B.Tech.(ECE) (2011 onwards Elective-I) / (ETE) (E-I 2011 onwards)

(Sem.–6)

INFORMATION THEORY & CODING

Subject Code : BTEC-907

Paper ID : [A2395]

Time : 3 Hrs.   Max. Marks : 60

INSTRUCTION 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 has to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.

SECTION-A

1. Write briefly :

   a. What is the condition for the entropy of the source to attain its maximum value?

   b. Define source information rate.

   c. State Shannon's source coding theorem.

   d. A typical voice communications channel has a bandwidth of 3.1 kHz (300 Hz - 3400 Hz) and S/N as 30 dB. Calculate the maximum channel capacity.

   e. Specify the algorithm for Lempel-Ziv source coding.

   f. What is meant by the syndrome word?

   g. Draw a suitable diagram depicting a simple operation of an algebraic cyclic coding technique.

   h. List the basic parameters that describe the BCH code.

   i. How is convolution code different from linear block code?

   j. Does ARQ mechanism rely on the use of an error detection code such as the Cyclic Redundancy Check (CRC)? Where does it find application?

SECTION-B

2. A communication system consists of six messages with probabilities 1/4, 1/8, 1/8, 1/8, 1/8, and 1/4, respectively. Determine the entropy of the system.

3. Consider an alphabet of a discrete memoryless source having five source symbols with their respective probabilities as 0.1, 0.2, 0.4, 0.1, and 0.2. Create source codeword for each symbol using Huffman source coding algorithm.

4. Hamming codes are a family of (n, k) block error-correcting codes. Compute the Hamming code for the given data bits 00111001.

5. Using the generator polynomials $g_1(x) = 1 + x + x^2$ and $g_2(x) = 1 + x^2$, draw the convolution encoder. What is its code rate?

6. Describe the operation of Go-back-N ARQ strategy.

SECTION-C

7. State and prove Shannon's channel capacity theorem. What is its significance?

8. For the convolution encoder shown in Figure below, draw the Trellis diagram.
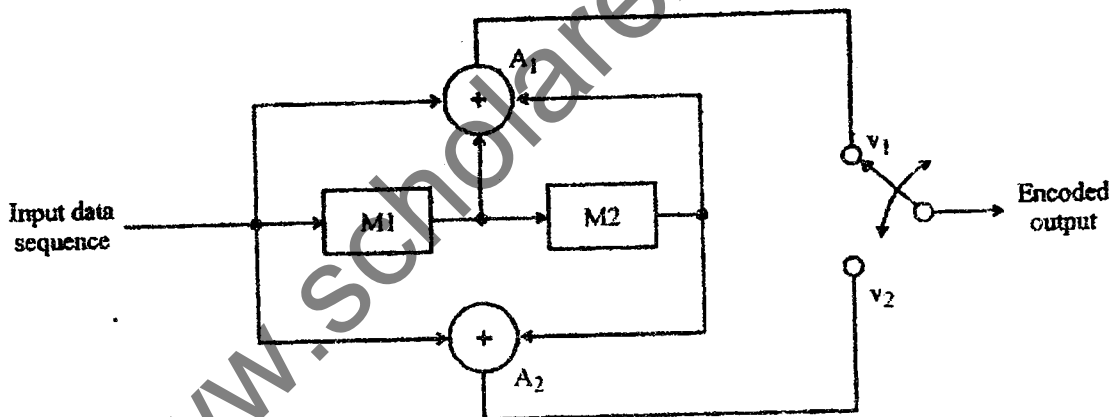
Generator sequence, G1 = (1,1,1)
G2 = (1,0,1)

9. Stop-and-Wait Automatic Repeat Request (ARQ) adds a simple error control mechanism to the Stop-and-Wait strategy. Explain how this protocol detects and corrects errors. Also suggest the ARQ mechanisms more suitable in a noisy environment.