647510 **BSCmaMD201x-1C** **Seat No :________**

B.Sc. Semester - 1 (NEP-2020) Examination
OCT/NOV-2025 (As Per Syllabus Year June-2025)
MAT: Matrices and Coordinate Geometry (Multidisciplinary Course)

Time: 2:00 Hours **Marks:50**

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

Que.1(A) Attempt any ONE out of TWO (05)

1) Expressed uniquely the matrix $A = \begin{pmatrix} 2 & 3 & 4 \\ 5 & 7 & 9 \\ -2 & 1 & 1 \end{pmatrix}$ as the sum of a hermitian matrix and a skew hermitian matrix:
2) If $A = \begin{pmatrix} 3 & -4 \\ 1 & -1 \end{pmatrix}$ then show that $A^n = \begin{pmatrix} 1+2n & -4n \\ n & 1-2n \end{pmatrix}, n \in \mathbb{N}$.

Que.1(B) Attempt any ONE out of TWO (05)

1) If $A = \begin{pmatrix} 0 & 2m & n \\ l & m & -n \\ l & -m & n \end{pmatrix}$ is an orthogonal then find value of $l, m\ and\ n$.
2) Find the inverse of matrix $A = \begin{pmatrix} 2 & 3 & 5 \\ 1 & 2 & 7 \\ 3 & 4 & 4 \end{pmatrix}$ by using elementary row operations:

Que.2(A) Attempt any ONE out of TWO (05)

1) Find the rank of a matrix $A = \begin{pmatrix} 1 & 3 & -3 & -1 & -4 \\ 1 & 4 & 1 & -2 & -2 \\ 2 & 9 & 0 & -5 & -2 \end{pmatrix}$ using echelon form.
2) Find two non-singular matrices P and Q such that PAQ is in the normal form, where $A = \begin{pmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \\ 3 & 1 & 1 \end{pmatrix}$. Also find the rank of A.

Que.2(B) Attempt any ONE out of TWO (05)

1) Find the rank of a matrix $A = \begin{pmatrix} 3 & -2 & 0 & -1 & -7 \\ 0 & 2 & 2 & 1 & -5 \\ 1 & -2 & -3 & -2 & 1 \\ 0 & 1 & 2 & 1 & -6 \end{pmatrix}$.
2) The row rank of a matrix is the same as its rank.

Que.3(A) Attempt any ONE out of TWO (05)

1) Verify Cayley – Hamilton theorem for matrix $A = \begin{pmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \\ 3 & 1 & 1 \end{pmatrix}$.
2) Find eigen values and eigen vectors of a matrix $A = \begin{pmatrix} 5 & 3 \\ -1 & 1 \end{pmatrix}$.

Que.3(B) Attempt any ONE out of TWO (05)

1) Prove that an eigen values of hermitian matrix is real.
2) For what values of α and β the system of linear equations

$$x + y + z = 6$$
$$x + 2y + 3z = 10$$
$$x + 2y + \alpha z = \beta$$

haves (i) unique solution (ii) no solution and (iii) an infinite solutions.

Que.4(A) Attempt any ONE out of TWO (05)

1) Find the area of a triangle having vertices $(-3,-30°), (5,150°)$ and $(7,210°)$.
2) Obtain the center and radius of the circle $r = 2\ cos\theta + 3\ sin\theta$.

Que.4(B) Attempt any ONE out of TWO (05)

1) Obtain the length of the perpendicular from origin to the line which passes through the points $\left(2, \frac{\pi}{6}\right)$ and $(\sqrt{3}, \frac{\pi}{3})$.
2) Obtain cartesian and cylindrical co-ordinates for the spherical co-ordinates $(2, \frac{\pi}{4}, \frac{3\pi}{4})$.

Que.5(A) Attempt any ONE out of TWO (05)

1) If A is an idempotent matrix then show that $B = I - A$ is idempotent and $AB = BA = 0$.
2) Find the rank of a matrix $A = \begin{pmatrix} 1 & 1 & -1 \\ 2 & 3 & 4 \\ 3 & -2 & 3 \end{pmatrix}$ by representing it to normal form.

Que.5(B) Attempt any ONE out of TWO (05)

1) If $A = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$ then express $2A^5 - 3A^4 + A^2 - 4I$ as a linear polynomial.
2) Convert the spherical equation $\theta = \frac{\pi}{4}$ in cartesian form. Also identify this equation in $\mathbb{R}^3$.

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