Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

SECOND SEMESTER M.TECH. (DEC/ME) DEGREE END SEMESTER EXAMINATION
JUNE 2019
SUBJECT: CODING THEORY (ECE - 5235)

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

Instructions to candidates
- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Given the following table with the first and the second row indicating source symbols and the probabilities respectively:

S………	s1	s2	s3	s4	s5	s6	s7
$P(S_i)$…	1/3	1/3	1/9	1/9	1/27	1/27	1/27

Find a minimum variance Huffman code for this source when the code alphabet, (i) X={0,1} and (ii) X={0,1,2}. Also Compute Code efficiency and redundancy for both (i) and (ii).

1B. What is the dimension of the vector space spanned by the vectors $\{110101,\ 010111,\ 110011, 011101, 100000\}$ over $GF(2)$?

(7+3)

2A. The generator and parity check matrix for a binary code is given by

$$G = \begin{bmatrix} 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 \end{bmatrix} \quad H = \begin{bmatrix} 1 & 1 & 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 \end{bmatrix}$$

Verify that H is a parity check matrix for this generator. Draw the logic diagram for the encoder for this non-systematic code. Draw the syndrome decoding table. Without actually constructing a code, find the error correcting and detecting capabilities of this code.

2B. Encode the string **APPLE** using Adaptive Huffman coding Procedure for a source with 26 letter alphabet **A to Z.**

(5+5)

3A. Obtain the output sequence of the non-systematic feed forward convolutional encoder shown in the **Figure 3A**.

3B. The generator matrix for linear $(5,2)$ block code is given by $\boldsymbol{G}[\boldsymbol{I} \mid \boldsymbol{P}] = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 \end{bmatrix}$

Draw the standard array table for this code.

(5+5)

4A. Given the parity polynomial $h(X) = 1 + X + X^2 + X^4$ for (7,4) cyclic code. Obtain the systematic generator matrix, systematic parity check matrix without performing elementary row operations. Also find the code.

4B. Construct an encoder for systematic (7,4) cyclic code whose generator polynomial is $g(X) = 1 + X + X^3$. Encode the message 0111 using the same.

(5+5)

5A. Write down the features of r^{th} order Reed Muller code. Construct the generator matrix for (16,11) RM code. Determine the minimum distance of this code. List the properties of this Matrix.

5B. Explain the LDPC code. List the properties of the Parity check matrix of the code.

(5+5)

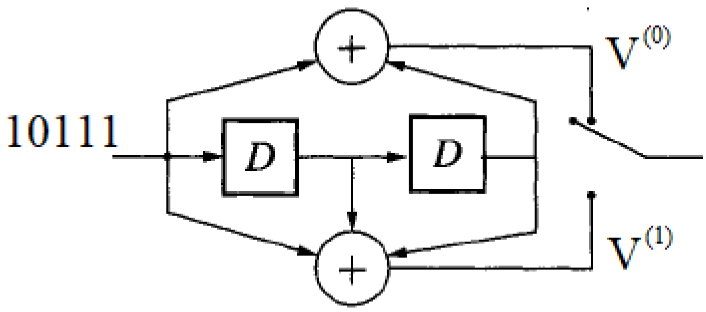

Figure 3A