

0193

TS

A

Total No. of Questions – 24

Regd.

--	--	--	--	--	--	--	--	--	--

Total No. of Printed Pages – 4

No.

Part - III  
MATHEMATICS, Paper-I(B)  
(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) Attempt all questions.

(ii) Each question carries two marks.

1. Find the value of  $x$ , if the slope of the line passing through  $(2, 5)$  and  $(x, 3)$  is 2.

2. Transform the equation  $x + y + 1 = 0$  into normal form.

3. Find the ratio in which the  $xz$ -plane divides the line joining A  $(-2, 3, 4)$  and B  $(1, 2, 3)$ .

4. Find the intercepts of the plane  $4x + 3y - 2z + 2 = 0$  on the co-ordinate axes.

5. Compute  $\lim_{x \rightarrow 0} \left( \frac{\sin ax}{\sin bx} \right)$ ,  $b \neq 0$ ,  $a \neq b$

6. Compute  $\lim_{x \rightarrow \pi/2} \left( \frac{\cos x}{x - \pi/2} \right)$

7. If  $y = \frac{a-x}{a+x}$  ( $x \neq -a$ ), find  $\frac{dy}{dx}$

8. If  $y = (\cot^{-1} x^3)^2$ , find  $\frac{dy}{dx}$

9. If the increase in the side of a square is 2%, then find the approximate percentage of increase in its area.

10. Find the value of C in Lagrange's mean value theorem for the function  $f(x) = x^2 - 1$  on  $[2, 3]$ .

### SECTION - B

5 × 4 = 20

II. Short answer type questions :

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

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

11. Find the locus of the third vertex of a right angled triangle, the ends of whose hypotenuse are  $(4, 0)$  and  $(0, 4)$ .

12. When the axes are rotated through an angle  $\frac{\pi}{6}$ , find the transformed equation of  $x^2 + 2\sqrt{3}xy - y^2 = 2a^2$ .

13. Find the value of k, if the lines  $2x - 3y + k = 0$ ,  $3x - 4y - 13 = 0$  and  $8x - 11y - 33 = 0$  are concurrent.

14. Find the real constants a, b, so that the function f given by

$$f(x) = \begin{cases} \sin x & , \text{ if } x \leq 0 \\ x^2 + a & , \text{ if } 0 < x < 1 \\ bx + 3 & , \text{ if } 1 \leq x \leq 3 \\ f(x) = -3 & \text{ if } x > 3 \end{cases}$$

is continuous on  $\mathbb{R}$ .

15. Find the derivative of  $x \sin x$  from the first principle.

16. Show that at any point  $(x, y)$  on the curve  $y = b e^{x/a}$ , the length of the sub-tangent is a constant and the length of the subnormal is  $\frac{y^2}{a}$ .

17. A particle is moving along a line according to  $S = f(t) = 4t^3 - 3t^2 + 5t - 1$  where  $S$  is measured in metres and  $t$  is measured in seconds. Find the velocity and acceleration at time  $t$ . At what time the acceleration is zero ?

### SECTION - C

5 × 7 = 35

III. Long answer type questions :

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

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

18. Find the circumcenter of the triangle whose vertices are  $(1, 3)$ ,  $(-3, 5)$  and  $(5, -1)$ .

19. If the equation  $ax^2 + 2hxy + by^2 = 0$  represents a pair of straight lines, then show that the angle  $\theta$  between the lines is given by

$$\cos \theta = \frac{|a + b|}{\sqrt{(a - b)^2 + 4h^2}}$$

20. Show that the lines joining the origin to the points of intersection of the curve  $x^2 - xy + y^2 + 3x + 3y - 2 = 0$  and the straight line  $x - y - \sqrt{2} = 0$  are mutually perpendicular.
21. Find the angle between two diagonals of a cube.
22. If  $y = \tan^{-1} \left[ \frac{\sqrt{1+x^2} + \sqrt{1-x^2}}{\sqrt{1+x^2} - \sqrt{1-x^2}} \right]$  for  $0 < |x| < 1$ , find  $\frac{dy}{dx}$ .
23. Show that the equation of the tangent to the curve  $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$  ( $a \neq 0, b \neq 0$ ) at the point  $(a, b)$  is  $\frac{x}{a} + \frac{y}{b} = 2$ .
24. From a rectangular sheet of dimensions  $30 \text{ cm} \times 80 \text{ cm}$  four equal squares of side  $x \text{ cm}$  are removed at the corners, and the sides are then turned up so as to form an open rectangular box. Find the value of  $x$ , so that the volume of the box is the greatest.
-