

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2023)

CLASS: IMSC
BRANCH: MATHS & COMP.

SEMESTER : I
SESSION : MO/2023

SUBJECT: MA109 MATRIX THEORY

TIME: 02 HOURS

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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|---|-----|----|----|
| Q.1(a) Find the value of x such that:
$\begin{bmatrix} 1 & x & 1 \end{bmatrix} \begin{bmatrix} 1 & 3 & 2 \\ 2 & 5 & 1 \\ 15 & 3 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 2 \\ x \end{bmatrix} = 0$ | [2] | 1 | 1 |
| Q.1(b) If A be any Square Hermitian matrix, such that, $A^2 = 0$, then prove that the matrix must be a zero matrix | [3] | 1 | 2 |
| Q.2(a) Show that the matrix $A = \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$ is involutory. | [2] | 1 | 3 |
| Q.2(b) Show that the matrix $(I - A)(I + A)^{-1}$ is a Unitary matrix when, $A = \begin{bmatrix} 0 & 1 + 2i \\ -1 + 2i & 0 \end{bmatrix}$ | [3] | 1 | 3 |
| Q.3(a) Find the Rank of a Matrix : $A = \begin{bmatrix} 1 & 2 & 3 & 1 \\ 2 & 4 & 6 & 2 \\ 1 & 2 & 3 & 2 \end{bmatrix}$ | [2] | 2 | 1 |
| Q.3(b) Find the inverse of the following matrix using elementary operations:
$A = \begin{bmatrix} 1 & 2 & 5 \\ 2 & 3 & 1 \\ -1 & 1 & 1 \end{bmatrix}$ | [3] | 2 | 1 |
| Q.4(a) Show that the following system of equations:
$3x + 4y + 5z = a$; $4x + 5y + 6z = b$; $5x + 6y + 7z = c$,
do not have a solution unless $a + c = 2b$. | [2] | 2 | 3 |
| Q.4(b) For what value of k , the following system of equations:
$x - ky + z = 0$; $kx + 3y - kz = 0$; $3x + y - z = 0$,
(i) has only trivial solution,
(ii) may possess non-trivial solution. | [3] | 2 | 2 |
| Q.5(a) Apply Gauss-Elimination method to solve the following system of equations:
$x - y + z = 1$; $2x + y - z = 2$; $5x - 2y + 2z = 5$. | [5] | 3 | 3 |

:::18/10/2023:::