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SEAT No. :

P5123

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F.Y. B.Sc. (Computer Science)

MATHEMATICS

MTC - 111 : Matrix Algebra

(2019 Pattern) (Semester - I) (Paper-I)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of single memory, non-programmable scientific calculator is allowed.

Q1) Attempt any five out of seven.

[10]

- a) Describe the nature of solution for the following system of linear equations.

$$x + y = 6$$

$$3x + 3y = 18$$

- b) If $u = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$, $v = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$, then compute, $u + v$, $u + 5v$.

- c) Is the following matrix in reduced row echelon form? Justify

$$\begin{bmatrix} 1 & 2 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}.$$

- d) If $A = \begin{bmatrix} 3 & -2 \\ 5 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 4 \\ 6 & -7 \end{bmatrix}$. Find, $A - 4B + 7I_2$.

- e) Determine whether the following matrix is invertible or not. If yes find its

inverse $A = \begin{bmatrix} 8 & 1 \\ 5 & 2 \end{bmatrix}$.

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- f) Write the standard matrix for the transformation that gives reflection through the x_1 -axis.
- g) If A is 3×7 matrix and $\text{nullity}(A) = 4$, then find the rank (A).

Q2) Attempt any three out of five.

[15]

- a) Compute the solution of the following system by using Cramer's rule.

$$5x_1 + 7x_2 = 3$$

$$2x_1 + 4x_2 = 1$$

- b) Solve the following system of linear equations.

$$x_2 + 4x_3 = -5$$

$$x_1 + 3x_2 + 5x_3 = -2$$

$$3x_1 + 7x_2 + 7x_3 = 6$$

- c) If A is an $m \times n$ matrix, $u, v \in \mathbb{R}^n$ and C is a scalar, then prove that,

a) $A(u+v) = Au + Av$

b) $A(Cu) = C(Au)$

d) Let, $V_1 = \begin{bmatrix} 1 \\ 0 \\ -1 \\ 0 \end{bmatrix}, V_2 = \begin{bmatrix} 0 \\ -1 \\ 0 \\ 1 \end{bmatrix}, V_3 = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 1 \end{bmatrix}.$

Does $\{V_1, V_2, V_3\}$ Span \mathbb{R}^4 ? Justify.

- e) Let, $T : \mathbb{R}^2 \rightarrow \mathbb{R}^3$ be a linear transformation, such that $T(x_1, x_2) = (x_1 - 2x_2, -x_1 + 3x_2, 3x_1 - 2x_2)$. Find X such that, $T(X) = (-1, 4, 9)$.

Q3) Attempt any one out of two questions.

[10]

- a) Find basis for col A and Nul A of the following matrix A.

$$A = \begin{bmatrix} 3 & 3 & 1 & -5 \\ -9 & -4 & 1 & 7 \\ 9 & 2 & -5 & 1 \end{bmatrix}$$

Also find rank and nullity of A.

- b) i) Find the volume of the following parallelepiped with one vertex at the origin and adjacent vertices are $(1, 0, -3)$, $(1, 2, 4)$ and $(5, 1, 0)$.
ii) Solve the following system of linear equations.

$$x_1 + x_3 = 2$$

$$-2x_1 + x_2 - 6x_3 = -1$$

$$x_2 + 8x_3 = 6$$

