Reg. No. | | | | | | | | | |

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

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
MAKEUP EXAMINATIONS, DECEMBER 2017

SUBJECT: LINEAR ALGEBRA AND ITS APPLICATIONS TO ELECTRICAL ENGINEERING [ELE 4030]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 26 December 2017** **Max. Marks: 50**

Instructions to Candidates:

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

1A. Define norm of a matrix with relevant axioms. Find L_0, L_1, $L_{Frobenious}$, and L_∞ norms of the following matrix.

$$B = \begin{pmatrix} 1 & 6 & 0 \\ 3 & 10 & 4 \\ 0 & 5 & 2 \end{pmatrix}$$

(03)

1B. State and prove the Cauchy-Schwarz and triangular inequality for vectors $x, y \in \mathcal{R}^2$ **(04)**

1C. Given the linear system $Ax = b$.

What are under defined, over defined, and well defined systems? Give their RREF form after elimination. **(03)**

2A. Reduce the following system to RREF (row reduced echelon form) using Gaussian elimination with backward/forward substitution.

$$u + 2v + w = 2$$
$$2u + 4v = 2$$
$$3u + 6v + w = 4$$

Find the solution using RREF if exists. Also mention whether the system is consistent. **(04)**

2B. Using Gauss-Jordan technique find the inverse of the following matrix:

$$P = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 5 & 7 \\ 3 & 6 & 8 \end{pmatrix}$$

(03)

2C. True or false? Give a counterexample if false and a reason if true.

(i) In $Ax = 0$ formulation, set of all possible x represent a vector space.
(ii) Rank of a matrix is the dimension of the column space.
(iii) Product of pivots = determinant of a matrix **(03)**

3A. Describe the column space and null space of A and the complete solution to $Ax = b$. Given:

$$A = \begin{pmatrix} 2 & 4 & 6 & 4 \\ 1 & 2 & 3 & 6 \\ 0 & 0 & 1 & 2 \end{pmatrix}; \text{ and } b = \begin{pmatrix} 4 \\ 3 \\ 5 \end{pmatrix}.$$

(04)

3B. Prove or disprove that reflection matrices are orthogonal matrices. **(02)**

3C. Determine the basis and rank of the matrix given below?

$$B = \begin{pmatrix} 1 & 2 & 1 & 1 \\ 2 & 4 & 2 & 2 \\ 3 & 6 & 3 & 4 \end{pmatrix}.$$

(02)

3D. Prove any two properties of determinants. **(02)**

4A. Derive expressions for determining unknown parameters of a line to be fitted over sparsely spaced data points using least squares technique. **(04)**

4B. Find q_1, $q_{2,}$, and q_3 (orthogonal vectors) as combinations of a, b and c (independent vectors) in G.

$$G = \begin{pmatrix} 1 & 2 & 3 \\ -1 & 0 & -3 \\ 0 & -2 & 3 \end{pmatrix}$$

(04)

4C. State and prove the Cayley-Hamilton theorem applicable to eigenvalues. **(02)**

5A. What are the eigenvalues and eigenvectors of $A = \begin{pmatrix} 6 & -3 & 1 \\ 3 & 0 & 5 \\ 2 & 2 & 6 \end{pmatrix}$? **(04)**

5B. What are Hermitian, positive definite, unitary, and symmetric matrices? **(04)**

5C. Prove or disprove that the symmetric matrices have real eigenvalues and orthogonal eigenvectors. **(02)**