

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

CLASS: IMSc
BRANCH: MATHEMATICS & COMPUTING

SEMESTER : I
SESSION : MO/2024

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 k , for which $A = \begin{bmatrix} 5 & 2 \\ 0 & k \end{bmatrix}$ is a root of $f(x) = x^2 - 25$. | [2] | CO 1 2 |
| Q.1(b) | If $A = \text{diag}(1, 2, -3)$ and $B = \text{diag}(2, -5, 0)$ are diagonal matrices then find A^{-1} and B^{-1} . | [3] | CO 1 2 |
| Q.2(a) | Show that $A = \begin{bmatrix} \frac{1}{3} - \frac{2}{3}i & \frac{2}{3}i \\ -\frac{2}{3}i & -\frac{1}{3} - \frac{2}{3}i \end{bmatrix}$ is unitary matrix. | [2] | CO 1 2 |
| Q.2(b) | Find real numbers x, y, z such that A is Hermitian, where
$A = \begin{bmatrix} 3 & x + 2i & yi \\ 3 - 2i & 0 & 1 + zi \\ yi & 1 - xi & -1 \end{bmatrix}$. | [3] | CO 1 2 |
| Q.3(a) | Find the rank of the matrix:
$\begin{pmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{pmatrix}$. | [2] | CO 1 2 |
| Q.3(b) | Test the consistency of the system of equations:
$x - y + 2z = 3;$
$x + y - 3z = 5;$
$x + 2y - 3z = 7.$ | [3] | CO 2 3 |
| Q.4 | Find the value of λ for which the system of equations is consistent,
$x + y + 4z = 1;$
$x + 2y - 2z = 1;$
$\lambda x + y + z = 1.$ | [5] | CO 2 3 |
| Q.5 | Use the Gauss elimination method to solve the system of equations:
$x + y + z = 6;$
$3x + 3y + 4z = 20;$
$2x + y + 3z = 13.$ | [5] | CO 3 3 |

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