

SAVITRIBAI PHULE PUNE UNIVERSITY
Progressive Education Society's
~ Modern college of Arts, Science & Commerce, Ganeshkhind,
Pune 411016 (Autonomous)
B.Sc. Blended program

(A degree of Savitribai Phule Pune University equivalent to the degree of University of Melbourne)

As per National Education policy (NEP)
End Semester Examination: April / May 2024

Program: B.Sc. Blended	Semester II	Set A
Program (Specific): B.Sc. Blended (Chemistry)		Course Type: Core
Class: F.Y.B.Sc. Blended		Max. Marks: 60
Name of the Course: Algebra		
course code: MTH201		
Paper No: I		Time: 2½ Hours

Note:

- 1) All question as compulsory.
- 2) Figures to the right corner indicate full marks.
- 3) Use of scientific calculators is allowed.
- 4) Draw a well labelled diagram wherever necessary.
- 5) Use only Blank or blue ink/ball/gel pens for writing.

SECTION I

Q.1] Select the correct option. (Any 5 out of 6) [1M × 5 = 5M]

- 1) If A and B are square matrices of the same order then $(A.B)^T = \text{-----}$.
 - a) $A^T.B^T$
 - b) $B^T.A^T$
 - c) $A^T + B^T$
 - d) $(BA)^T$
- 2) Every Differentiable function is _____.
 - a) Discontinuous
 - b) Continuous
 - c) both a and b
 - d) none of these.
- 3) If $z = 2 + 3i$ is a complex number, then modulus of z is _____.
 - a) $\sqrt{11}$
 - b) $\sqrt{12}$
 - c) 4
 - d) $\sqrt{14}$

- 4) Conjugate of $z_1 + z_2$ if $z_1 = 2 + 3i$ and $z_2 = 5 + 2i$ is—.
- $-3 - i$
 - $7 + 5i$
 - $7 - 5i$
 - $3 + i$
- 5) $\lim_{y \rightarrow 2} (y^2 + 2y + 1) =$
- 9
 - 8
 - 9
 - 6.
- 6) According to Fundamental theorem of Algebra, The polynomial function $f(x) = x^3 + 5x^2 - x - 5$ has how many complex solutions?
- 2
 - 4
 - 3
 - 1

Q.2] Answer in brief. (Any 5 out of 6)

[3M × 5 = 15M]

- Find Expansion Value of the Matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 2 \\ 3 & 2 & 1 \end{bmatrix}$.
- Let $v = R^3$ and $W = \{(x, y, z) : x + y + z = 0\}$ is Subspace ?
- Find the Characteristics equation and eigenvalues of Matrix $\begin{bmatrix} 3 & 5 \\ 2 & 4 \end{bmatrix}$.
- Check whether the Set $S = \{\cos x, \sin x\}$ is linearly dependent or not.
- State Mean Value Theorem and Rank Nullity Theorem.
- Use Properties of Conjugate and modulus show that $\overline{iz} = -i\bar{z}$.

Q.3] Answer in detail.(Any 2 out of 3)

[5M × 2 = 10M]

- Show that Set $B = \{(1, 1, 1), (1, 1, 0), (1, 0, 0)\}$ is a basis set for vector space R^3 .
- Find the Basis and Dimension of row space of matrix $A = \begin{bmatrix} 1 & 2 & -1 \\ 3 & 0 & 1 \\ 1 & -1 & 1 \end{bmatrix}$.
- Solve the following system of linear equation by Gauss Elimination Method.

$$5x_1 + 6x_2 = 7$$

$$3x_1 + 4x_2 = 5.$$

Q.4] Answer in detail.(Any 3 out of 5)

[5M × 3 = 15M]

- 1) Evaluate $\lim_{x \rightarrow 0} \left(\frac{\sqrt{1+x} - 1}{x} \right)$.
- 2) Discuss the continuity of $f(x) = \sqrt{9 - a^2}$ on the interval $[-3, 3]$.
- 3) Determine the value of k for which the vector $\bar{w} = (1, -2, k)$ is a linear combination of vector $\bar{u} = (3, 0, -2)$ and $\bar{v} = (2, -1, -5)$.
- 4) If $A = \begin{bmatrix} 2 & 5 & 6 \\ 0 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & 1 \\ 0 & 4 \\ 5 & 7 \end{bmatrix}$, then, verify that $(A.B)^T = B^T.A^T$.
- 5) Show that set $S = \{(1, 1, 1), (1, 1, 0), (1, 0, 0)\}$ span R^3 .

Q.5] Answer in detail.(Any 5 out of 7)

[3M × 5 = 15M]

- 1) If $A = \begin{bmatrix} 2 & 4 \\ 1 & 1 \end{bmatrix}$, then prove that $A^2 - 3A = 2I$.
- 2) Find the argument of complex number $z = -1 + i$.
- 3) Verify that $\sqrt{2} - i - i(1 - \sqrt{2}i) = -2i$.
- 4) Evaluate limit $\lim_{x \rightarrow 2} \left(\frac{x^7 - 128}{x^5 - 32} \right)$.
- 5) Find inverse of the Matrix $\begin{bmatrix} 2 & -6 \\ 1 & -2 \end{bmatrix}$.
- 6) Test Whether the function $f(x)$ is continuous at $x = -4$, where

$$f(x) = \frac{x^2 + 16x + 48}{x + 4}, \quad x \neq -4$$

$$= 8, \quad x = -4.$$
- 7) Solve the example using L' Hospital Rule $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$.
