# B.Tech Even Semester Examination, May, 2025

## Electronics & Communication Engineering

(6th Semester)

### Course No: ECC-607A

*(Information Theory and Coding)*

*Full Marks: 50*
*Pass Marks: 25*
*Time: 2 hours*

**Note:**

1. Attempt any five questions.
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.

1. Show that if there are M number of equally likely message, then the entropy of the source is $\log_2 M$. A source transmits two independent messages with probabilities P and 1-P respectively. Proved that the entropy is maximum when both the messages are equally likely. Plot the variation of entropy H as a function of probability P of the message. 4+4+2=10

2. Determine the (i) Marginal entropy, (j) Conditional entropy, (k) Joint Entropy and (l) Mutual Entropy for the given 2.5x4=10

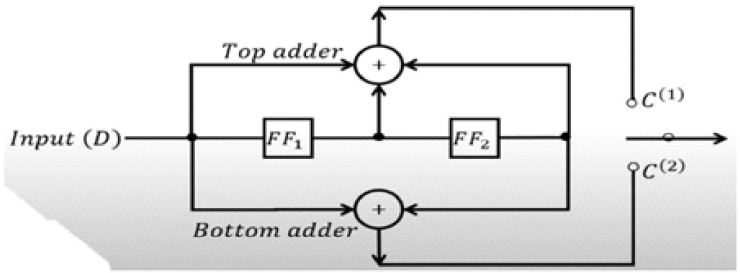
P(X,Y) =

| | | | |
|---|---|---|---|
| 0.25 | 0 | 0 | 0 |
| 0.10 | 0.3 | 0 | 0 |
| 0 | 0.05 | 0.10 | 0 |
| 0 | 0 | 0.05 | 0.1 |
| 0 | 0 | 0.05 | 0 |

3. State and prove 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+5=10

4. A sequence is given as "cabracadabrarrarrad" with window size 13 and look ahead buffer = 6. Encode and Decode the given sequence using Sliding window technique. Show each step clearly using Search Buffer (SB) and Lookahead Buffer (LAB). 10

5. Consider the binary convolutional encoder shown in the Figure




Obtain the (i) State Table (j) State transition Table (k) sate diagram (l) code tree (l) Encode the message D = [10011] using the code tree. 2+3+1+3+1=10

6. Apply Shannon Fano coding for the following message [M] = {m1, m2, m3, m4, m5, m6} and [P] = {0.30, 0.25, 0.15, 0.12, 0.08, 0.10} and calculate the Coding Efficiency and redundancy. (Each step should be clearly mention for calculation of H and L) 4+2+2+1+1=10

7. A 5-bit data 01101 is given, represent given data in Hamming code. Clearly mention the Code length and parity bits calculation for each P. For (11,5) Hamming code, how many errors can be detected and corrected. 6+4

8. Encode and Decode the given string by LZ2 "ABCDABCABCDAABCABCE" 10

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