

"Section-B"

Marks: 50

Q.2. Attempt any ten (10) of the following parts. All parts carry equal marks.

- (i) Find the composite function of $f(g(x))$ and $g(f(x))$. If $f(x) = \sin x$, $g(x) = 1 - x^2$
- (ii) Evaluate: $\lim_{x \rightarrow 1} \frac{\sqrt{x} - 1}{x - 1}$
- (iii) Determine the derivative of a function $f(x) = x^2 - 6x + 5$ by first principle rule at a point $P(4, -3)$
- (iv) Find $\frac{dy}{dx}$ when $y = x^3 \cdot \ln \sqrt{x}$
- (v) Find all the relative extrema of $f(x) = x^3 - 3x^2 + 1$
- (vi) $\vec{F}(t) = 2t\hat{i} - 5\hat{j} + t^2\hat{k}$, $\vec{G}(t) = (1-t)\hat{i} + \frac{1}{t}\hat{k}$, find $2\vec{F}(t) - 3\vec{G}(t)$
- (vii) Evaluate: $\int \frac{5}{1+x^2} dx$
- (viii) Evaluate: $\int_1^2 (2x^{-2} - 3) dx$
- (ix) Find the equation of the straight line that passes through the pair of points $E(1, 0)$ and $F(2, 5)$.
- (x) For what value of 'n' the line $2x + 2y + n = 0$ touches the circle $x^2 + y^2 = 81$
- (xi) Find the equation of parabola whose vertex is at origin, x-axis is the line of symmetry and passes through the point $(3, 6)$
- (xii) Solve $\frac{dy}{dx} = \frac{1}{x^2}$, using initial condition, $y(2) = 0$
- (xiii) Find the partial derivatives f_x and f_y if $f(x, y) = \sin^{-1} xy$

"Section-C"

Marks: 30

Note: - Attempt any three (3) questions. All questions carry equal marks.

- Q.3. (a) Find the equation of hyperbola whose foci are at $(5, 0)$ and $(-5, 0)$, eccentricity is $5/3$.
- (b) If $y = \frac{1}{x} \cdot \tan^{-1} \left(\frac{x+1}{x-1} \right)$, find $\frac{dy}{dx}$
- Q.4. (a) Find the area of a triangular region whose vertices are $P_1(4, -5)$, $P_2(5, -6)$ and $P_3(3, 1)$.
- (b) Find the Maclaurin series expansion for $f(x) = \sin^2 x$
- Q.5. (a) Find the equation of ellipse a focus is at $(-2, 3)$, a vertex is at $(6, 3)$ and length of minor axis is 6.
- (b) Evaluate integration by parts: $\int x \cos x dx$
- Q.6. (a) Draw graph of function $y = 2|4x + 3| + 1$
- (b) Use trapezoidal rule to approximate the value of $\int_0^2 \sqrt{1+x^2} dx$, $n = 6$