193

II

Total No. of Questions – 24
Total No. of Printed Pages – 3

Regd. 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) Answer **all** questions.

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

1. Find the equation of the straight line passing through (– 4, 5) and cutting off equal and non zero intercepts on the co-ordinate axes.

2. Find the area of the triangle formed by the straight line $x - 4y + 2 = 0$ and the coordinate axes.

3. Find the coordinates of the vertex 'C' of Δ ABC if its centroid is origin and the vertices A, B are (1, 1, 1) and (– 2, 4, 1) respectively.

4. Find the equation of the plane passing through (– 2, 1, 3) and having (3, – 5, 4) as d.r.'s of its normal.

5. Compute the limit $\lim\limits_{x \to 0} \frac{\sin ax}{x \cos x}$.

6. Compute the limit $\lim\limits_{x \to \infty} \frac{11x^3 - 3x + 4}{13x^3 - 5x^2 - 7}$.

7. Find the derivative of the function $\frac{1 - \cos 2x}{1 + \cos 2x}$.

8. Define the derivative of a function.

9. Find Δy and dy for the function $y = x^2 + 3x + 6$ for the value of $x = 10$ and $\Delta x = 0.01$.

10. State Legrange's Mean value theorem.

SECTION – B $5 \times 4 = 20$

II. Short answer type questions :

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

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

11. Find the equation of the locus of a point, the difference of whose distances from $(-5, 0)$ and $(5, 0)$ is 8.

12. When the axes are rotated through an angle α, find the transformed equation of $x \cos \alpha + y \sin \alpha = p$.

13. Transform the equation $4x - 3y + 12 = 0$ into

(i) intercept form and

(ii) normal form

14. Check the continuity of f given by

$$f(x) = \frac{x^2 - 9}{x^2 - 2x - 3}, \; 0 < x < 5 \text{ and } x \neq 3 \text{ at the point } 3$$

$$1.5, \text{ if } x = 3.$$

15. Find the derivative of $f(x) = \sin 2x$ using the first principle.

16. Find the equations of tangent and normal to the curve $y = x^3 + 4x^2$ at $(-1, 3)$.

17. A container is in the shape of an inverted cone has height 8 m and radius 6 m at the top. If it is filled with water at the rate $2\ m^3$/minute, how fast is the height of water changing when the level is 4 m ?

SECTION - C

$5 \times 7 = 35$

III. Long Answer Type questions :

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

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

18. (a) If Q (h, k) is the foot of the perpendicular from $p(x_1, y_1)$ on the straight line $ax + by + c = 0$ then prove that $\frac{h - x_1}{a} = \frac{k - y_1}{b} = \frac{-(ax_1 + by_1 + c)}{a^2 + b^2}$.

    (b) Find the foot of the perpendicular drawn from (4, 1) upon the straight line $3x - 4y + 12 = 0$.

19. (a) Let the equation $ax^2 + 2hxy + by^2 = 0$ represents a pair of straight lines and the angle between them is θ then show that $\cos\theta = \frac{|a + b|}{\sqrt{(a - b)^2 + 4h^2}}$.

    (b) Find the angle between the pair of lines represented by the equation $x^2 - 7xy + 12y^2 = 0$.

20. Show that the lines joining to 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. Find the angle between the curves $y^2 = 4x$; $x^2 + y^2 = 5$.

24. The profit function $p(x)$ of a company, selling x items per day is given $p(x) = (150 - x)\,x - 1600$.
    Find the number of items that the company should sell for maximum profit. Also find the maximum profit.
