M.TECH (Digital Communications)

FIRST SEM. EXAMINATION, 2010-11

Subject: INFORMATION THEORY AND CODING

1. Attempt any TWO of the following

a) An analog signal has a 4 GHZ bandwidth. The signal is sampled at 2.5 times the nyquist rate and each sample is quantized into one of 256 equally likely levels. Assume that the successive samples are statistically independent.

(i) What is information rate of this source?
(ii) Can the output of this source we transmitted without error over a Gaussian Channel with the bandwidth of 50 KHZ and S/N ratio of 23 dB?
(iii) What will be the Bandwidth requirements of a Analog Channel for transmitting the output of the source without errors if the S/N ratio is 10 dB?

b) The international Morse code uses a sequence of dots and dashes to transmit letters of the English alphabet. The dash is represented by a current pulse that has duration of 3 units and dot has duration of 1 unit. The probability of occurrence of a dash is 1/3 of the probability of occurrence of a dot.

(i) Calculate the information content of a dot and dash.

(ii) Calculate the average information in dot-dash mode.

(iii) Assume that the dot lasts 1msec, which is the same time interval as the pulse between symbols; Find the average rate of information transmission.

c) Explain Markoff statistical Model for information sources.

2. Attempt any TWO of the following:

a) Explain the capacity of a discrete memoryless channel with example.

b) A discrete memoryless sources has five symbols x1, x2, x3, x4 and x5 with probabilities 0.4, 0.19, 0.16, 0.15 and 0.15 respectively attached to every symbol. Construct a Huffman code for the source and calculate the efficiency ŋ.

c) Two sources emit messages{x1, x2…xn} with probabilities {P1, P2…Pn} and {y1, y2…yn} with probabilities {q1, q2..qn}. Prove that $H(X) \leq -\sum Pk \log qk$ for k=1 to N.

3. Attempt any TWO of the following

a) Explain discrete communication channels and define the average rate of information transmission over discrete channel.

b) Explain entropy and information rate of transmission of Markoff sources.

c) A CRT terminal is used to enter alphanumeric data into a computer. The CRT is connected to the computer through a voice grade telephone line having a usable bandwidth of 3000 HZ and an output S/N of 10 dB. Assume that the terminal has 128 characters and that the data sent from the terminal consist of independent sequence of equiprobable characters.

(i) Find the capacity of the channel.
(ii) Find the maximum (theoretical) rate at which data can be transmitted from the terminal to the computer without error

4. Attempt any TWO of the following

a) Explain entropy maximization of continuous channel with continuous noise.

b) Define channel capacity theorem with some properties.

c) Explain efficiencies of different communication system.

5. Attempt any TWO of the following

a) Explain the following:

(i) Galois Fields

(ii) Binary cyclic codes

b) Explain the following:

(i) Majority Logic decoding

(ii) Convolution Codes

c) Explain the following:

(i) ARQ

(ii) Burst error Correcting codes