

## SECTION – I

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

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- (i) Find the domain and range of the function  $g$  defined by :  $g(x) = \sqrt{x^2 - 4}$
- (ii) The real valued functions  $f$  and  $g$  are given. Find  $f \circ g(x)$ , if  
 $f(x) = 3x^4 - 2x^2$  and  $g(x) = \frac{2}{\sqrt{x}}$ ,  $x \neq 0$
- (iii) Evaluate  $\lim_{\theta \rightarrow 0} \frac{1 - \cos \theta}{\theta}$
- (iv) Evaluate  $\lim_{x \rightarrow 1} \frac{x^3 - 3x^2 + 2x - 1}{x^3 - x}$
- (v) Find  $\frac{dy}{dx}$  if  $x^2 - 4xy - 5y = 0$
- (vi) Differentiate w.r.t. 'x'  $\cot^{-1}\left(\frac{x}{a}\right)$
- (vii) Find  $f'(x)$  if  $f(x) = \sqrt{\ln(e^{2x} + e^{-2x})}$
- (viii) Find  $y_2$  if  $x^3 - y^3 = a^3$
- (ix) Prove that  $\frac{d}{dx} (\operatorname{cosec}^{-1} x) = \frac{-1}{|x|\sqrt{x^2 - 1}}$
- (x) Differentiate  $\frac{2x-1}{\sqrt{x^2+1}}$
- (xi) Find the interval in which function is increasing or decreasing :  
 $f(x) = \cos x$   $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
- (xii) Find  $y_4$  if  $y = \sin 3x$

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

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- (i) Use differentials to approximate the value of  $\sqrt[4]{17}$
- (ii) Solve  $\int \frac{dx}{\sqrt{x+1} - \sqrt{x}}$
- (iii) Evaluate  $\int \frac{\cot \sqrt{x}}{\sqrt{x}} dx$
- (iv) Solve  $\int \frac{\sec^2 x}{\sqrt{\tan x}} dx$
- (v) Solve  $\int e^{2x} [-\sin x + 2 \cos x] dx$
- (vi) Evaluate  $\int_0^{\frac{\pi}{4}} \sec x (\sec x + \tan x) dx$
- (vii) Solve the differential equation  $\frac{1}{x} \frac{dy}{dx} = \frac{1}{2}(1 + y^2)$
- (viii) Evaluate  $\int x \ln x dx$
- (ix) The points  $A(-5, -2)$ ,  $B(5, -4)$  are ends of a diameter of a circle. Find centre and radius of it.

(Turn Over)

3. (x) Transform the equation  $5x - 12y + 39 = 0$  into normal form.  
 (xi) Find  $k$  so that the lines joining  $A(7, 3)$ ,  $B(k, -6)$  and  $C(-4, 5)$ ,  $D(-6, 4)$  are parallel.  
 (xii) Find the lines represented by  $2x^2 + 3xy - 5y^2 = 0$

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

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- (i) Graph the inequality  $5x - 4y \leq 20$   
 (ii) Find the equation of the circle with ends of diameter at  $(-3, 2)$  and  $(5, -6)$   
 (iii) Find the centre of the circle  $4x^2 + 4y^2 - 8x + 12y - 25 = 0$   
 (iv) Find the length of the tangent from the point  $(-5, 10)$  to the circle  $5x^2 + 5y^2 + 14x - 12y - 10 = 0$   
 (v) Find the coordinates of the points of intersection of the line  $x + 2y = 6$  with the circle  $x^2 + y^2 - 2x - 2y - 39 = 0$   
 (vi) Find the vertex of the parabola  $x^2 = 4(y - 1)$   
 (vii) Find the foci of the hyperbola  $\frac{y^2}{16} - \frac{x^2}{9} = 1$   
 (viii) Find a unit vector in the direction of  $\underline{v} = -\frac{\sqrt{3}}{2}\underline{i} - \frac{1}{2}\underline{j}$   
 (ix) Find a vector whose magnitude is 4 and is parallel to  $2\underline{i} - 3\underline{j} + 6\underline{k}$   
 (x) If  $\underline{v}$  is a vector for which  $\underline{v} \cdot \underline{i} = 0$ ,  $\underline{v} \cdot \underline{j} = 0$  and  $\underline{v} \cdot \underline{k} = 0$ , find  $\underline{v}$   
 (xi) If  $\underline{a} + \underline{b} + \underline{c} = 0$ , then prove that  $\underline{a} \times \underline{b} = \underline{b} \times \underline{c} = \underline{c} \times \underline{a}$   
 (xii) Find the volume of parallelepiped for which the vectors  $\underline{u} = \underline{i} - 4\underline{j} - \underline{k}$ ,  $\underline{v} = \underline{i} - \underline{j} - 2\underline{k}$  and  $\underline{w} = 2\underline{i} - 3\underline{j} + \underline{k}$  are three edges.  
 (xiii) Give a force  $\underline{F} = 2\underline{i} + \underline{j} - 3\underline{k}$  acting at a point  $A(1, -2, 1)$ . Find the moment of  $\underline{F}$  about the point  $B(2, 0, -2)$

SECTION - II

Note : Attempt any THREE questions.

5. (a) Discuss the continuity of  $f(x)$  at  $x = c$   $f(x) = \begin{cases} 3x - 1 & \text{if } x < 1 \\ 4 & \text{if } x = 1 \\ 2x & \text{if } x > 1 \end{cases}$ ,  $c = 1$  5  
 (b) Show that  $\frac{dy}{dx} = \frac{y}{x}$  if  $\frac{y}{x} = \tan^{-1} \frac{x}{y}$  5  
 6. (a) Evaluate  $\int x \sin^{-1} x \, dx$  5  
 (b) Find the interior angles of the triangle with vertices  $A(6, 1)$ ,  $B(2, 7)$ ,  $C(-6, -7)$  5  
 7. (a) Evaluate  $\int_0^{\frac{\pi}{4}} \frac{1}{1 + \sin x} \, dx$  5  
 (b) Minimize  $z = 2x + y$  subject to constraints  $x + y \geq 3$ ,  $7x + 5y \leq 35$ ;  $x \geq 0$ ,  $y \geq 0$  5  
 8. (a) Prove that in any triangle ABC  $b^2 = c^2 + a^2 - 2ca \cos B$ . 5  
 (b) Find the length of the chord cut off from the line  $2x + 3y = 13$  by the circle  $x^2 + y^2 = 26$  5  
 9. (a) If  $y = (\cos^{-1} x)^2$  then prove that  $(1 - x^2)y_2 - xy_1 - 2 = 0$  5  
 (b) Find the points of intersection of the given conic  $\frac{x^2}{18} + \frac{y^2}{8} = 1$  and  $\frac{x^2}{3} - \frac{y^2}{3} = 1$  5