



A Charutar Vidya Mandal's Institution
V. P. & R. P. T. P. SCIENCE COLLEGE
 (AUTONOMOUS) (Grant-in-Aid)



Affiliated to Sardar Patel University, Vallabh Vidyanagar -388120

Bachelor of Science (Semester II) Internal Examination-2025

US02MIMTH01: Matrices and Complex numbers

Date: 05-03-2025 Day: Wednesday

Time: 12:45 pm to 1:45 pm

Total marks: 20

NOTE: The symbols used in this paper have usual meaning unless specified.

Q. 1 Choose the most appropriate answer from the following multiple-choice questions. [06]

- (1) If the matrix A has non-zero minor of order r and all the minors of higher orders are zero, then
 (a) $\rho(A) = r$. (b) $\rho(A) \neq r$. (c) $\rho(A) \leq r$. (d) $\rho(A) \geq r$.
- (2) A system of m linear equations $AX = 0$ in n unknowns has only trivial solution if
 (a) $m = n$. (b) $m \neq n$. (c) rank of $A = m$. (d) rank of $A = n$.
- (3) The matrix _____ is in reduced row echelon form.
 (a) $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ (b) $B = \begin{bmatrix} 1 & -3 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$ (c) $C = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$ (d) $D = \begin{bmatrix} 1 & -1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{bmatrix}$
- (4) Argument of a complex number $z = -1 + i$ is
 (a) $\frac{\pi}{4}$. (b) $\pi - \frac{\pi}{4}$. (c) $\pi + \frac{\pi}{4}$. (d) $-\frac{\pi}{4}$.
- (5) $(\cos \theta + i \sin \theta)^{\frac{3}{7}}$ has only _____ distinct values.
 (a) 3 (b) 7 (c) 10 (d) 4
- (6) If $z = \cos \theta + i \sin \theta$, then $z^3 - \frac{1}{z^3} =$ _____.
 (a) $2 \cos 3\theta$ (b) $2i \cos 3\theta$ (c) $2 \sin 3\theta$ (d) $2i \sin 3\theta$

Q. 2 (A) Determine rank of the matrix $\begin{bmatrix} 1 & 2 & 4 & 0 \\ -3 & 1 & 5 & 2 \\ -2 & 3 & 9 & 2 \end{bmatrix}$ by reducing it to row echelon form. [03]

(B) Using Cramer's rule solve the following system of linear equations. [04]

$$\begin{aligned} x + 5y &= 2 \\ 11x + y + 2z &= 3 \\ x + 5y + 2z &= 1. \end{aligned}$$

OR



Q. 2 (A) Using Gauss elimination method, solve the system of linear equations : [03]



$$x + 3y - 2z = 0$$

$$2x - y + 4z = 0$$

$$x - 11y + 14z = 0.$$

(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) Express the complex number $z = \sqrt{3} - i$ in its polar form.

[02]

(B) Prove that there are only q distinct values of $(\cos \theta + i \sin \theta)^{\frac{1}{q}}$, where $q \in \mathbb{N}$.

[05]

OR

Q. 3 (A) Prove that $(1 + \cos \theta + i \sin \theta)^n + (1 + \cos \theta - i \sin \theta)^n = 2^{n+1} \cos^n \left(\frac{\theta}{2} \right) \cos \left(\frac{n\theta}{2} \right)$. [04]

(B) Prove that $\cos 6\theta = 32 \cos^6 \theta - 48 \cos^4 \theta + 18 \cos^2 \theta - 1$.

[03]

All The Best