

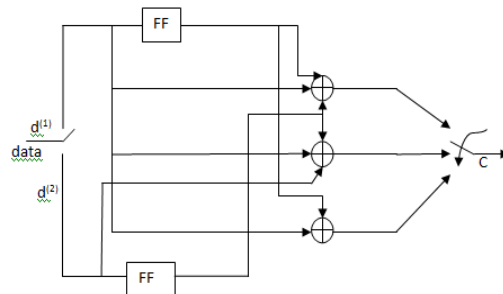
GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013****Subject code: 1724103****Date: 31-12-2013****Subject Name: Error Control Coding In Communication****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

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

- Q.1 (a)** Write a short note on Error control strategies. 07
- (b)** Consider the linear block code with the codeword defined by 07
 $U = m_1 + m_2 + m_4 + m_5, m_1 + m_3 + m_4 + m_5, m_1 + m_2 + m_3 + m_5, m_1 + m_2 + m_3 + m_4, m_1, m_2, m_3, m_4, m_5$
 (i) Show the generator matrix.
 (ii) Show the parity-check matrix.
 (iii) Find n , k and $d_{\min}$.
- Q.2 (a)** Prove that a linear block code with a minimum distance $d_{\min}$ can detect up to $(d_{\min} - 1)$ errors in each code vector and can correct up to $\lfloor (d_{\min} - 1)/2 \rfloor$ errors where $\lfloor (d_{\min} - 1)/2 \rfloor$ denotes the largest integer no greater than $(d_{\min} - 1)/2$. 07
- (b)** Consider a (15,11) cyclic code generated by $g(x) = 1 + x + x^4$. Devise a feedback shift register encoder circuit. Illustrate the encoding procedure with the message vector 10010110111 by listing the state of the registers. 07
- OR**
- (b)** The generator polynomial for a (15,7) cyclic code is 07
 $G(x) = 1 + x^4 + x^6 + x^7 + x^8$
 (i) Find the code-vector in systematic form for the message $d(x) = x^2 + x^3 + x^4$
 (ii) Assume that the first and last bit of the code vector $v(x)$ for $d(x) = x^2 + x^3 + x^4$ suffer transmission errors. Find syndrome of $v(x)$.
- Q.3 (a)** Explain operation of meggett decoder of cyclic code with block diagram. 07
- (b)** Consider a (3,1,2) convolution code with $g^{(1)} = (011)$, $g^{(2)} = (110)$ and $g^{(3)} = (101)$. 07
 (i) Draw the encoder block diagram
 (ii) Find the generator matrix
 (iii) Find the code-vector corresponding to the information sequence $d = 10001$

OR

- Q.3 (a)** What are RS codes? How are they formed? List the applications of RS codes. 07
- (b)** For the (3,2,1) encoder shown in figure, find code-word C for input sequences of 07
 $d^{(1)} = 101$ and $d^{(2)} = 110$ using
 (i) Time domain approach
 (ii) Transform domain approach



- Q.4 (a)** Write short note on interleaved codes **07**
- (b)** For the $(7,4)$ single error correcting cyclic code, the generator polynomial $g(x)=1+x+x^3$, find all the 16 code vectors of the cyclic code both in nonsystematic and systematic form. **07**
- OR**
- Q.4 (a)** What do you understand by state diagram and code tree of a convolution encoder? Explain clearly. **07**
- (b)** Using RS code circuit to encode the symbols $\{2,6,7\}$ with a $(7,3)$ R-S code in systematic form. Show the resulting codeword in binary form. Verify the encoding results by evaluating the codeword polynomial at the roots of the $(7,3)$ R-S generated polynomial $g(x)$. **07**
- Q.5 (a)** Explain recursive systematic convolution code. **07**
- (b)** Explain procedure of R-S code decoding using suitable example. **07**
- OR**
- Q.5 (a)** Write a short note on MAP decoding algorithm. **07**
- (b)** Write short note on PG-LDPC code **07**
