Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

SIXTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION

APRIL/MAY 2018

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. Solve the following system of linear equations using Gaussian elimination:

$$\begin{cases} 2x_1 + 3x_2 + 4x_3 + x_4 = 24 \\ x_2 + x_3 - 3x_4 = 18 \\ 4x_3 + 5x_4 = 10 \\ x_1 - x_3 = 7 \end{cases}$$

1B. Calculate the inverse of the given matrix using Gauss Jordan method: $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 0 & 3 \\ 4 & -3 & 8 \end{bmatrix}$

1C. Suppose that A and B are nxn matrices and the equation **ABx=0** has nontrivial solution what can you say about the matrix **AB**?

(5+3+2)

2A. Define spanning set of a vector space, Basis vectors and change of basis vectors. Consider the vector space consisting of all 2x2 matrices, find basis for these 2x2 matrices.

2B. Determine a spanning set of null space, column space, row space and rank of the matrix

$$A = \begin{bmatrix} 1 & 3 & 3 & 2 \\ 2 & 6 & 9 & 7 \\ -1 & -3 & -3 & 4 \end{bmatrix}$$

2C. Compute the pseudoinverse of the matrix $A = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 5 & 7 & 7 & 9 \end{bmatrix}$

(5+3+2)

3A. Perform a singular value decomposition on the matrix A given below and with the help of this decomposition: $A = \begin{bmatrix} 1 & -1 \\ 2 & -3 \\ 3 & 4 \end{bmatrix}$

3B. Let A be 3x3 matrix with eigenvalues -1, 2, 3. Find the determinant of A^{-1}.

3C. Show that Modal matrix of a Hermitian matrix with distinct eigenvalues is a unitary matrix.

(5+3+2)

4A. Find the modal matrix of $A = \begin{bmatrix} 8.25 & -9.75 & -7.5 \\ 2.25 & 2.25 & -1.5 \\ 2.25 & -12.57 & -4.5 \end{bmatrix}$

4B. Explain the Gram-Schmidt orthogonalization procedure

4C. Compute the DFT of the four point sequence $x(n) = [1\ 2\ 3\ 4]$ using Twidle factor matrix.

(5+3+2)

5A. Convolve the following matrices $f(n,m) = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ and $h(n,m) = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

5B. Define Homogeneous Coordinate system. With example explain different transformation of two dimensional objects.

5C. Explain the generalized fourier series.

(5+3+2)