

## SECTION – I

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

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- (i) Find domain and range of  $f(x) = \sqrt{x+1}$
- (ii) Find  $f \circ f(x)$  if  $f(x) = \sqrt{x+1}$
- (iii) Obtain  $f^{-1}(x)$  from  $f(x) = 3x^3 + 7$
- (iv) Evaluate  $\lim_{\theta \rightarrow 0} \frac{1 - \cos \theta}{\theta}$
- (v) Express  $\lim_{x \rightarrow +\infty} \left( \frac{x}{1+x} \right)^x$  in terms of “e”
- (vi) If  $y = \frac{x^2+1}{x^2-3}$ , then find  $\frac{dy}{dx}$
- (vii) Prove that derivative of  $\tan^{-1} x$  w.r.t. “x” is  $\frac{1}{1+x^2}$
- (viii) Differentiate  $\frac{1}{a} \sin^{-1} \left( \frac{a}{x} \right)$  w.r.t. “x”
- (ix) Find  $\frac{dy}{dx}$  if  $y = x^2 \ln \sqrt{x}$
- (x) If  $y = e^{-x} (x^3 + 2x^2 + 1)$ , then find  $\frac{dy}{dx}$
- (xi) Apply the Maclaurin’s series expansion to prove that  $e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$
- (xii) Determine the interval in which  $f(x) = \sin x, x \in (-\pi, \pi)$  is decreasing.

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

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- (i) If  $x^2 + 2y^2 = 16$ , find  $\frac{dy}{dx}$  by using differentials.
- (ii) Evaluate  $\int \frac{x}{x+2} dx$
- (iii) Evaluate indefinite integral  $\int \frac{\sec^2 x}{\sqrt{\tan x}} dx$
- (iv) Evaluate  $\int \ln x dx$
- (v) Evaluate the definite integral  $\int_{-1}^1 (x^{1/3} + 1) dx$
- (vi) Find the area between the x-axis and the curve  $y = x^2 + 1$  from  $x = 1$  to  $x = 2$
- (vii) Evaluate  $\int e^{-x} (\cos x - \sin x) dx$
- (viii) Solve  $x dy + y(x-1) dx = 0$
- (ix) Show that the points A (3, 1), B (-2, -3) and C (2, 2) are vertices of an isosceles triangle

3. (x) Find an equation of line having x-intercept : -9 and slope : -4  
 (xi) Show that the lines  $4x - 3y - 8 = 0$ ,  $3x - 4y - 6 = 0$  and  $x - y - 2 = 0$  are concurrent.  
 (xii) What is homogeneous equation?

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

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- (i) Graph the solution set of  $2x + 1 \geq 0$   
 (ii) Define problem constraint.  
 (iii) Find an equation of circle with centre  $(\sqrt{2}, -3\sqrt{3})$  and radius  $2\sqrt{2}$   
 (iv) Find slope of tangent to  $x^2 + y^2 = 5$  at  $(4, 3)$   
 (v) Check the position of the point  $(5, 6)$  with respect to the circle  $x^2 + y^2 = 81$   
 (vi) Find focus and vertex of  $y^2 = 8x$   
 (vii) Find equation of ellipse with foci  $(\pm 3, 0)$  and minor axis of length 10.  
 (viii) Find equation of hyperbola with centre  $(0, 0)$ , focus  $(6, 0)$ , vertex  $(4, 0)$   
 (ix) Find a vector from the point A to the origin where  $\vec{AB} = 4\hat{i} - 2\hat{j}$  and B  $(-2, 5)$   
 (x) Find  $\alpha$  so that  $|\alpha\hat{i} + (\alpha+1)\hat{j} + 2\hat{k}| = 3$   
 (xi) Find the cosine of the angle  $\theta$  between  $\underline{u}$  and  $\underline{v}$ ;  $\underline{u} = \hat{i} - 3\hat{j} + 4\hat{k}$ ;  $\underline{v} = 4\hat{i} - \hat{j} + 3\hat{k}$   
 (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) A force  $\vec{F} = 7\hat{i} + 4\hat{j} - 3\hat{k}$  is applied at P  $(1, -2, 3)$ . Find its moment about the point Q  $(2, 1, 1)$

SECTION - II

Note : Attempt any THREE questions.

5. (a) Discuss the continuity of  $f(x)$  at  $x = 1$   $f(x) = \begin{cases} 3x - 1 & \text{if } x < 1 \\ 4 & \text{if } x = 1 \\ 4x & \text{if } x > 1 \end{cases}$  5  
 (b) Show that  $2^{x+h} = 2^x \left\{ 1 + (\ln 2)h + \frac{(\ln 2)^2 h^2}{2!} + \frac{(\ln 2)^3 h^3}{3!} + \dots \right\}$  5  
 6. (a) Evaluate  $\int \sqrt{4 - 5x^2} dx$  5  
 (b) Find the equation of perpendicular bisector of segment joining the points A  $(3, 5)$  and B  $(9, 8)$  5  
 7. (a) Evaluate the integral  $\int_0^{\pi/4} \frac{\cos \theta + \sin \theta}{2 \cos^2 \theta} d\theta$  5  
 (b) Maximize  $f(x, y) = x + 3y$  subject to the constraints  $2x + 5y \leq 30$ ;  $5x + 4y \leq 20$ ,  $x \geq 0$ ,  $y \geq 0$  5  
 8. (a) Find the interior angles whose vertices are A  $(-2, 11)$ , B  $(-6, -3)$ , C  $(4, -9)$  5  
 (b) Find an equation of the circle passing through the points A  $(4, 5)$ , B  $(-4, -3)$ , C  $(8, -3)$  5  
 9. (a) Prove angle in a semi circle is right angle. 5  
 (b) Find an equation of the tangent to the parabola  $y^2 = -6x$  which is parallel to the line  $2x + y + 1 = 0$ . Also find point of tangency. 5