

SECTION – I

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

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- (i) Express the area A of a circle as a function of its circumference C .
- (ii) For the real-valued function $f(x) = \frac{2x+1}{2x-1}$, $x > 1$. Find $f^{-1}(x)$
- (iii) Evaluate $\lim_{x \rightarrow 3} \frac{x-3}{\sqrt{x}-\sqrt{3}}$
- (iv) Find the domain and range of $g(x) = |x-3|$
- (v) If $y = \left(\sqrt{x} - \frac{1}{\sqrt{x}} \right)^2$, find $\frac{dy}{dx}$
- (vi) Find $\frac{dy}{dx}$ if $xy + y^2 = 2$
- (vii) Differentiate $\sin x$ w.r.t. $\cot x$
- (viii) Find $\frac{dy}{dx}$ if $y = x^2 \ln \frac{1}{x}$
- (ix) Find y_2 if $y = x^2 \cdot e^{-x}$
- (x) If $y = \ln(\tanh x)$, find $\frac{dy}{dx}$
- (xi) Find $\frac{dy}{dx}$ if $y = (x^2 + 5)(x^3 + 7)$
- (xii) Find $f'(x)$ if $f(x) = \sqrt{\ln(e^{2x} + e^{-2x})}$

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

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- (i) Use differential to find $\frac{dy}{dx}$ for $xy + x = 4$
- (ii) Evaluate the integral $\int \frac{3x+2}{\sqrt{x}} dx$
- (iii) Evaluate $\int \frac{x+b}{(x^2+2bx+c)^{1/2}} dx$
- (iv) Evaluate $\int e^x (\cos x + \sin x) dx$
- (v) Evaluate $\int \frac{(a-b)x}{(x-a)(x-b)} dx$
- (vi) Evaluate $\int_{-1}^1 (x^{1/3} + 1) dx$
- (vii) Find the area above the x-axis and under the curve $y = 5 - x^2$ from $x = -1$ to $x = 2$
- (viii) Solve differential equation $ydx + xdy = 0$
- (ix) Find mid-point of line segment joining $A(-8, 3)$; $B(2, -1)$
- (x) Two points 'P' and 'O' given in xy-coordinate system. Find XY-coordinates of 'P' referred to translated axis $O'X$ and $O'Y$ for $P(-2, 6)$; $O'(-3, 2)$
- (xi) Find equation of the line joining $(-5, -3)$ and $(9, -1)$
- (xii) Find equation of vertical line through $(-5, 3)$

(Turn Over)

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

- (i) Graph the solution set of given linear inequality in xy-plane : $2x + y \leq 6$
- (ii) Find the centre and radius of the circle with the given equation
 $5x^2 + 5y^2 + 14x + 12y - 10 = 0$
- (iii) Find the focus and vertex of the parabola $x^2 = -16y$
- (iv) Write an equation of parabola with given elements : Focus $(-3, 1)$;
 directrix $x - 2y - 3 = 0$
- (v) Find an equation of directrices of given hyperbola $\frac{x^2}{4} - \frac{y^2}{9} = 1$
- (vi) Find the centre and eccentricity of given hyperbola $\frac{y^2}{16} - \frac{x^2}{9} = 1$
- (vii) Find the unit vector in the same direction as the vector $\underline{v} = [3, -4]$
- (viii) Find the constant a so that the vectors $\underline{v} = \underline{i} - 3\underline{j} + 4\underline{k}$ and $\underline{w} = a\underline{i} + 9\underline{j} - 12\underline{k}$ are parallel.
- (ix) Find a vector of length 2 in the direction opposite that of $\underline{v} = -\underline{i} + \underline{j} + \underline{k}$
- (x) Find the cosine of the angle θ between \underline{u} and \underline{v} $\underline{u} = [2, -3, 1]$ and $\underline{v} = [2, 4, 1]$
- (xi) Compute $\underline{b} \times \underline{a}$. Check your answer by showing that \underline{b} is perpendicular to $\underline{b} \times \underline{a}$:
 $\underline{a} = 2\underline{i} + \underline{j} - \underline{k}$; $\underline{b} = \underline{i} - \underline{j} + \underline{k}$.
- (xii) If $\underline{a} + \underline{b} + \underline{c} = 0$, then prove that $\underline{a} \times \underline{b} = \underline{b} \times \underline{c} = \underline{c} \times \underline{a}$
- (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) Find value of k , if the function $f(x) = \begin{cases} \frac{\sqrt{2x+5} - \sqrt{x+7}}{x-2} & , x \neq 2 \\ k & , x = 2 \end{cases}$ is continuous at $x = 2$ 5
- (b) If $y = \tan(p \tan^{-1} x)$ then show that $(1+x^2)y_1 - p(1+y^2) = 0$ 5
6. (a) Evaluate $\int \frac{\sqrt{2}}{\sin x + \cos x} dx$ 5
- (b) Find an equation of the line through the intersection of the lines $x - y - 4 = 0$ and $7x + y + 20 = 0$ and parallel to the line $6x + y - 14 = 0$ 5
7. (a) Find the area bounded by the curve $y = x^3 - 4x$ and the x-axis. 5
- (b) Maximize $f(x, y) = 2x + 5y$ subject to the constraints $2y - x \leq 8$, $x - y \leq 4$, $x \geq 0$, $y \geq 0$ 5
8. (a) Write equation of the circle passing through the points A $(-7, 7)$, B $(5, -1)$ and C $(10, 0)$ 5
- (b) Find a vector of length 5 in the direction opposite that of $\underline{v} = \underline{i} - 2\underline{j} + 3\underline{k}$ 5
9. (a) Show that $y = \frac{\ln x}{x}$ has maximum value at $x = e$ 5
- (b) Find focus, vertex and directrix of parabola $x^2 - 4x - 8y + 4 = 0$ 5