4. Write short answers to any NINE (9) questions : 18

    (i) Find the coordinates of the point that divides the join of A (-6, 3) and B (5, -2) internally in ratio 2 : 3.

    (ii) Find the slope and inclination of the line joining the points A (-2, 4) and B (5, 11)

    (iii) By means of slopes show that points A (-1, -3), B (1, 5) and C (2, 9) are collinear.

    (iv) Find equation of the line through (-4, 7) and parallel to the line $2x - 7y + 4 = 0$

    (v) Find equation of circle with centre at (5, -2) and radius 4.

    (vi) Find focus and vertex of the parabola $y^2 = -8(x - 3)$

    (vii) Find equation of tangent to the parabola $x^2 = 16y$ at the point whose abscissa is 8.

    (viii) Find foci and vertices of the ellipse $25x^2 + 9y^2 = 225$

    (ix) Find the angle between the vectors $\underline{u} = 2\underline{i} - \underline{j} + \underline{k}$ and $\underline{v} = -\underline{i} + \underline{j}$

    (x) Find scalar α so that the vectors $2\underline{i} + \alpha\underline{j} + 5\underline{k}$ and $3\underline{i} + \underline{j} + \alpha\underline{k}$ are perpendicular.

    (xi) If $\underline{v}$ is a vector for which $\underline{v}.\underline{i} = 0$, $\underline{v}.\underline{j} = 0$, $\underline{v}.\underline{k} = 0$ find $\underline{v}$

    (xii) Prove that $\underline{a} \times (\underline{b} + \underline{c}) + \underline{b} \times (\underline{c} + \underline{a}) + \underline{c} \times (\underline{a} + \underline{b}) = 0$

    (xiii) Find the value of α so that $\alpha\underline{i} + \underline{j}$, $\underline{i} + \underline{j} + 3\underline{k}$ and $2\underline{i} + \underline{j} - 2\underline{k}$ are coplanar.

SECTION – II

Note : Attempt any THREE questions.

5. (a) If $f(x) = \begin{cases} 3x & \text{if } x \le -2 \\ x^2 - 1 & \text{if } -2 < x < 2 \\ 3 & \text{if } x \ge 2 \end{cases}$

    discuss continuity at $x = 2$ and $x = -2$ 5

  (b) If $y = e^x \sin x$, show that $\dfrac{d^2y}{dx^2} - 2\dfrac{dy}{dx} + 2y = 0$ 5

6. (a) Integrate $\displaystyle\int \dfrac{12}{x^3 + 8} dx$ 5

  (b) Find equations of two parallel lines, perpendicular to $2x - y + 3 = 0$ such that the product of the x- and y-intercepts of each is 3.   5

7. (a) Evaluate the definite integral $\displaystyle\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} \dfrac{\cos x}{\sin x (2 + \sin x)} dx$ 5

  (b) Minimize $z = 2x + y$ subject to the constraints

         $x + y \ge 3$, $7x + 5y \le 35$, $x \ge 0$, $y \ge 0$ 5

8. (a) Find equation of the line through the point (2, -9) and intersection of the lines

       $2x + 5y - 8 = 0$

       $3x - 4y - 6 = 0$ 5

  (b) Show that the circles $x^2 + y^2 + 2x - 2y - 7 = 0$ and $x^2 + y^2 - 6x + 4y + 9 = 0$ touch externally.   5

9. (a) Find an equation of the ellipse having foci (± 5, 0) and passing through the point $\left(\dfrac{2}{3}, \sqrt{3}\right)$ 5

  (b) A particle acted upon by constant forces $4\underline{i} + \underline{j} - 3\underline{k}$ and $3\underline{i} - \underline{j} - \underline{k}$ is displaced from A (1, 2, 3) to B (5, 4, 1). Find the work done.   5