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

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKEUP EXAMINATIONS, MAY 2018

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

REVISED CREDIT SYSTEM

Time: 3 Hours | **Date: May 05, 2018** | **Max. Marks: 50**

Instructions to Candidates:
- Answer **ALL** the questions.
- Missing data may be suitably assumed.

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

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

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

1C. Define norm of a vector with relevant axioms. What are L_1, L_2, and L_∞ norms of vector? **(03)**

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

$$2\,u + 4v + \ 2w \ = \ 4$$

$$4u + 8v = \ 4$$

$$6u + 12v + 2w = 8$$

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

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

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

2C. 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)**

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

$$B = \begin{pmatrix} 1 & 2 & 1 & 1 \\ 2 & 4 & 2 & 2 \\ 3 & 6 & 3 & 3 \end{pmatrix}.$$ **(04)**

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

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

(03)

3C. Prove any three properties of determinants. **(03)**

4A. Project b onto the column space of $A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \\ 0 & 1 \end{bmatrix}$

Find the projection p, error $e = b - p$, and the projection matrix P.

(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. What is eigenspace? **(02)**

5A. What are the eigenvalues and eigenvectors of $A = \begin{pmatrix} 6 & -3 & 1 \\ 3 & 0 & 5 \\ 2 & 2 & 6 \end{pmatrix}$? **(05)**

5B. Diagonalize the matrix B, if possible. $B = \begin{pmatrix} 1 & 3 & 3 \\ -3 & -5 & -3 \\ 3 & 3 & 1 \end{pmatrix}$ **(05)**