

**GUJARAT TECHNOLOGICAL UNIVERSITY****ME Semester –I Examination Feb. - 2012****Subject code: 710402N****Date: 13/02/2012****Subject Name: Information Theory and Coding****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) State and prove Macmillan's theorem 07  
 (b) Define entropy and discuss the conditions for maximum and minimum entropy. 07

- Q.2** (a) State and prove Shannon's Noiseless coding Theorem. 07  
 (b) Briefly Describe: 07  
       (1) Binary symmetric Channels.  
       (2) Information rate.  
       (3) Hamming Distance.

**OR**

- (b) A zero memory source emits six messages with probabilities 0.3, 0.25, 0.15, 0.12, 0.1 and 0.08. Find the 4-ary (quaternary) Huffman code. Determine its average word length, the efficiency and the redundancy. 07

- Q.3** (a) Write a short note on Hamming codes-perfect codes for single errors. Draw and explain the diagram of an encoder for the Hamming code of length 7. 07  
 (b) Derive the equation for channel capacity of a discrete memory less channel. 07

**OR**

- Q.3** (a) Write a short note on Golay code-A perfect code for triple errors. 07  
 (b) Find a generator polynomial  $g(x)$  for a (7,4) cyclic code and find code vectors for the following data vectors: 1010, 1111, 0001, and 1000. 07

- Q.4** (a) Briefly explain Burst error detecting and correcting codes. 07  
 (b) Briefly explain secret key encryption. 07

**OR**

- Q.4** (a) Briefly explain public key encryption. 07  
 (b) With neat figure explain Data encryption standard. 07

- Q.5** (a) For convolutional code describe: Maximum-likelihood decoding (Viterbi's Algorithm). What are its advantages? 07  
 (b) A zero memory source emits messages  $m_1$  and  $m_2$  with probabilities 0.8 and 0.2 respectively. Find the optimum (Huffman) binary code for this source as well as for its second and third order extensions (that is for  $N=2$  and 3). Determine the code efficiency in each case. 07

**OR**

- Q.5** (a) For convolutional code describe sequential decoding briefly. What are its disadvantages? 07  
 (b) Draw the diagram of an encoder for systematic cyclic code and explain cyclic code generation in detail. Also explain the decoding procedure. 07

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