Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2014

Subject code: 710203N

Date: 19-06-2014

Subject Name: Information Theory and Coding

Time: 02:30 pm - 05:00 pm

Total Marks: 70

- Instructions:
 - 1. Attempt all questions.
 - 2. Make suitable assumptions wherever necessary.
 - 3. Figures to the right indicate full mark.
- Q.1 (a) Communication system always encounters one of 3 possible interface waveform 07 F1, F2 and F3. The probability of each interface is 0.8, 0.16 and 0.04 respectively. The communication system fails with probability 0.01, 0.1 and 0.4, When it encounters F1, F2 and F3 respectively. Given that system has failed. Find the probability that the failure is result of F1, F2 or F3 respectively.
 - (b) Give the properties of a PDF (Probability Density Function) and show that a 07 normal (Gaussian) PDF satisfies those properties.
- Q.2 (a) Define ACF (Auto-correlation function) for random process and explain its main 07 properties.
 - (b) Let x and y be independent uniform Random Variable over (0, 1). Find the PDF of z = x + y

OR

- (b) Explain how the spectral density of a WSS (Wide Sense Stationary) random 07 process can be estimated.
- Q.3 (a) Explain the characteristic function and the moment generating function for a 07 continuous random variable.
 - (b) Explain information and entropy in the context of a discrete message source. Also 07 give various units of information and entropy.

OR

- Q.3 (a) A Discrete Memoryless Source has five Symbols X1, X2, X3, X4 and X5 with the probabilities 0.4, 0.19, 0.16, 0.15 and 0.10 respectively attached to every symbol i) Construct a Shannon fano code for the source and calculate code efficiency.
 ii) Repeat (i) for hamming code, compare the two techniques of source coding.
 - (b) Prove that the entropy for a discrete source is a maximum when the output 07 symbols are equally probable.
- Q.4 (a) Write a short note on cyclic codes also mention advantages and disadvantages. 07
 - (b) i) What is mutual information? Show that mutual information has the symmetric 07 property i.e. $I(x_j; y_k) = I(y_k; x_j)$.

ii) Prove that instantaneous codes always satisfy the Kraftøs inequality.

OR

- Q.4 (a) The generator polynomial of a (7, 4) cyclic code is $g(x) = 1+x+x^3$. Find all the 16 07 code words.
 - (b) What is convolution code? List out techniques for encoding and decoding 07 convolution code. Explain any one in details.
- Q.5 (a) What is hamming distance? Give the criteria for error detection and error 07 correction capabilities of a code, respectively.
 - (b) Discuss the properties of liner codes. Show that the presence of an all zero code 07 word is a necessary but not a sufficient condition for linearity.

- Explain MPEG-1 standard giving the details of audio and video compression Q.5 07 **(a)** techniques applied. 07
 - Write short notes on any two of the following:i) Run Length Encoding **(b)**

 - ii) Fading Channels
 - iii) Cryptography
