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

Semester Examination – OCT - 2022

Branch: Electronics and Telecommunication Engineering **Sem.:- II**

Subject with Subject Code:- Information Theory and Coding (MTECC202, MTETC202, MTDCC202)

Marks: 60

Date:-18/10/2022 **Time:- 3 Hr.**

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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 A) In a factory, four machines A_1, A_2, A_3 and A_4 produce 10%, 20%, 30% and 40% of the items, respectively. The percentage of defective items produced by them is 5%, 4%, 3% and 2%, respectively. An item selected at random is found to be defective. What is the probability that it was produced by the machine A_2? (06)

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

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

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

Q.2 A) The joint *pdf* of a two dimensional Random Variable (X, Y) is given by (06)

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

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. $P(X < Y)$

B) Write a note on Wide sense stationary process. (06)

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Q.3 A) Find the mutual information of the channel whose P(X,Y) is (06)

$$P(X,Y) = \begin{array}{c} \\ x1 \\ x2 \\ x3 \\ x4 \end{array} \begin{array}{c} \begin{array}{ccc} y1 & y2 & y3 \end{array} \\ \begin{pmatrix} 0.125 & 0.075 & 0.050 \\ 0.125 & 0.075 & 0.050 \\ 0.125 & 0.075 & 0.050 \\ 0.125 & 0.075 & 0.050 \end{pmatrix} \end{array}$$

B) Apply the Shannon-Fano coding procedure for the following message ensemble. Find Efficiency of this method. Take M=2. (06)

X	x_1	x_2	x_3	x_4	x_5	x_6	x_7
P	0.4	0.2	0.12	0.08	0.08	0.08	0.04

Q.4 A) A parallel resonating circuit is tuned at 200 MHz with a Q of 10 and capacitance of 10 pF. The temperature of the circuit is 17° C. what noise voltage will be observed across the circuit by a wide band voltmeter? Assume the values of constant terms as usual. (06)

B) Write a note on Narrow band Noise (06)

Q.5 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 }

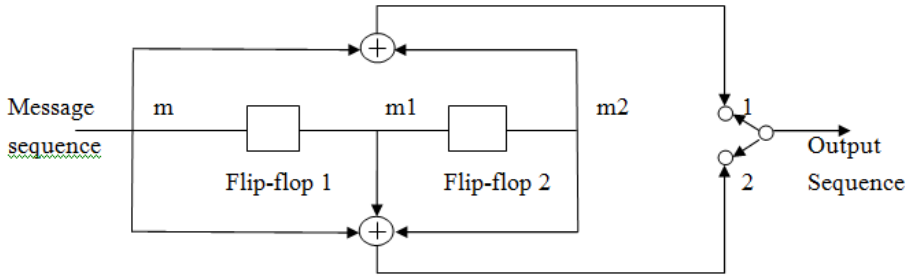

Fig. 1

B) The generator polynomial of a (7,4) cyclic code is $G(p)= p^3+p+1$. Find all code vectors for the code in systematic form. (06)

Q.6 Write a note on: (12)

1. Characteristics of speech signal
2. Vector quantization

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