

## School of Engineering

**B.TECH Electronics and Communication Engineering in Artificial Intelligence and Machine  
Semester End Examination - Jun 2024**

**Duration : 180 Minutes  
Max Marks : 100**

### Sem VI - G2UC604T - Information Theory and Coding

General Instructions

*Answer to the specific question asked*

*Draw neat, labelled diagrams wherever necessary*

*Approved data hand books are allowed subject to verification by the Invigilator*

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|-----|--|--------|
| 1)  | What is meant by constraint length of a convolutional encoder?   | K1(2)  |
| 2)  | Explain the concept of binary symmetric channel with binary communication channel.   | K2(4)  |
| 3)  | Write Shannon's first theorem on Source Coding and deduce the equations for average number of bits, coding efficiency and redundancy.  | K2(6)  |
| 4)  | Compare convolutional codes with block codes. Draw a (2,1,2) convolutional encoder and write the generator sequences.  | K3(9)  |
| 5)  | Distinguish between a trellis diagram and tree diagram.  | K3(9)  |
| 6)  | Determine the Huffman coding for the following message with their probabilities given $p(x_1) = 0.05$ , $p(x_2) = 0.15$ , $p(x_3) = 0.2$ , $p(x_4) = 0.05$ , $p(x_5) = 0.15$ , $p(x_6) = 0.3$ , $p(x_7) = 0.1$ . Find the efficiency and redundancy of the code.   | K5(10) |
| 7)  | A discrete memory less source has an alphabet of seven symbols whose probabilities of occurrence are as described below<br>Symbol: $S_0, S_1, S_2, S_3, S_4, S_5, S_6$<br>Prob : 0.25, 0.25, 0.0625, 0.0625, 0.125, 0.125, 0.125<br>(i) Compute the Huffman code for this source moving a combined symbols as high as possible<br>(ii) Calculate the coding efficiency<br>(iii) Why the computed source has a efficiency of 100% | K4(12) |
| 8)  | Draw the diagram of the $\frac{1}{2}$ rate convolutional encoder with generator polynomials $G_1(D) = 1+D$ , $G_2(D) = 1+D+D^2$ and complete the encoder output for input sequence 101101.   | K5(15) |
| 9)  | A convolutional code is described by the following generator sequences,<br>$g(1) = \{1,0,1\}$ , $g(2) = \{1,0,0\}$ , $g(3) = \{1,1,1\}$ .<br>i) Draw the encoder to this code<br><br>ii) Draw the state diagram<br>iii) If the message sequence is 10110, Design the code word.  | K5(15) |
| 10) | A source emits an independent sequence of symbols from an alphabet consisting of five symbols A, B, C, D & E with probabilities of $\frac{1}{4}$ , $\frac{1}{8}$ , $\frac{1}{8}$ , $\frac{3}{16}$ & $\frac{5}{16}$ respectively. Determine the Shannon binary code for each symbol and efficiency of the coding scheme.  | K6(18) |