Electronics and Communication Engineering Department NIT Hamirpur (HP)
End Semester Examination - Nov/Dec 2023

Semester: 7th

B.Tech ECE Dual Degree

Sub: Information Theory & Coding

Code: EC-611

Max. Marks = 50

Time = 3:00 Hrs

Note:
1. All questions are compulsory
2. Assume suitable data whenever necessary

Q.No.1. Drive the capacity of the band limited AWGN channel in bits per second. What is Shannon Limit?

[6]

Q.No.2. Find all the cyclic binary codes of block length 5. Find the minimum distance of each code. [5]

Q.No.3. Let the polynomial

$$g(x) = x^{10} + x^8 + x^5 + x^4 + x^2 + x + 1$$

be the generator polynomial of a cyclic code over GF(2) with block length 15. [7]

(i) Find the generator polynomial Matrix G.

(ii) Find the parity check matrix H.

(iii) How many errors can this code detect?

(iv) How many errors can this code correct?

(v) Write the generator matrix in the systematic form.

Q.No.4. Consider the convolutional encoder given in Fig 1. Let the received word (with errors) be

$$r = 10\ 11\ 11\ 01\ 10\ 01\ 11\ 10$$
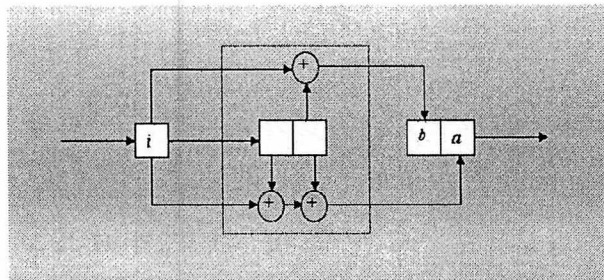
Find the transmitted sequence. [5]

Fig: 1

Q.No.5. Encode the following bit stream: 111100001010... using the encoder given in figure 2. Also list out the corresponding states of the memory. [5]
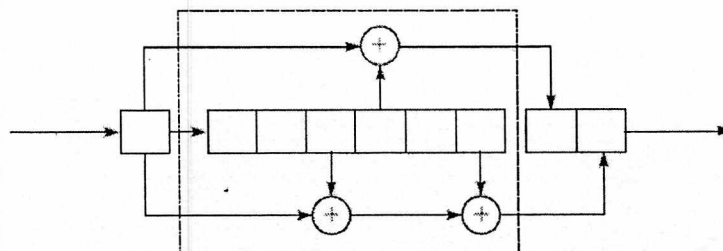

Fig: 2

Q.No.6. Consider the following generator matrix over GF(2) [10]

$$G = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{pmatrix}$$

(i) Generate all possible codewords using this matrix.
(ii) Find the parity check matrix, H.
(iii)) Is this a linear code?
(iv) Find out the Syndrome and Construct the standard array for this code.
(v) What is the minimum distance of this code?
(vi) How many errors can this code detect?
(vii) Write down the set of error patterns this code can detect.
(viii) How many errors can this code correct?
(ix) What is the probability of symbol error if we use this encoding scheme? Compare it with the uncoded probability of error.

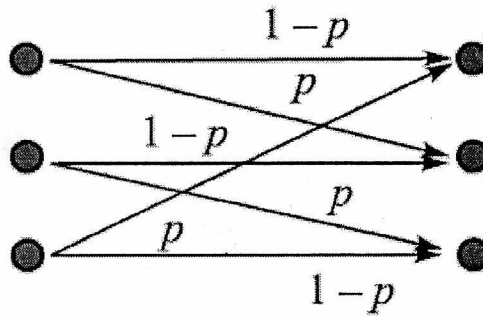**Q.No.7.** Determine the channel capacity of the channel shown in Fig 3 [7]

Fig: 3

Q.No.8. State source coding theorem and proof it. What is the significance of the source coding theorem? [5]

***************************ALL THE BEST***