

SECTION-I

Write short answers of any eight parts from the following:

(8x2=16)

- i. Express perimeter P of a square as a function of its area A.
- ii. If $f(x) = (-x + 9)^3$, find $f^{-1}(x)$
- iii. Find $\lim_{x \rightarrow 0} \frac{1 - \cos 2x}{x^2}$
- iv. Differentiate w.r.t "x" $(\sqrt{x} - \frac{1}{\sqrt{x}})^2$
- v. If $y = \sqrt{x + \sqrt{x}}$ find $\frac{dy}{dx}$
- vi. Find $\frac{dy}{dx}$ if $x = y \sin y$
- vii. Find $f'(x)$ if $f(x) = x^3 \cdot e^{1/x}$
- viii. If $y = x^2 \cdot \ln\left(\frac{1}{x}\right)$, find $\frac{dy}{dx}$
- ix. If $y = \sin h^{-1}\left(\frac{x}{2}\right)$, Find $\frac{dy}{dx}$
- x. Apply the Maclaurin series to prove that: $\sqrt{1+x} = 1 + \frac{x}{2} - \frac{x^2}{8} + \dots$
- xi. Graph the solution set of linear inequality in xy-plane, $2x + y \leq 6$
- xii. What is a feasible solution?

3. Write short answers of any eight parts from the following:

(8x2=16)

- i. Using differentials find $\frac{dy}{dx}$ and $\frac{dx}{dy}$ for $x^2 + 2y^2 = 16$
- ii. Evaluate: $\int \frac{(1-\sqrt{x})^2}{\sqrt{x}} dx$
- iii. Evaluate: $\int \frac{x+2}{\sqrt{x+3}} dx$
- iv. Evaluate: $\int \tan^{-1} x dx$
- v. Evaluate: $\int \frac{5x+8}{(x+3)(2x-1)} dx$
- vi. Evaluate: $\int_{-2}^0 \frac{1}{(2x-1)^2} dx$
- vii. Solve the differential equation $\frac{dy}{dx} = \frac{y^2+1}{e^{-x}}$
- viii. Find sum of \overline{AB} and \overline{CD} where $A(1, -1)$, $B(2, 0)$, $C(-1, 3)$ and $D(-2, 2)$
- ix. Find direction Cosines of vector $\underline{V} = 3\underline{i} - \underline{j} + 2\underline{k}$
- x. Find α so that $\underline{U} = 2\alpha \underline{i} + \underline{j} - \underline{k}$ and $\underline{V} = \underline{i} + \alpha \underline{j} + 4\underline{k}$ are perpendicular.
- xi. Compute $\underline{a} \times \underline{b}$ and $\underline{b} \times \underline{a}$ for $\underline{a} = \underline{i} + \underline{j}$, $\underline{b} = \underline{i} - \underline{j}$
- xii. Find volume of parallelepiped determined by $\underline{U} = \underline{i} + 2\underline{j} - \underline{k}$, $\underline{V} = \underline{i} - 2\underline{j} + 3\underline{k}$ and $\underline{W} = \underline{i} - 7\underline{j} - 4\underline{k}$

4. Write short answers of any nine parts from the following:

(9x2=18)

- i. The point $C(-5, 3)$ is the center of the circle and $P(7, 2)$ lies on the circle. What is the radius of the circle.
- ii. Show that the points $A(0, 2)$, $B(\sqrt{3}, -1)$ and $C(0, -2)$ are vertices of a right triangle.
- iii. The points $P(-2, 6)$ and $Q(-3, 2)$ are given in xy-coordinate system. Find the XY-coordinate of P referred to the translated axes OX' and OY'.
- iv. Find an equation of the line through $(-5, -3)$ and $(9, -1)$.
- v. Convert $4x + 7y - 2 = 0$ in slope-intercept form.
- vi. Find the lines represented by $3x^2 + 7xy + 2y^2 = 0$
- vii. Find the point of intersection of the lines $3x + y + 12 = 0$ and $x + 2y - 1 = 0$
- viii. Find center and radius of circle $5x^2 + 5y^2 + 14x + 12y - 10 = 0$
- ix. Find focus and vertex of parabola $y^2 = -12x$
- x. Find foci of an ellipse $9x^2 + y^2 = 18$
- xi. Find eccentricity of hyperbola, $\frac{y^2}{4} - x^2 = 1$
- xii. Write parametric equations of hyperbola.
- xiii. Write down equation of tangent to the circle $x^2 + y^2 = 25$ at $(4, 3)$.

SECTION-II

Note Attempt any three questions. Each question carries equal marks:

(10x3=30)

5. (a) Evaluate: $\lim_{x \rightarrow 0} \frac{\sec x - \cos x}{x}$ (b) Find $\frac{dy}{dx}$ if $x\sqrt{1+y} + y\sqrt{1+x} = 0$.
6. (a) Evaluate: $\int \frac{x}{x^4 + 2x^2 + 5} dx$ (b) Find equation of the line through $(5, -8)$ and perpendicular to the join of $A(-15, -8)$ and $B(10, 7)$.
7. (a) Solve the differential equation $(y - x \frac{dy}{dx}) = 2(y^2 + \frac{dy}{dx})$ (b) Graph the feasible region of the following system of linear inequalities and find the corner points.
 $2x + y \leq 10, x + 4y \leq 12, x + 2y \leq 10, x \geq 0, y \geq 0$
8. (a) Show that $y = \frac{\ln x}{x}$ has maximum value at $x = e$. (b) Write an equation of the circle that passes through the given points $A(4, 5)$, $B(-4, -3)$, $C(8, -3)$
9. (a) Find the focus, vertex and directrix of the parabola $x^2 - 4x - 8y + 4 = 0$