

166

II

Total No. of Questions – 24

Regd.

Total No. of Printed Pages - 4

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**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** questions.

(ii) Each question carries **two** marks.

1. If  $A = \{-2, -1, 0, 1, 2\}$ , and  $f: A \rightarrow B$  is a surjection defined by  $f(x) = x^2 + x + 1$ , then find B.

2. Find the domain of the real valued function  $f(x) = \sqrt{9 - x^2}$ .

3. Construct a  $3 \times 2$  matrix whose elements are defined by  $a_{ij} = \frac{1}{2} |i - 3j|$ .

4. If  $A = \begin{bmatrix} 2 & 4 \\ -1 & k \end{bmatrix}$  and  $A^2 = O$ , then find the value of k.

5. If  $\alpha, \beta, \gamma$  are the angles made by the vector  $3\vec{i} - 6\vec{j} + 2\vec{k}$  with the positive directions of the co-ordinate axes, then find  $\cos \alpha, \cos \beta, \cos \gamma$ .

6. Find the vector equation of the plane passing through the points  $\vec{i} - 2\vec{j} + 5\vec{k}$ ,  $-5\vec{j} - \vec{k}$  and  $-3\vec{i} + 5\vec{j}$ .
7. If  $\vec{a} = \vec{i} - \vec{j} - \vec{k}$  and  $\vec{b} = 2\vec{i} - 3\vec{j} + \vec{k}$ , then find the projection vector of  $\vec{b}$  on  $\vec{a}$ .
8. If  $\cos \theta = t$  ( $0 < t < 1$ ) and  $\theta$  does not lie in the first quadrant, find the values of  $\sin \theta$  and  $\tan \theta$ .
9. Find the maximum and minimum values of  $13 \cos x + 3\sqrt{3} \sin x - 4$ .
10. Show that  $\tan^{-1} \left( \frac{1}{2} \right) = \frac{1}{2} \log_e 3$ .

SECTION – B

5 × 4 = 20

II. Short Answer Type questions :

(i) Answer any **five** questions.

(ii) Each question carries **four** marks.

11. If A is a non-singular matrix, then prove that  $A^{-1} = \frac{\text{adj } A}{|A|}$ .

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

13. Find the unit vector perpendicular to the plane and passing through the points (1, 2, 3), (2, -1, 1) and (1, 2, -4).
14. Prove that  $\sqrt{3} \operatorname{cosec} 20^\circ - \sec 20^\circ = 4$ .
15. Solve the equation  $1 + \sin^2 \theta = 3 \sin \theta \cos \theta$ .
16. Show that  $\tan^{-1} \frac{1}{2} + \tan^{-1} \frac{1}{5} + \tan^{-1} \frac{1}{8} = \frac{\pi}{4}$ .
17. If  $\cot \frac{A}{2} : \cot \frac{B}{2} : \cot \frac{C}{2} = 3 : 5 : 7$ , then show that  $a : b : c = 6 : 5 : 4$  (In  $\Delta ABC$ )

SECTION – C

5 × 7 = 35

III. Long Answer Type questions :

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

18. If  $f : A \rightarrow B$  be a bijection, then prove that (i)  $f \circ f^{-1} = I_B$  (ii)  $f^{-1} \circ f = I_A$ .
19. Show that  $49^n + 16n - 1$  is divisible by 64 for all positive integers  $n$ .

20. Show that 
$$\begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix} = (a - b)(b - c)(c - a)(ab + bc + ca).$$

21. Solve  $x + y + z = 9$ ,  $2x + 5y + 7z = 52$  and  $2x + y - z = 0$  by using matrix inversion method.

22. If  $A = (1, -2, -1)$ ,  $B = (4, 0, -3)$ ,  $C = (1, 2, -1)$  and  $D = (2, -4, -5)$ , then find the shortest distance between the lines  $\overleftrightarrow{AB}$  and  $\overleftrightarrow{CD}$ .
23. If  $A + B + C = 180^\circ$ , then show that  $\cos 2A + \cos 2B + \cos 2C = -4 \cos A \cdot \cos B \cdot \cos C - 1$ .
24. If  $r_1 = 8$ ,  $r_2 = 12$ ,  $r_3 = 24$ , then find the values of  $a$ ,  $b$ ,  $c$  (in  $\Delta ABC$ ).
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