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.

$x + y = 2$

$x - y = 0$

b) If $u = \begin{bmatrix} -2 \\ 3 \\ -4 \end{bmatrix}$ and $V = \begin{bmatrix} a \\ b \\ c \end{bmatrix}$ then Find $u^T v$ and $v^T u$.

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

d) If $u = \begin{bmatrix} 5 \\ 9 \end{bmatrix}$, $v = \begin{bmatrix} 4 \\ 3 \end{bmatrix}$ then compute $u + v$, $5u$.

e) Determine whether the following matrix is invertible or not. If yes, Find its Inverse. $A = \begin{bmatrix} 3 & 2 \\ 7 & 4 \end{bmatrix}$

f) Write the standard matrix for the transformation that gives reflection through the x_1–axis.

g) Let $A = \begin{bmatrix} 3 & 1 \\ 4 & 2 \end{bmatrix}$ write 5A. Is det(5A)=5det(A)? Justify.

P.T.O.

Q2) Attempt any three out of five. [15]

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

$$3x_1 - 2x_2 = 6$$
$$-5x_1 + 4x_2 = 8$$

b) Solve the following system of linear system.

$$x_2 + 4x_3 = -5$$
$$x_1 + 3x_2 + 5x_3 = -2$$
$$3x_1 + 7x_2 + 7x_3 = 6$$

c) Check whether the vector $\begin{bmatrix} 1 \\ -2 \\ 5 \end{bmatrix}$ is in span $\{v_1, v_2, v_3\}$?

where, $v_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$, $v_2 = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$, $v_3 = \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$

d) Let $T : R^2 \rightarrow R^2$ be a linear transformation that maps $u = \begin{bmatrix} 5 \\ 2 \end{bmatrix}$ into $\begin{bmatrix} 2 \\ 1 \end{bmatrix}$ and maps $v = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$ into $\begin{bmatrix} -1 \\ 3 \end{bmatrix}$. Use the fact that T is a linear transformation To find the images under T of $3u$, $2v$ and $3u + 2v$.

e) Let, $T : R^2 \rightarrow R^3$ 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, $T(X) = (-1, 4, 9)$.

P.T.O.

Q3) Attempt any one out of two questions. [10]

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

$$A = \begin{bmatrix} 4 & 5 & 9 & -2 \\ 6 & 5 & 1 & 12 \\ 3 & 4 & 8 & -3 \end{bmatrix}$$

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.

$$x_1 - 2x_2 + x_3 = 0$$

$$2x_2 - 8x_3 = 8$$

$$5x_1 - 5x_3 = 10$$

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