

**166****III**

Total No. of Questions – 24

Regd.

Total No. of Printed Pages - 3

No.

**Part – III**  
**MATHEMATICS, Paper – I(A)**  
**(English Version)**

Time : 3 Hours]

[Max. Marks : 75

Note : This question paper consists of three Sections – A, B and C.

**SECTION – A****10 × 2 = 20****I. Very Short Answer Type questions :**

- (i) Answer **all** the questions.  
(ii) Each question carries **two** marks.

1. Find the domain of the real valued function  $f(x) = \sqrt{x^2 - 25}$ .
2. If  $f : \mathbb{R} \rightarrow \mathbb{R}$ ,  $g : \mathbb{R} \rightarrow \mathbb{R}$  are defined by  $f(x) = 3x - 1$ ,  $g(x) = x^2 + 1$  then find  $(f \circ g)(2)$ .
3. Define a symmetric matrix. Give one example of order  $3 \times 3$ .
4. Find the inverse of the matrix  $\begin{bmatrix} 1 & 2 \\ 3 & -5 \end{bmatrix}$ .
5. If the vectors  $-3\bar{i} + 4\bar{j} + \lambda\bar{k}$  and  $\mu\bar{i} + 8\bar{j} + 6\bar{k}$  are collinear then find  $\lambda$  and  $\mu$ .
6. Find the vector equation of the plane passing through the points  $(0, 0, 0)$ ,  $(0, 5, 0)$  and  $(2, 0, 1)$ .

7. Find the angle between the vectors  $\bar{i} + 2\bar{j} + 3\bar{k}$  and  $3\bar{i} - \bar{j} + 2\bar{k}$ .
8. Find the value of  $\sin 330^\circ \cos 120^\circ + \cos 210^\circ \sin 300^\circ$ .
9. Find the extreme values of  $\cos 2x + \cos^2 x$ .
10. For any  $x \in \mathbb{R}$  show that  $\cosh 2x = 2 \cosh^2 x - 1$ .

## SECTION - B

5 × 4 = 20

## II. Short Answer Type questions :

- (i) Answer any **five** questions.
- (ii) Each question carries **four** marks.

11. If  $A = \begin{bmatrix} 7 & -2 \\ -1 & 2 \\ 5 & 3 \end{bmatrix}$  and  $B = \begin{bmatrix} -2 & -1 \\ 4 & 2 \\ -1 & 0 \end{bmatrix}$  then find  $AB'$  and  $BA'$ .

12. If  $\bar{a}$ ,  $\bar{b}$ ,  $\bar{c}$  are non-coplanar vectors, prove that the following four points are co-planar  $-\bar{a} + 4\bar{b} - 3\bar{c}$ ,  $3\bar{a} + 2\bar{b} - 5\bar{c}$ ,  $-3\bar{a} + 8\bar{b} - 5\bar{c}$  and  $-3\bar{a} + 2\bar{b} + \bar{c}$ .

13. Let  $\bar{a}$  and  $\bar{b}$  be vectors, satisfying  $|\bar{a}| = |\bar{b}| = 5$  and  $(\bar{a}, \bar{b}) = 45^\circ$ . Find the area of the triangle having  $\bar{a} - 2\bar{b}$  and  $3\bar{a} + 2\bar{b}$  as two of its sides

14. If  $A$  is not an integral multiple of  $\frac{\pi}{2}$  then prove that

(i)  $\tan A + \cot A = 2 \operatorname{cosec} 2A$  and

(ii)  $\cot A - \tan A = 2 \cot 2A$

15. Solve the equation  $\sqrt{3} \sin \theta - \cos \theta = \sqrt{2}$ .

16. Prove that  $\sin^{-1} \left( \frac{4}{5} \right) + \sin^{-1} \left( \frac{5}{13} \right) + \sin^{-1} \left( \frac{16}{65} \right) = \frac{\pi}{2}$

17. If  $a = (b - c) \sec \theta$ , prove that  $\tan \theta = \frac{2\sqrt{bc}}{b - c} \sin \frac{A}{2}$

**III. Long Answer Type questions :**

- (i) Answer any **five** questions.  
 (ii) Each question carries **seven** marks.

18. Let  $f : A \rightarrow B$ ,  $g : B \rightarrow C$  be bijections then prove that  $g \circ f : A \rightarrow C$  is a bijection.

19. Using mathematical induction, prove that :

$$\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + \dots + \frac{1}{(2n-1)(2n+1)} = \frac{n}{2n+1} \text{ for all } n \in \mathbb{N}.$$

20. Show that

$$\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3.$$

21. Solve the following system of equations by Gauss-Jordan Method :

$$2x - y + 3z = 9, x + y + z = 6 \text{ and } x - y + z = 2.$$

22. For any four vectors  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  and  $\vec{d}$ , prove that

$$(i) \quad (\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = [\vec{a} \vec{c} \vec{d}] \vec{b} - [\vec{b} \vec{c} \vec{d}] \vec{a} \text{ and}$$

$$(ii) \quad (\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = [\vec{a} \vec{b} \vec{d}] \vec{c} - [\vec{a} \vec{b} \vec{c}] \vec{d}$$

23. If A, B, C are the angles in a triangle, then prove that

$$\cos A + \cos B + \cos C = 1 + 4 \sin \left( \frac{A}{2} \right) \sin \left( \frac{B}{2} \right) \sin \left( \frac{C}{2} \right)$$

24. Show that in any triangle ABC

$$r + r_3 + r_1 - r_2 = 4R \cos B.$$