Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH(ECE)/SEM-2/MCE-202/2012

2012
ERROR CONTROL CODING

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Question 1 is compulsory and attempt any *four* from the rest.

1. Write short notes on any *two* of the following : $2 \times 7 = 14$

   a) Binary BCH code.

   b) Reed-Solomon Code

   c) Standard Array

   d) Viterbi decoding.

2. a) Consider a (7, 4) block code. The generator matrix is given below :

$$\begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

   i) Find H, the parity check matrix of the code.

   ii) Find the syndrome for the received vector 1101101. Is this a valid code vector ?

iii) All code words of the code.

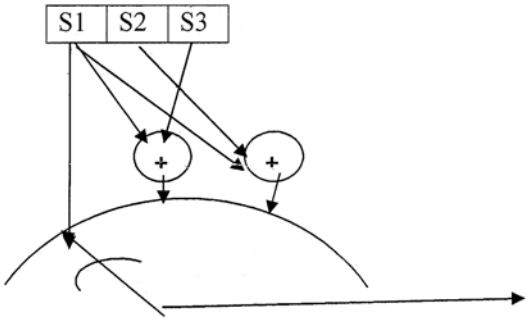
iv) What is the error correcting capability of the code ?

v) What is the error detecting capability of the code ?

b) Give diagrammatic representation of Block Encoder.

c) Define code rate and block length. 10 + 2 + 2

3. For the convolutional encoder shown in figure,



draw the state and trellis diagrams and determine the output digit sequence for the data digits 11010100. What is a constraint length and rate efficiency ? Define free distance (d_{free}) for convolutional code. 14

4. For a (6, 3) systematic linear block code, the three parity check digits c_4, c_5 and c_6 are

$$c_4 = d_1 + d_2 + d_3$$

$$c_5 = d_1 + d_2$$

and $$c_6 = d_1 + d_3$$

a) Construct the appropriate generator matrix for this code.

b) Construct the code generated by this matrix.

c) Determine the error correcting capabilities of this code.

d) Prepare a suitable decoding table.

e) Decode the following received words : 101100, 000110, 101010 14

5. a) What are cyclic codes ? Why are they called subclass of block code ?

b) Write the advantages and disadvantages of cyclic code.

c) Consider the (7, 4) cyclic code generated by $g(X) = 1 + X + X^3$ and message polynomial to be encoded be $x(X) = X + X^2$. Determine the code vector $y(X)$ in systematic form, corresponding to message polynomial. 4 + 4 + 6

6. a) What is the purpose of the hamming code ?

b) Define a Galois field and state its various properties.

c) How does single bit error differ from a burst error ?

d) Define repetition code. 3 + 5 + 2 + 4