Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Remedial Examination January/ February 2011

Subject code: 710402
Subject Name: Information Theory and Coding

Date: 01 /02 /2011 **Time: 02.30 pm – 05.00 pm**
Total Marks: 60

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** i) Define Instantaneous code and Derive Krafts inequality for code alphabet of *r* symbols. **04**

ii) Construct a ternary instantaneous code for the following source alphabet with the prescribed lengths of code words. **02**

Symbol	1	2	3	4	5	6	7	8	9	0
Length	1	3	3	3	3	3	2	2	2	2

(b) Define Entropy of a source. Explain Binary Huffman Encoding with the help of an example. **06**

Q.2 **(a)** i) Obtain the Expression of Mutual Information of Discrete Memoryless channel and from this define channel capacity. **03**

ii) Find the channel capacity of the BSC channel. **03**

(b) A binary channel matrix is given by, **06**

Input \ Output	$y1$	$y2$
$x1$	$2/3$	$1/3$
$x2$	$1/10$	$9/10$

It is also given $P_X(x_1) = 1/3$, $P_X(x_2) = 2/3$.
Determine $H(x)$, $H(x/y)$, $H(y)$, $H(y,x)$ and $I(x,y)$.

OR

(b) Explain Shannon-Fano code with an appropriate example. **06**

Q.3 **(a)** For a (6,3) systematic linear block code, the three parity check digits are **04**
c4 = d1+d2+d3, c5 = d1+d2, c5 = d1+d3

i) Construct the appropriate generator matrix for this code and code

ii) table. Determine the error correcting capability.

iii) Decode the received words 101100, 000110, 101010. **02**

(b) i) Obtain the generator matrix and code table for (7,4) code and draw the encoder block diagram. **04**

ii) Obtain the generator matrix (15,11) code and code word for data word 10111010101. **02**

OR

Q.3 **(a)** Describe the procedure for encoding and decoding of linear block code. **06**

(b) Derive Hamming Bound for (*n*,k) binary and r-ary t-error correcting block code, where *n*=length of code word and *k*=length of data word (n>k). **06**

Q.4 **(a)** Obtain generator matrix and code table for systematic (7,4) cyclic code. Construct the syndrome table and decode the received word 0101000. **06**

(b) A three error correcting (23,12) Golay code is a cyclic code with a generator polynomial **06**

$g(x) = x^{11}+x^9+x^7+x^6+x^5+x+1$.

Determine the code words for the data vectors 000011110000 and 101010101010.

OR

Q.4 **(a)** Explain Reed-Solomon Encoding. **06**

(b) Find the generator matrix G' for a non-systematic (23,12) Golay code described by polynomial **06**

$g(x) = x^{11}+x^9+x^7+x^6+x^5+x+1$.

Determine the code words for the data vectors 000011110000 and 101010101010.

Q.5 **(a)** A rate ½ convolution encoder with constraint length 3 is described by **06**

$g_1(x) = 1+x+x^2$ and

$g_2(x) = 1+x^2$.

Draw the trellis diagram for this encoder and encode the message 10111.

(b) Explain the Viterbi Convolution Decoding Algorithm. **06**

OR

Q.5 **(a)** Give differences between public key and private key encryption. Discuss the Knapsack problem. **06**

(b) Write short note on Hamming Codes. **06**

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