Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

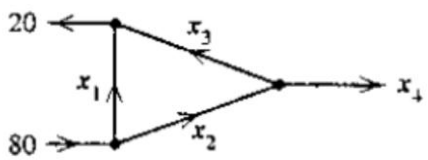
SIXTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION - April/May 2017

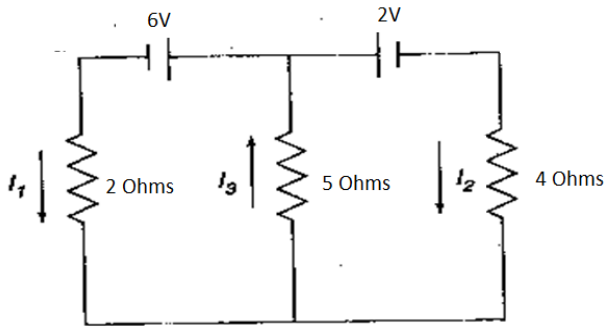
SUBJECT: LINEAR ALGEBRA FOR SIGNAL PROCESSING (ECE – 4008)

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

Instructions to candidates

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

1A.	Find the least square solution of the over determined system given by following system of linear equations. $x_1 + 3x_2 = 17$ $5x_1 + 7x_2 = 19$ $11x_1 + 13x_2 = 23$
1B.	Find the general flow pattern of the following network. Assuming all that the flows are all non-negative, what is the largest possible value of x_3? 
1C.	Define the following (i) Jacobian of a matrix (ii) Positive semidefinite matrix
	(5+3+2)
2A.	Transform the vector $[3\ \ 2\ \ 1\ \ 1]^T$ by the following sequence of operations (i) Translate by -1, -1, -1 in x, y and z axes respectively. (ii) Rotate counterclockwise by 30^0 about x axis and 45^0 about y axis respectively.
2B.	If x[n] = {1,2,-4,5,6} the input to an LTI system whose impulse response is h[n] = {1,-2,3,1,-4], determine output of this system.
2C.	Diagonalaize the following matrix $\begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}$
	(5+3+2)

3A.	Find the currents in the following circuit using QR factorization technique.  Figure 3A
3B.	Design a matched filter for a radar system where a discrete signal has to be detected. The channel considered is AWGN having variance σ^2. Why it is called a matched filter?
3C.	Use matrix multiplication to find the reflection of (2, −5, 3) about the xy–plane
	(5+3+2)
4A.	Explain the method of estimating the frequency of a signal buried in white noise using signal subspace decomposition technique. Give a suitable example.
4B.	Write a 6-point DFT matrix and prove that it is a unitary matrix. How linear convolution can be achieved using this matrix?
4C.	Give an example to the following (i) Toeplitz matrix (ii) Markov matrix
	(5+3+2)
5A.	Find singular value decomposition of the following matrix. Mention any two applications of SVD in image processing. $\begin{bmatrix} 1 & -1 \\ -2 & 2 \\ 2 & -2 \end{bmatrix}$
5B.	Find the inverse of following matrix using Gauss-Jordan method. $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 5 & 6 & 0 \end{bmatrix}$
5C.	Explain the process by which an image can be compressed using Eigen value decomposition.
	(5+3+2)