6 a) The diagram shown below shows the encoder for a code rate $r = \frac{1}{2}$, constraint length 4, of a convolutional encoder. Determine the encoder output produced by the message sequence 101111..... (10)
i. Construct the code tree for the coder.
ii. Construct the trellis.
- Q7 a) Construct (15, 11) linear block code for the given message block. The parity check matrix is as shown below. (7)
$$H_{4 \times 15} = \begin{bmatrix} 1111 & 1110 & 0001 & 000 \\ 1111 & 0001 & 0100 & 100 \\ 1100 & 1101 & 1010 & 010 \\ 1010 & 1011 & 1110 & 001 \end{bmatrix} \text{ and } m = (0010 \ 1100 \ 111)$$

b) Briefly explain weight and distance of a code. Mention the characteristics of a liner code? (3)
- Q8 Write Short Notes (Any Two) (5 x 2)
- a) Explain the Ungerboeck Partitioning scheme and the trellis structure in TCM code formation.
 - b) Data encryption standard (DES).
 - c) Asymmetric-key cryptography.
 - d) Describe the operation of JPEG decoding stage with a block diagram