Total No. of Questions : 8] [Total No. of Printed Pages :

Roll No. 0112C507MT10

MCSE–202

M. Tech. (Second Semester)
EXAMINATION, August, 2008
(Computer Science & Engg.)
INFORMATION AND CODING THEORY
(MCSE – 202)

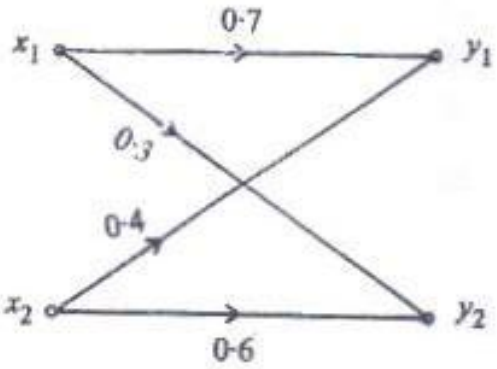
Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Find the channel capacity of the channel shown in fig.



(10)

(b) Define and prove the source coding theorem for a discrete memoryless source (DMS).

2. Consider the source symbols and their respective probabilities listed ahead :

P. T. O.

Symbols	Probability	Self information	Code word
x_1	0·50	1·0000	1
x_2	0·30	1·7370	00
x_3	0·20	2·3219	01

Show that grouping of two letters to make a symbol improves the coding efficiency.

3. (a) Define and prove the information capacity theorem for band limited, power limited Gaussian channels.

   (b) Discuss the capacity of channel of infinite bandwidth.

4. An analog signal having 4 kHz bandwidth is sampled at 1·25 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 the information rate of this source ?

   (ii) Can the output of this source be transmitted without error over an AWGN channel with a bandwidth of 10 kHz and an S/N ratio of 20 dB ?

   (iii) Find the S/N ratio required for error free transmission for part (ii).

   (iv) Find the bandwidth required for an AWGN channel for error free transmission of the output of this source if the S/N ratio is 20 dB.

5. (a) Discuss the properties of linear codes. Show that the presence of an all zero code word is a necessary but not a sufficient condition for linearity.

   (b) Discuss the error detection and correction capabilities of block codes.

6. For a (6, 3) systematic linear block codes, the three parity check bits c_4, c_5 and c_6 are formed from the following equations :

$$c_4 = d_1 \oplus d_3$$
$$c_5 = d_1 \oplus d_2 \oplus d_3$$
$$c_6 = d_1 \oplus d_2$$

   (i) Write down the generator matrix.

   (ii) Construct all possible code words.

   (iii) Suppose the received word is 010111.

   Decode this received word by finding the location of the error and the transmitted data bits.

7. (a) Consider the polynomial :

$$g(x) = x^6 + 3x^5 + x^4 + x^3 + 2x^2 + 2x + 1$$

   (i) Is this a valid generator polynomial for a cyclic code over GF (4) with a block length 15 ?

   (ii) Find the parity check matrix H.

   (iii) What is the minimum distance of this code ?

   (iv) What is the code rate ?

   (b) Discuss about the properties of BCH codes.

8. Write short notes on any *two* of the following :

   (a) Run length encoding and PCX formal

   (b) Fading channels

   (c) Cryptography