

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

Time: 2:00 Hours

Marks:50

Instructions:

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

Que.1(A) Answer any one. (05)

- 1) Define:
 - a) Idempotent Matrix,
 - b) Trace of Matrix,
 - c) Scalar Matrix,
 - d) Hermitian Matrix,
 - e) Skew Symmetric Matrix.
- 2) Prove that every square matrix can be expressed uniquely as the sum of a symmetric and a skew symmetric Matrices.

Que.1(B) Answer any one. (05)

- 1) In usual notation Prove that $(A+B)^T = A^T + B^T$
- 2) If A is n-square matrix then prove that $A \cdot (\text{adj } A) = |A|I_n$

Que.2(A) Answer any one. (05)

- 1) Find rank of matrix $\begin{bmatrix} 1 & 3 & 7 \\ 2 & 4 & 3 \\ 8 & 6 & 2 \end{bmatrix}$ using echelon form.
- 2) Using Cayley- Hamilton theorem find inverse of $\begin{bmatrix} 2 & 1 & 2 \\ 2 & 2 & 1 \\ 1 & 2 & 2 \end{bmatrix}$

Que.2(B) Answer any one. (05)

- 1) Find Eigen value and Eigen vector of matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$
- 2) Find cylindrical co ordinates for given spherical co ordinates $(2, \frac{\pi}{4}, \frac{\pi}{6})$.

Que.3(A) Answer any one. (05)

- 1) If $AB=BA$ and $S^2=B$ then show that $(A^{-1}SA)^2 = B$, where A and B be two conformable matrices for multiplication.
- 2) Find area of triangle with vertices $(1, 30^\circ)$, $(2, 60^\circ)$, $(3, 90^\circ)$.

Que.3(B) Answer any one. (05)

- 1) Obtain the equation of circle where centre is (p, α) and radius a.
- 2) Derive formula to find distance between two points in polar coordinates.

Que.4(A) Answer any one. (05)

- 1) In usual notations derive the equation of a conic in polar coordinate $1/r = 1 + e \cos \theta$
- 2) If $A = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$ then prove that $A^n = \begin{bmatrix} \cos n\theta & \sin n\theta \\ -\sin n\theta & \cos n\theta \end{bmatrix}$ where $n \in N$.

Que.4(B) Answer any one. (05)

- 1) If P'P and Q'Q are the perpendicular focus chords of a conic then prove that $\frac{1}{SP \cdot SP'} + \frac{1}{SQ \cdot SQ'} = \text{constant}$.
- 2) Find the polar coordinates for the Cartesian coordinates (1,1) and the Cartesian coordinates for the polar coordinates $(1, \frac{\pi}{2})$.

Que.5(A) Answer any one. (05)

- 1) Convert the equation $5x^2 + 5y^2 = 8z^2$ into spherical form and cylindrical form.
- 2) Solve the linear equations: $x+y+z=2$, $2x+y-z=3$, $3x-y+6z=7$

Que.5(B) Answer any one. (05)

- 1) Prove that every square matrix satisfies its characteristic equation.
- 2) Obtain the equation of circle whose end points of diameter are (2,0) and $(3, \pi/2)$.