Total No. of Questions: 09

B.Tech. (ECE) (2011 Onwards Elective–I)/
B.Tech. (ETE) (E-I 2011 Onwards) (Sem. – 6)

INFORMATION THEORY AND CODING

M Code: 71236
Subject Code: BTEC-907
Paper ID: [A2395]

Time: 3 Hrs. **Max. Marks: 60**

INSTRUCTIONS TO CANDIDATES:

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION A

1. a) Define i) Joint entropy; and ii) Conditional entropy.

   b) What are instantaneous codes?

   c) What is meant by constraint length and free distance of a convolution code?

   d) How syndrome is calculated in Hamming codes and cyclic codes?

   e) State the channel coding theorem for a discrete memoryless channel.

   f) Define mutual information.

   g) Find entropy of a source emitting symbols x, y, z with probabilities of 1/5, 1/2, 1/3 respectively.

   h) What is meant by cyclic code?

   i) What is the difference between block codes and convolutional codes?

   j) What is meant by stop-and-wait ARQ? Explain.

SECTION B

2. Define Mutual Information. Explain how it is related to entropy for a lossless channel, prove that H(X/Y)=0.
3. Define BCH code and brief about Reed-Solomon code.
4. Write the steps involved in Huffman coding algorithm.
5. State Hartley -Shannon Law.
6. Given an AWGN channel with 4kHz bandwidth and the noise power spectral density $\eta/2 = 10^{-12}$ W/Hz. The signal power required at the receiver is 0.1mW. Calculate the capacity of this channel.

SECTION C

7. A DMS X has five symbols x_1, x_2, x_3, x_4 and x_5 with $P(x_1) = 0.4$, $P(x_2) = 0.19$, $P(x_3) = 0.16$, $P(x_4) = 0.15$ and $P(x_5) = 0.1$.
   a) Construct Shannon-Fano code for X, and calculate the efficiency of the code.
   b) Repeat for the Huffman code and compare the results.
8. For a systematic linear block code, the three parity check digits, C_4, C_5 and C_6 are given by:

   $C_4 = m_l \oplus m_2 \oplus m_3$

   $C_5 = m_1 \oplus m_2$

   $C_6 = m_1 \oplus m_3$

   a) Construct generator matrix.
   b) Construct code generated by this matrix.
   c) Determine error detecting probability.
   d) Prepare decoding table.
   e) Decode the received word 101100 and 000110.
9. Explain ARQ strategies and Hybrid ARQ schemes in detail.