



A Charutar Vidya Mandal's Institution

V. P. & R. P. T. P. SCIENCE COLLEGE

(AUTONOMUS) (Grant-in-Aid)



Affiliated to Sardar Patel University, Vallabh Vidyanagar -388120

Bachelor of Science (Semester II) External Examination-2025**US02MIMTH01: Matrices and Complex numbers**

Date: 09-04-2025, (Wednesday)

Time: 2:00 pm to 3:30 pm

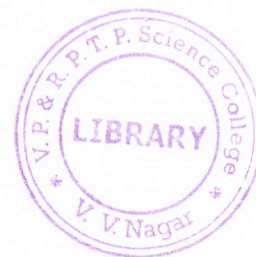
Total marks: 25

NOTE: The symbols used in this paper have usual meaning unless specified.**Q. 1 Write the most appropriate answer from the following multiple-choice questions. [05]**

- (1) The system $AX = 0$ of m equations in n unknowns has non-trivial if:
 (a) $\rho(A) < n$. (b) $\rho(A) > n$. (c) $\rho(A) = n$. (d) $m = n$.
- (2) The matrix _____ will describe the reflection of a point $A(x, y)$ in the X -axis.
 (a) $\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$ (c) $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$
- (3) If $|A + 4I| = 0$ then one of the characteristic roots of A is
 (a) 0 (b) 1 (c) 4 (d) -4
- (4) If $z = 2 + 3i$ then $z \cdot \bar{z} =$ _____.
 (a) 13 (b) $\sqrt{13}$ (c) 5 (d) $\sqrt{5}$
- (5) If $z = \cos \theta + i \sin \theta$, then $z^3 + \frac{1}{z^3} =$ _____.
 (a) $2i \sin 3\theta$ (b) $2i \cos 3\theta$ (c) $2 \sin 3\theta$ (d) $2 \cos 3\theta$

Q. 2 (A) Under what condition the rank of the following matrices is 3? Is it possible for the rank to be 1? Why? [03]

$$A = \begin{bmatrix} 2 & 4 & 2 \\ 3 & 1 & 2 \\ 1 & 0 & x \end{bmatrix}$$

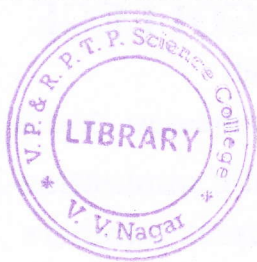


(B) Find the characteristic roots and characteristic vectors of the following matrix [07]

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}.$$

OR

Q. 2 (A) Define reduced row echelon form for the matrix and using Gauss elimination method, solve the system of linear equations: [06]



$$x_1 - x_3 = 2$$

$$x_1 + x_2 + 2x_3 = 4$$

$$x_1 + x_2 = 4$$

$$x_1 + x_2 + x_3 = 4$$

$$x_1 + 3x_2 - x_3 = 8$$

(B) Compute the inverse of the matrix

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ -2 & 1 & -1 & -2 \\ -4 & -2 & -3 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}.$$

[04]

Q. 3 (A) Prove that $(\cos \theta + i \sin \theta)^n = \cos n\theta + i \sin n\theta$, $\forall n \in \mathbb{Q}$ [07]

(B) Expand $\cos^4 \theta$ in series of cosine of multiples of θ . [03]

OR

Q. 3 (A) Find all the values of $\left(\frac{1}{2} + i\frac{\sqrt{3}}{2}\right)^{\frac{3}{4}}$. Also prove that the continued product of all these value is one. [06]

(B) Expand $\sin n\theta$ and $\cos n\theta$ in powers of $\sin \theta$ and $\cos \theta$ where $n \in \mathbb{N}$. [04]

All The Best