Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS / M.TECH (ECE - NEW) / SEM-2 / MCE-202 / 2011

2011

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.

Answer **Q. No. 1** and any **four** questions: 5 × 14 = 70

1.   i)   What is the advantage of error control coding ?

     ii)   Define Group, Ring and Field.

     iii)   What is the advantage of binary code ?

     iv)   What is Hamming distance ?

     v)   Define Linear Block Code.

     vi)   What is the fundamental difference between BCH and
            RS code ?

     vii)   Give the example of an Abelian Group.

                                              2 + 3 + 2 + 2 + 2 + 2 + 1

30006 (M.TECH)   [Turn over

2. a) The received sequence for the message (0100), is (1 1 0 1 1 0 0). Correct the error using Hamming code.

   b) A source is transmitting six messages with probability 0·3, 0·25, 0·15, 0·12, 0·10 and 0·08 respectively. Find the binary HUFFMAN source code for the above message.   7 + 7

3. a) Determine the minimum distance of an even parity (3, 2) block code.

   b) For a (6, 3) code, the H matrix is given by
   $$\begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}.$$ For all possible data word find the

   corresponding code words and also find Hamming distance of the code.   4 + 10

4. Generate (7, 3) systematic and non-systematic cyclic code using Matrix method for the data [1 0 0]. It is given that the generator polynomial $g (x) = 1 + x + x^2 + x^4$ 14

5. a) Find the output of the Convolution Encoder for an input data (10110).

   b) Explain maximum likelihood decoding of convolution code.   8 + 6

30006 (M.TECH)   2

6. a) Construct a double error correcting (15,7) BCH code over $GF(2^4)$.

   b) A decoder for the triple error correcting (15, 5) BCH code uses the Peterson-Gorenstein-Zierler decoder to determine the error. Given that the input to the decoder is $V(x) = x^8 + x^5 + x^2 + x + 1$. Find the correct codeword. 6 + 8

7. a) Construct a single error correcting Reed-Solomon code with block length 7.

   b) Consider the (7, 5) single error correcting Reed-Solomon code given that $v = (0, 1, \alpha^5, \alpha^2, 1, \alpha^6, \alpha^3)$, where α is an element of GF (2^3), corresponds to a codeword c with a single error. Determine the position and magnitude of the error. 6 + 8

=============