INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR
B.TECH IT 5TH SEMESTER FINAL SEMESTER EXAMINATION 2021
SUBJECT – INFORMATION AND CODING THEORY (IT 3105)

Full Marks = 50 Time: 90 mins

(Answer Q1 and any two questions from the rest. Write your name and roll number on the front page. Scan your answer script, make a single .pdf file of your answer script and upload in the google classroom.)

1. Write short notes on:
   (a) Channel capacity and Shannon limit for a Gaussian Channel
   (b) Space time code

   5 + 5 = 10

2. (a) Consider a source with number of levels/msg M = 3 with probabilities 0.5, 0.4, 0.1. Perform prefix free tree coding with block size n = 2. Find source entropy, decodability and optimality of the coding.
   (b) For the Markov source given below, find individual source entropy, average source entropy. Draw the tree diagram. Find the probability of occurrence of the symbols AAA, ACB, ACC and BBB.

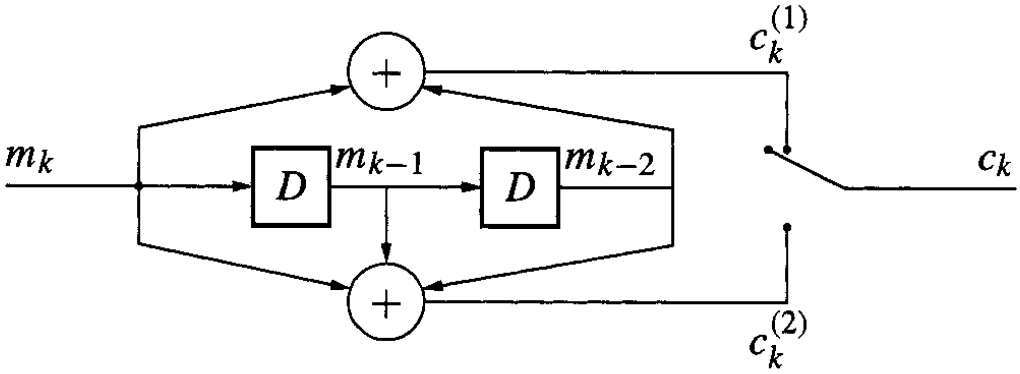
   8 + 12 = 20

3. (a) Define a priory and a posteriory entropy of a noisy transmission channel with U input symbols and V output symbols. Design the channel matrix.
   (b) For a Binary symmetric channel with α as the source probability and p as the channel error probability, calculate average mutual information (I). Then compute the maximum and minimum value of I. Explain your answer.

   5 + 15 = 20

4. (a) What is Hamming Distance? Give example.
   (b) Derive Hamming bound.
   (c) For a (7, 3) systematic code with parity check matrix given below, compute the syndrome decoding table. For a received word r = [0 0 1 1 0 1 1] detect and correct error if there is any.

   5 + 5 + 15 = 20



5. (a) A convolutional encoder is given above. Find the code rate and constraint length of the encoder.
   (b) For the input stream m = [1 1 0 0 1 0 1] find the coded sequence.
   (c) Draw the Trellis diagram for the encoder.

   5 + 5 + 10 = 20