Reg. No.										

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

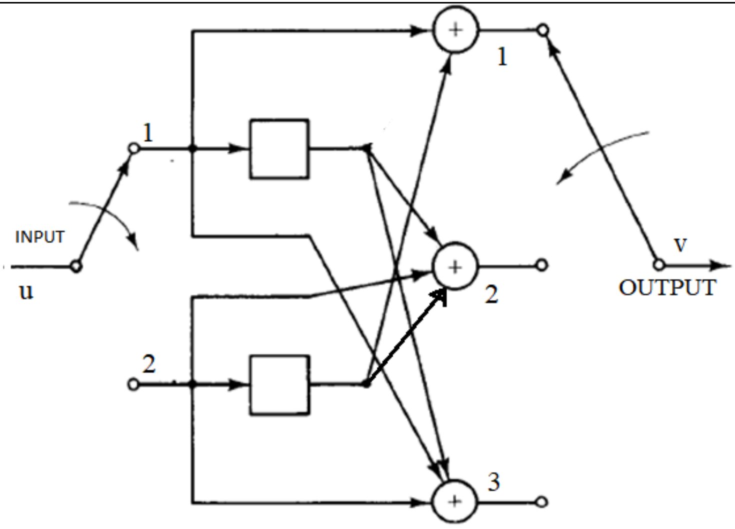
SEVENTH SEMESTER BTECH. (E & C) DEGREE POE (MAKEUP) – FEBRUARY 2022

SUBJECT: ERROR CONTROL CODING (ECE - 4073)

TIME: 75 min **MAX. MARKS: 20**

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

Q. No.	Questions	Marks
1A	Consider two linear block code C_1 (n_1,k_1,d_1) and C_2 (n_2,k_2,d_2) generated by generator matrix G1 & G2 respectively as given below, where (n_1,k_1,d_1) and (n_2,k_2,d_2) represents the block length, message length, minimum distance of the linear block code C_1 and C2. Determine the block length, message length, and minimum distance for the linear block codes. Are C1 & C2 equivalent codes. Determine the weight distribution of the codes $G1 = \begin{bmatrix} 110000 \\ 001100 \\ 000011 \end{bmatrix}$ & $G_2 = \begin{bmatrix} 111111 \\ 011011 \\ 001001 \end{bmatrix}$.	4
1B	A cyclic code C(n,k) is defined by the generator polynomial $x^5 + x+1$. Encode the message $m(x)= x^4 + x^2+1$. Determine the CRC and transmitted code for the message. Also give the implementation of the syndrome circuit (right side entry and left side entry).	3
1C	Implement the cyclic Hamming decoding circuit using $g(x) = 1+x+x^5$. Modify this circuit to implement (24, 19) shortened decoder. Explain every step with all necessary computations.	3
2A	Design and implement a circuit to determine syndrome S_{10} for a triple error correcting BCH code using minimal polynomials over $GF(2^4)$. Use $p(x)=1+x+x^4$. Explain the design steps clearly	2
2B.	A convolutional encoder is as shown in Figure 2B. Determine the generator sequences. Calculate the output of an encoder when it is fed with the input sequences $u^{(1)} = (1\ 0\ 0\ 0\ 1)$ & $u^{(2)} = (0\ 1\ 0\ 1\ 0)$ applying (i) convolution operation, (ii) using G matrix.	5

	 **Figure 2B**	
2C.	Analyse the received code "11 01 11 00 11 "applying Viterbi Algorithm, on the trellis diagram for the convolutional encoder defined with $g^{(1)}$=(110) and $g^{(2)}$=(101). Estimate the code word	3