BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)
B.Tech.Sem - VI E &TC :SUMMER- 2022
SUBJECT : INFORMATION THEORY & CODING

Day : Thursday   Time : 02:30 PM-05:30 PM
Date : 23-06-2022   **S-13365-2022**   Max. Marks : 60

N.B.
1) All questions are **COMPULSORY**
2) Figures to the right indicate **FULL** marks.
3) Use of non – programmable **CALCULATOR** is allowed.

Q.1 **a)** Write algorithm statement for   **(08)**
          i)   Lempel – Ziv encoding method
          ii) Lempel – Ziv decoding method

      b) Explain Information rate in detail.   **(02)**

OR

A DMS has an alphabet of seven symbols with probabilities for its output as   **(10)**
describe in below table

Symbol	S_0	S_1	S_2	S_3	S_4	S_5	S_6
Probability	0.25	0.25	0.125	0.125	0.0625	0.125	0.0625

      i)   By comparing Huffman coding methods and Shannon Fano coding
          method find code length for all probabilities
      ii) Find code efficiency and redundancy
      iii) Find information rate

Q.2 Consider that two sources S_1 and S_2 transmit messages x_1, x_2, x_3 and y_1, y_2, y_3 **(10)**
with a conditional probability of $P(Y/X)$ as shown in matrix. Probability of x_1,
x_2, x_3 is 0.3, 0.25, 0.45 respectively
Calculate H(X), H (Y), H(Y/X) ,H (X/Y), H (X,Y), I (X;Y)

$$P(Y/X) = \begin{bmatrix} 0.9 & 0.1 & 0 \\ 0 & 0.6 & 0.4 \\ 0 & 0.3 & 0.7 \end{bmatrix}$$

OR

Write a short note on   **(10)**
      i)   Channel coding theorem
      ii) Channel matrix
      iii) Error free communication

Q.3 Explain differential entropy for Gaussian distribution .If a Gaussian channel   **(10)**
has 2.8 MHz Bandwidth. Calculate channel capacity if the signal to noise
spectral density ratio is 10^5 Hz also find maximum rate of information.
OR
      a) Explain channel capacity theorem and its implementation in detail.   **(06)**

      b) Explain how sphere packing is affect channel capacity   **(04)**

P.T.O

Q.4 a) Explain in detail code rate and linear block codes **(05)**

b) Explain encoding and decoding of cyclic code. **(05)**

OR

a) Write definition of syndrome, explain its properties along with syndrome **(07)** decoding.

b) Explain with example generator matrix and parity check matrix **(03)**

Q.5 Consider (3,4) linear block code for parity matrix is given by **(10)**

$$P = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 0 & 0 & 0 \end{bmatrix}$$

i) Find generator check matrix
ii) Fid all code matrix
iii) Determine error density and error correction capacity
iv) If receiver code words are
1) 0011110   2) 1110111
Check whether they are correct or contain error

OR

Design an encoder, decoder and syndrome calculator for (7,4) cyclic code **(10)** generated by $g(x) = x^3 + x+1$. Using shift register method, verify its operation using the message vector 0110.

Q.6 a) Explain sequential decoding in detail. **(05)**

b) Explain viterbi algorithm in detail. **(05)**

OR

Obtain the codeword for cyclic encoder of below d\figure for message signal **(10)** (10011) using the transform domain approach. The impulse response of input top adder output path is (1,1,1) and that of input bottom adder output path is (1,0,1)