Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

SEVENTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION
NOV/DEC 2015
SUBJECT: ERROR CONTROL CODING (ECE - 439)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.

1A. Construct GF (2^3) using polynomial $x^3 + x + 1$. Solve for x and y if $\alpha x + \alpha^2 y = \alpha^4$; $\alpha^2 x + y = \alpha^4$. Also find the value of $x^{64} + y^{64}$

1B. Find the conjugates of α^3 in finite field GF (2^3) and its minimal polynomial.

1C. Define coding gain with example. Discuss its significance.

(5+3+2)

2A. Devise an encoder and decoder of C(n, k) linear block code specified by the parity check equations $V_0 = u_0 + u_2 + u_3$; $V_1 = u_0 + u_1 + u_2$; $V_2 = u_1 + u_2 + u_3$. (i) Give G & H matrices of code C in systematic form. (ii) Find the generator matrix of dual code of C. (iii) minimum distance of the code C. (iv) encode the message $1 + x^2$ (v) How many error patterns goes undetected?

2B. If weight distribution of coset-leaders are $\alpha_0 = 1$, $\alpha \ = 6, \alpha_2 = 1$ and others zero. If the bit transition probability is 10^{-2}, find the probability of error. Give the relation between weight distribution of linear code and its dual code.

2C. Explain standard array with example.

(5+3+2)

3A. For a (15,11) cyclic code defined by polynomial $1 + x + x^4$ find G & H in systematic form.

3B. Explain the implementation of (*n-l,k-l*) shortened encoder and decoder with example.

3C. Implement a Meggitt decoder for the cyclic code defined by polynomial $1 + x + x^4$

(5+3+2)

4A. Find the error location polynomial if received polynomial $r(x) = x^4 + x^9$ using triple error correcting BCH code.

4B. Implement the Chien's search algorithm for the error location polynomial $1 + \alpha^3 x^2 + \alpha^6 x^3$.

4C. Find the error polynomial if error location polynomial is $\sigma(x) = (1 + \alpha x)(1 + \alpha^6 x)(1 + \alpha^{10})$ over GF(2^4)

(5+3+2)

5A. Find the symbol error values if syndromes of received polynomial are $\{\alpha^{13}, \alpha^{14}, \alpha^9, \alpha^7, \alpha^8, \alpha^3\}$ and error location numbers are $\{\alpha^3, \alpha^8, \alpha^{13}\}$ using triple error RS code over GF (2^4).

5B. Implement an RS encoder with block length 15 and capable of correcting double symbols.

5C. Explain various types of ARQ strategies.

(5+3+2)

6A. For the state diagram shown in Figure Q6A, decode the received bit {00, 10, 00, 10, 00, 11, 10, 01} using Viterbi decoding algorithm.

6B. For the convolutional code shown in Figure Q6B, Determine various generator polynomials that completely describe the code. If the message polynomials $[U^1; U^2]$ is $[D^2 + D^3; 1 + D + D^4]$, Find the matrix G and code polynomial $V(D)$.

6C. Derive the expression for the efficiency for the selective repeat ARQ strategy considering erroneous channel.

(5+3+2)

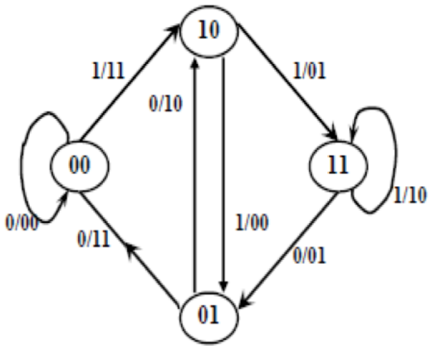

Figure 6A

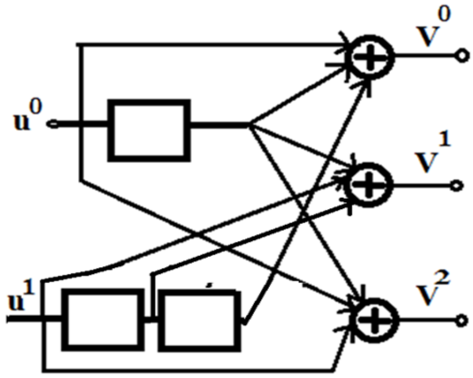

Figure 6B