

AMIETE – ET (Current Scheme)

Time: 3 Hours

DECEMBER 2015

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

- a. Information theory is themeasurement of communication systems.
 (A) Qualitative (B) Quantitative
 (C) Parametric (D) None of these
- b. The relation between information and uncertainty is
 (A) Directly Proportional (B) Inversely Proportional
 (C) Both (A) and (B) (D) None of these
- c. The relation between information and probability is
 (A) Directly Proportional (B) Inversely Proportional
 (C) Both (A) and (B) (D) None of these
- d. The formula of Self Information of the event $X=x_i$ of random variable X with possible outcomes $x_i, i= 1, 2, 3, \dots, n$ is
 (A) $I(x_i)=\log P(x_i)$ (B) $I(x_i)=-\log P(x_i)$
 (C) $I(x_i)=\exp P(x_i)$ (D) None of these
- e. The output of discrete memory less source is _____ of previous output.
 (A) Dependent (B) Independent
 (C) Both (A) and (B) (D) None of these
- f. The probabilistic behaviour of discrete memory less source is called
 (A) Entropy (B) Mutual Information
 (C) Both (A) and (B) (D) None of these
- g. The Hamming distance between two binary codes 11011101 and 10011010 is
 (A) 5 (B) 7
 (C) 4 (D) 8
- h. Which is the correct properties of Linear Block Code?
 (A) The sum of two codeword belonging to the code is also a codeword belonging to the code
 (B) The all-zero codeword is not always a codeword
 (C) Both (A) and (B)
 (D) None of these

- i. The Hamming weight of a binary linear block code 01110110 is
 (A) 3 (B) 5
 (C) 8 (D) None of these
- j. Maximum entropy of discrete binary source observe at the probability
 (A) 1 (B) 0
 (C) 0.5 (D) None of these

Answer any FIVE Questions out of EIGHT Questions.

Each question carries 16 marks.

- Q.2** a. Define the time probability. Explain the various properties of probability density function. (8)
- b. Explain joint probability and conditional probability. (8)
- Q.3** a. Show that mean and variance of random variable X having uniform distribution in the interval [a, b] are $\mu_x = \frac{a+b}{2}$ and $\sigma_x^2 = (a-b)^2/12$ (8)
- b. Explain the concept of statistical average in random signal theory. (8)
- Q.4** a. Define the concept of average information content of long independent sequences. (8)
- b. Give the Mark off Model for information sources. (8)
- Q.5** a. Derive the mathematical formula of Self Information of the event $X=x_i$ of random variable X with possible outcomes $x_i, i= 1, 2, 3, \dots, n$. Give the various properties of information. (8)
- b. Define the term entropy. Compute the formula of entropy with its properties. (8)
- Q.6** a. Explain discrete memory less channel in detail. (8)
- b. Show that $H(X,Y) = H(X) + H(Y|X)$
 $= H(Y) + H(X|Y)$ (8)
- Q.7** a. Elaborate the channel capacity theorem for discrete memory less channel in detail. (8)
- b. Give the concept of Differential entropy and mutual information for continuous ensembles. (8)
- Q.8** a. If $g(x)$ is a polynomial of degree $(x-k)$ and is a factor of $x^n + 1$ then $g(x)$ generates an (n, k) cyclic code in which the code polynomial $V(x)$ for a data vector $D = (d_0, d_1, \dots, d_{n-1})$ is generated by $V(x) = D(x)g(x)$ (8)
- b. Design a linear block code with a minimum distance of three and a message block size of 8 bits R. (8)
- Q.9** a. Explain the special classes of cyclic codes:
 (i) BCH
 (ii) Burst & random error correcting codes (8)
- b. Decode the given sequence 1101 011001 of a convolutional code with a code rate $r = 1/2$ and constraint length $k = 3$ using Viterbi decoding algorithm. (8)