

## SECTION – I

## 2. Write short answers to any EIGHT (8) questions :

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- (i) For  $f(x) = \frac{2x+1}{x-1}$ , find  $f^{-1}(x)$
- (ii) Evaluate  $\lim_{\theta \rightarrow 0} \frac{1 - \cos \theta}{\sin \theta}$
- (iii) Discuss the continuity of  $f(x)$  at  $x = c = 2$ ,  $f(x) = \begin{cases} 2x+5 & \text{if } x \leq 2 \\ 4x+1 & \text{if } x > 2 \end{cases}$
- (iv) Differentiate w.r.t 'x'  $(x-5)(3-x)$
- (v) Find  $\frac{dy}{dx}$  if  $y^2 - xy - x^2 + 4 = 0$
- (vi) Differentiate w.r.t. 'θ'  $(\sin 2\theta - \cos 3\theta)^2$
- (vii) Find  $\frac{dy}{dx}$  if  $y = x^2 \ln \frac{1}{x}$
- (viii) Find  $y_4$  if  $y = (2x+5)^{3/2}$
- (ix) Apply Maclaurin series expansion to prove that  $\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$
- (x) Find extreme values for  $f(x) = x^2 - x - 2$
- (xi) Define feasible region.
- (xii) Graph the inequality  $x + 2y \leq 6$

## 3. Write short answers to any EIGHT (8) questions :

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- (i) Find  $\delta y$  and  $dy$  in the case  $y = x^2 + 2x$  when  $x$  changes from 2 to 1.8
- (ii) Evaluate  $\int \frac{1}{\sqrt{x}(\sqrt{x}+1)} dx$ ,  $x > 0$
- (iii) Evaluate  $\int a^{x^2} x dx$  ( $a > 0, a \neq 1$ )
- (iv) Evaluate  $\int \sqrt{4-5x^2} dx$
- (v) Evaluate  $\int_0^{\frac{\pi}{6}} x \cos x dx$
- (vi) Find area below the curve  $y = 3\sqrt{x}$  and above the x-axis between  $x=1$  and  $x=4$
- (vii) Solve the differential equation  $x^2(2y+1)\frac{dy}{dx} - 1 = 0$
- (viii) Find the position vector of the point of division of the line segments joining the following pair of points, in the given ratio, point C with position vector  $2\hat{i} - 3\hat{j}$  and point D with position vector  $3\hat{i} + 2\hat{j}$  in the ratio 4 : 3
- (ix) If  $\underline{u} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ ,  $\underline{v} = -\hat{i} + 3\hat{j} - \hat{k}$  and  $\underline{w} = \hat{i} + 6\hat{j} + z\hat{k}$  represent the sides of a triangle, find the value of  $z$ .

(Turn Over)

3. (x) Find the angle between the vectors  $\underline{u} = 2\hat{i} - \hat{j} + \hat{k}$  and  $\underline{v} = -\hat{i} + \hat{j}$ .
- (xi) If  $\underline{a} = 4\hat{i} + 3\hat{j} + \hat{k}$  and  $\underline{b} = 2\hat{i} - \hat{j} + 2\hat{k}$ , find a unit vector perpendicular to both  $\underline{a}$  and  $\underline{b}$ .  
Also find the sine of angle between the vectors  $\underline{a}$  and  $\underline{b}$ .
- (xii) Find the area of the triangle with vertices A (1, -1, 1), B (2, 1, -1) and C (-1, 1, 2)

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

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- (i) Show that the points A (0, 2), B ( $\sqrt{3}$ , -1) and C (0, -2) are vertices of a right triangle.
- (ii) Find k so that the line joining A (7, 3), B (k, -6) and line joining C (-4, 5), D (-6, 4) are parallel.
- (iii) Find an equation of line if its slope is 2 and y-intercept is 5.
- (iv) Transform the equation  $5x - 12y + 39 = 0$  into two-intercept form.
- (v) Find the distance from the points P (6, -1) to the line  $6x - 4y + 9 = 0$
- (vi) Find the point of intersection of lines  $3x + y + 12 = 0$  and  $x + 2y - 1 = 0$
- (vii) Find the angle between the lines represented by  $x^2 - xy - 6y^2 = 0$
- (viii) Find an equation of circle with centre at ( $\sqrt{2}$ ,  $-3\sqrt{3}$ ) and radius  $2\sqrt{2}$
- (ix) Find centre and radius of circle  $x^2 + y^2 + 12x - 10y = 0$
- (x) Find vertex and directrix of parabola  $x^2 = 16y$
- (xi) Find the focus and vertex of parabola  $x^2 = 4(y - 1)$
- (xii) Find centre and foci of  $4x^2 + 9y^2 = 36$
- (xiii) Find eccentricity and vertices of  $\frac{y^2}{16} - \frac{x^2}{9} = 1$

SECTION - II

Note : Attempt any THREE questions.

5. (a) Evaluate  $\lim_{\theta \rightarrow 0} \frac{1 - \cos p\theta}{1 - \cos q\theta}$  5
- (b) If  $\frac{y}{x} = \tan^{-1} \frac{x}{y}$  then prove that  $\frac{dy}{dx} = \frac{y}{x}$  5
6. (a) Evaluate  $\int \frac{x}{x^4 + 2x^2 + 5} dx$  5
- (b) Find equations of two parallel lines perpendicular to  $2x - y + 3 = 0$  such that the product of the x-intercept and y-intercept of each is 3. 5
7. (a) Evaluate  $\int_0^{\frac{\pi}{4}} (1 + \cos^2 \theta) \tan^2 \theta d\theta$  5
- (b) Minimize  $z = 2x + y$  subject to the constraints  
 $x + y \geq 3$ ,  $7x + 5y \leq 35$ ,  $x \geq 0$ ,  $y \geq 0$  5
8. (a) If  $y = (\cos^{-1} x)^2$ , prove that  $(1 - x^2)y_2 - xy_1 - 2 = 0$  5
- (b) Find equations of the tangents to the circle  $x^2 + y^2 = 2$  and parallel to the line  $x - 2y + 1 = 0$  5
9. (a) Find volume of the tetrahedron with the vertices (0, 1, 2), (3, 2, 1), (1, 2, 1) and (5, 5, 6) 5
- (b) Find the centre, foci, eccentricity and directrices of ellipse  $\frac{(2x-1)^2}{4} + \frac{(y+2)^2}{16} = 1$  5