IM. Tech. ECT

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103

Winter End Semester Examination – December - 2019

Branch: Electronics and Telecommunication Engineering **Sem.:- II**
Subject:- Information Theory and Coding (MTETC202/MTDCC202) **Marks: 60**
Date:- 13/12/2019 **Time:- 3 Hr.**

Instructions to the Students

1. Each question carries 12 marks.
2. Attempt **any five** questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

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(Marks)

Q.1 Write notes on (12)

a) Stationary and non-stationary processes

b) Markov processes.

c) Central Limit Theorem

Q.2 A) A continuous RV has a pdf $f(x) = 3x^2$, $0 \le x \le 1$. Find a and b (06) such that

i. $P(X \le a) = P(X > a)$

ii. $P(X > b) = 0.05$

B) The joint *pdf* of a two dimensional Random Variable (X, Y) is (06) given by

$$f(x,y) = xy^2 + \frac{x^2}{8},\ 0 \le x \le 2,\ 0 \le y \le 1.$$

Compute:

i. $P(X > 1)$

ii. $P(Y < 1/2)$ iii. $P(X > 1 / Y < \frac{1}{2})$

iv. $P(Y < \frac{1}{2} / X > 1)$ v. $P(X < Y)$

Q.3 A) Explain the Resistor noise with the help of an equivalent diagram and power density spectrum. (06)

B) A parallel resonating circuit is tuned at 200 MHz with a Q of 10 and capacitance of 10 *p*F. The temperature of the circuit is 17° C. what noise voltage will be observed across the circuit by a wide band oscillator? Assume the values of constant terms as usual. (06)

Q.4 A) For the convolutional encoder of Fig.1, determine the following (06)

i. Dimension of the code ii. Code rate

iii. Constraint length iv. Generating sequences

v. Output sequence for message sequence of m = { 1 1 0 1 1 }

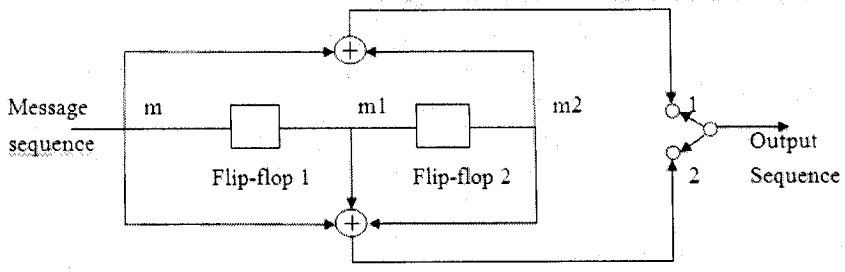

Fig. 1

B) A discrete source transmits messages x1, x2 and x3 with the probabilities 0.3, 0.4 and 0.3. The source is connected to the channel given in fig. 2. Calculate all entropies. (06)

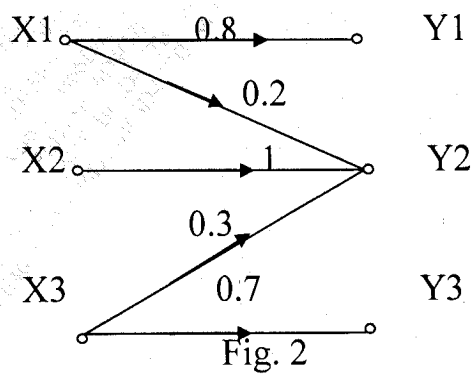

Fig. 2

Q.5 A) Write a note on Syndrome decoding. What happens if double error occurs in received code word when the minimum distance criterion is 3? (06)

B) The parity check matrix of a (7, 4) Hamming code is given as follows (06)

$$H = \begin{pmatrix} 1\ 1\ 1\ 0 : 1\ 0\ 0 \\ 0\ 1\ 1\ 1 : 0\ 1\ 0 \\ 1\ 1\ 0\ 1 : 0\ 0\ 1 \end{pmatrix}_{3\times 7}$$

i. Find the generator matrix.
ii. List all the code vectors.
iii. What is the minimum distance between the code vectors?
iv. How many errors can be detected? How many errors can be corrected?

Q.6 A) Write a note on sub-band coding. (06)

B) Discuss any three types of vocoders in brief. (06)

Paper End