Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

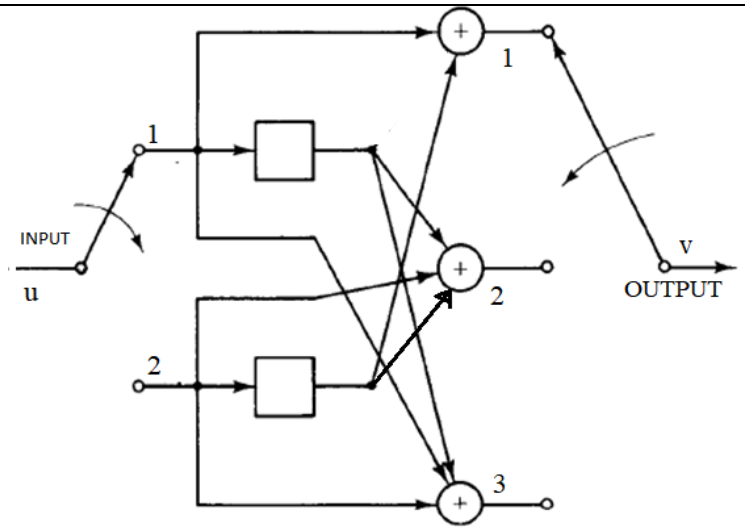
SEVENTH SEMESTER BTECH. (E & C) DEGREE END SEMESTER EXAMINATION
DECEMBER 2021-JANUARY 2022
SUBJECT: ERROR CONTROL CODING (ECE - 4073)

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 C1 (n1, k1, d1) and C2 (n1, k1, d2), where (n_1,k1,d1) and (n_2,k2,d2) represents the block length, message length, minimum distance of the linear block code C_1 and C2. Considering G1 and G_2 as the generator matrices of C_1 and C2 respectively, evaluate the block length, message length, minimum distance for the linear block generated by $G_3 = [G_1 G_2]$ and $G_4 = \begin{bmatrix} 0 & G_1 \\ G_2 & 0 \end{bmatrix}$.	4
1B	Analyse block codes C_1 & C_2 described by parity-check matrices H_1 & H_2. Does H_1 & H_2 result in the same codes? Determine the Generator matrix for both codes in systematic form. List all the code words of the codes. $H_1 = \begin{bmatrix} 1010 \\ 1101 \end{bmatrix}$ and $H_2 = \begin{bmatrix} 0111 \\ 1101 \end{bmatrix}$.	3
1C	Implement the cyclic Hamming decoding circuit using $g(x) = 1+x+x^4$. Modify this circuit to implement (12, 8) shortened decoder. Explain every step with all necessary computations.	3
2A	Design and implement a circuit to determine syndrome S_5 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 1 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 $g^{(1)}$=(101) and $g^{(2)}$=(110). Estimate the code word	3