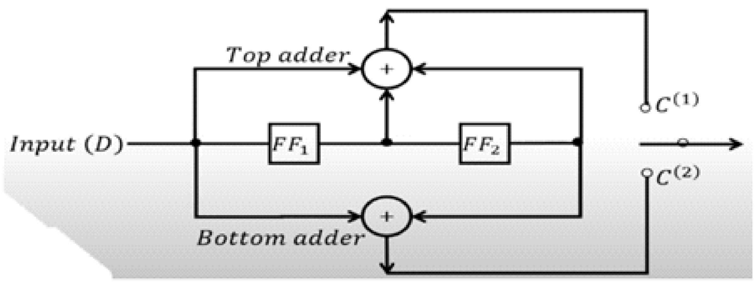
UNIT-V

9. a) Discus Viterbi Algorithm. Decode the given sequence 11 01 10.

   b Discuss Code trellis and state diagram of convolution code. 7+7= 14

10. Consider the binary convolutional encoder shown in the Figure



Obtain the (i) State Table (j) State transition Table (k) sate diagram (l) code tree (m) Encode the message D = [10011] using the code tree.
2+3+2+5+2=14

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B.Tech Even Semester Examination, May, 2025

Electronics & Communication Engineering

(6th Semester)

Course No: ECC-607A

(Information Theory and Coding)

Full Marks: 70

Pass Marks: 28

Time: 3 hours

Note:

1. Attempt any five questions taking one from each unit.
2. Begin each answer in a new page
3. Answer parts of a question at a place
4. Assume reasonable data wherever required
5. The figure in the right margin indicates full marks for the question
6. All the mathematical symbols and abbreviations have their usual meanings.

UNIT-I

1. a) Proved that the upper bound on entropy is given as $H_{Max} = Log_2 M$. Here "M" is the number of messages emitted by the source.

   b) A discrete source emits one of the six symbols one every M-second. The symbol probabilities are 1/2,1/4, 1/8,1/16,1/32 and 1/32 respectively. find the source entropy and information rate. 8+3+3=14

2. a) The source emits three messages with probabilities P1=0.7, P2=0.2, and P3 =0.1 calculate (i) Source entropy, (j) Maximum entropy, (k) Source efficiency and (L)Redundancy.

b) Discuss the block diagram of information theory architecture. If there are M equally likely and independent messages, then proved that the amount of information carried by each message will be, I = N bits, where $M = 2^N$ and N is an integer.

3+1+1+1+5+3=14

UNIT-II

3. a) Prove the relation between joint and conditional entropy

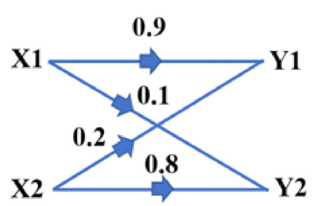
(i) $H(X, Y) = H\left(\frac{X}{Y}\right) + H(y)$, (j) $H(X, Y) = H\left(\frac{Y}{X}\right) + H(x)$ and (k) $H(X, Y) = H(Y) + H(X)$.

b) A source generates information with probabilities P1=0.1, P2=0.2, P3 =0.3 and P4 =0.4.

Find the entropy of the system and what percentages of maximum possible information is being generated by this source.?

5+5+4=14

4. Describe the four types of channels.



Consider a binary channel as shown (i) Find channel matrix, (j) Find P(y1) and P(y2) when P (x1) = P(x2) = 0.5. (k) Find the joint probability P (x1, y2) and P (x2, y1) when P(x1) = P(x2) = 0.9.

6+2+3+3=14

UNIT-III

5. State and proved Shannon limit. In a communication system, the source transmits 5-different message x1, x2, x3, x4, x5 with probabilities of 0.3, 0.15, 0.25, 0.05, 0.25 respectively. If the number of symbols used to code these messages is 2. Then find the code word for each message and the coding efficiency by applying Huffman coding method. 5+9=14

6. a) Define channel capacity and also derived its formula and proved that. (i) Noiseless channel has infinite capacity (j) Infinite bandwidth channel has limited capacity.

b) The data is transmitted at a rate of 10kbps over a channel having the bandwidth of 3KHz. Determine Signal to Noise ratio. If the bandwidth is increased to 10KHz then calculate and compared Signal to Noise Ratio. 8+6=14

UNIT-IV

7. A sequence is given as "cabracadabrarrarrad" with window size 13 and lookahead duffer = 6. Encode and Decode the given sequence using Sliding window technique Shows each step clearly using Search Buffer (SB) and Lookahead Buffer (LAB). 8+6=14

8. a) A 5-bit data 01101 is given, represent the given data in Hamming code.

b If the received Hamming Code is 1110101 with even parity, then Detect and Correct the error. 7+7=14