(79) T.E. (EXTC) - VI 12/5/2015

Digital Communication

Q.P. Code : 5127

(3 Hours) **[Total Marks : 80**

N.B: (1) Question No.**1** is **compulsory.**
(2) Attempt any three out of remaining five questions.
(3) **Figures** to the **right** indicate marks.

1. Attempt any four :
   (a) Consider an extremely noisy channel having a bandwidth of 1 kHz. What could be the channel capacity? **5**
   (b) Consider a binary data sequence 1111101111. Draw the waveforms for the given binary data sequence, using Bipolar AMI RZ and Manchester. **5**
   (c) State two criteria which a spread-spectrum communication system must satisfy. Justify that the spread-spectrum signals are transparent to the interfering signals, and vice-versa. **5**
   (d) What is the significance of Euclidian distance? **5**
   (e) Define code rate, hamming distance and Hamming weight in the context of linear block code .Also explain linearity property and cyclic property of linear codes. **5**

2. (a) Consider an alphabet of a discrete memory less source having five different source symbols with their respective probabilities as 0.1, 0.2, 0.4, 0.1, and 0.2. **10**
   (i) Create a Huffman Tree for Huffman source coding technique.
   (ii) Tabulate the codeword and length of codewords for each source symbol.
   (iii) Determine the average codeword length of the specified discrete memoryless source.
   (iv) Comment on the results obtained

   (b) A convolution code is described by generator sequence $G_1=(1, 1, 1)$ and $G_2=(1,0,1)$ **10**
   (i) Draw the encoder for this code.
   (ii) Draw the state transition diagram for this code.
   (iii) Draw the trellis diagram for this code.

3. (a) Explain how matched filter and Correlator are two ways of synthesizing optimum filter. What is matched filter? 10

(b) For a Quadrature Phase Shift Keying (QPSK), Explain the modulator, synchronous demodulator, Bandwidth and advantages. 10

4 (a) What is coherent demodulator? Describe coherent detection method of binary FSK signals. Also draw power spectra for BFSK modulated signal. 10

(b) In a digital communication system, the bit rate of a bipolar NRZ data sequence is 1 Mbps and carrier frequency of transmission is 100MHz. Determine the symbol rate of transmission and the bandwidth requirement of the communications channel for 10

(i) 8-ary PSK system

(ii) 16-ary PSK system.

5. (a) Parity check matrix for (7, 3) code is given below 10

$$H = \begin{bmatrix} 0111000 \\ 1010100 \\ 1100010 \\ 1110001 \end{bmatrix}$$

Construct syndrome table for signal bit error patterns. Using syndromes, find error pattern and codeword for each of the following received vectors

$r_1 = 0011101$, $r_2 = 1101110$.

(b) A (7. 4) cyclic code is described by a generator polynomial 10

$g(x) = 1 + x + x^3$

(i) Find the codeword using polynomial division method for m = 1010

(ii) Design an encoder for systematic code generation and explain its working.

(iii) Design a syndrome generator and explain how received message is corrected?

6 Attempt the following (any two) : 20

(a) What do you mean by an eye diagram? What is its purpose? Mention the four parameters observed from the eye pattern. Explain with the help of suitable illustration.

(b) Explain with the help of block diagrams and waveforms, the following techniques of spread spectrum communication.

(a) Direct sequence (b) Frequency hopping.

(c) Viterbi decoding algorithm for convolution codes.
