M 22235

Reg. No. : .....

Name : .....

VII Semester B.Tech. Degree (Reg./Supple./Improv. – Including Part Time) Examination, November 2012
(2007 Admn. Onwards)
PT2K6/2K6 EC 703 : INFORMATION THEORY AND CODING

Time : 3 Hours Max. Marks : 100

***Instruction** : Answer **all** questions.*

1. a) Define mutual information. List its properties.

   b) State and prove Kraft's Mc Millan inequality.

   c) Define primitive polynomials and irreducible polynomials. Give examples.

   d) Make Mod – 7 addition and multiplication table.

   e) Define hamming weight and hamming distance of (7, 4) linear block code. Define its minimum distance.

   f) Give the condition to be satisfied by a polynomial to be the generator polynomial of a cyclic code. Hence find the generator polynornial for a (7, 4) cyclic code.

   g) Explain how a maximum likelihood decoder becomes a minimum distance decoder in a BSC using convolution codes.

   h) What are Turbo codes ? With block diagram, explain the working of a Turbo encoder. **(8×5=40)**

P.T.O.

2. a) Consider two sources S_1 and S_2 emits messages x_1, x_2, x_3 and y_1, y_2, y_3 with joint probabilities p(x,y) as given in matrix below. Calculate H(x), H(y) H(x/y), H(y/x) and I(x, y).

P(x, y)

	y_1	y_2	y_3
x_1	$3/40$	$1/40$	$1/40$
x_2	$1/20$	$3/20$	$1/20$	15
x_3	$1/8$	$1/8$	$3/8$

OR

b) i) State and prove maximal property and additive property of entropy. 5

ii) Encode the following source symbols using Shannon Faro code and Huffmann code.

$X = \{x_1, x_2, x_3, x_4, x_5\}$

$p(x) = \{0.2, 0.1, 0.05, 0.05, 0.6\}$

Find efficiency of this code in both methods. Compare performance of the coding methods. 10

3. a) i) Construct a table of $GF(2^3)$ based on the primitive polynomial $p(x) = 1 + x + x^3$. Determine the order of each element. 8

ii) What is minimal polynomial. Find minimal polynomials of the elements of $GF(2^3)$. 7

OR

b) i) Show that $x^5 + x^3 + 1$ is irreducible over GF(2). 10

ii) Let V be a vector space over a field F. Prove that for any scalar 'a' in F, and any vector v is V,

$(-a).v = a.(-v) = -(a.v)$. 5

4. a) Consider (6,3) linear block code generated by

$$G = \begin{bmatrix} 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$, then give its

i) Parity check matrix H

ii) Encoder diagram

iii) Standard array

iv) Decoder block diagram. **15**

OR

b) Describe the characteristics and encoding principle of RS codes. **15**

5. a) Construct rate $\frac{1}{3}$, K=3, convolution encoder.

Given

$g_1 = [100]$, $g_2 = [101]$, $g_3 = [111]$

Sketch tree diagram and trellis diagram of this encoder. **15**

OR

b) Write notes on the following :

i) Golay codes

ii) Trellis coded modulation

iii) Puncturing of a code. **15**
