

Name of Course	: Generic Elective
Unique Paper Code	: 32355101_OC
Name of Paper	: GE-1 Calculus
Semester	: I
Duration	: 3 hours
Maximum Marks	: 75 Marks

Attempt any four questions. All questions carry equal marks.

- For the function $f(x) = x^3 - 3x^2$,
 - Find the interval in which the function is increasing or decreasing.
 - Find the points of relative maxima, relative minima or none.
 - Find the interval where the graph is concave up and where it is concave down.
 - Determine points of inflexion, if any.
 - Sketch the graph.
 - Find all the vertical and horizontal asymptotes of the function $g(x) = \frac{3x^3 + 4x - 9}{x^3 - 27}$.
- By using L' Hospital's Rule, find the following limits
 - $\lim_{x \rightarrow 1} (\cos x)^{\left(\frac{1}{x^2}\right)}$
 - $\lim_{x \rightarrow +\infty} \left(1 + \frac{2}{x^2}\right)^{3x^2}$.
 - If the limit of $\left(\frac{a \sin 3x - \sin x}{x^3}\right)$ as $x \rightarrow 0$ is finite, find the value of a and the limit.
- Find the volume by washers of the solid that results when the region enclosed by the curve $y = \sqrt{100 - x^2}$ and the line $2y = x + 10$ is revolved about the x-axis.
 - Find the arc length of the curve $x = 7t^3$ and $y = 4t^2$; $1 \leq t \leq 5$.
- Find $T(t)$, $N(t)$ and $B(t)$ at the given point $r(t) = 6\cos t \mathbf{i} + 6\sin t \mathbf{j} + (t/4) \mathbf{k}$; $t = \pi/2$.
 - Find the curvature and the radius of curvature at the stated point. $x = 5 \sin t$, $y = 5 \cos t$, $z = 7t$; $t = \pi/4$.
- Find the absolute maxima and minima of function $f(x, y) = x^3 + 4x - 4xy + y^2$ over the rectangle $R : -2 \leq x \leq 2, 0 \leq y \leq 2$.
 - Sketch the curve $r = 2 - \sin\theta$.
- Find the equation of hyperbola with foci $(0, \pm 6)$ and asymptotes $y = \pm \frac{2}{3}x$.
 - Check whether $\lim_{(x,y) \rightarrow (0,0)} \frac{x^2 y^3}{(x^4 + 2y^2)^{1/2}}$ exists or not.
 - Find the equation of tangent plane of the function $f(x, y) = x^2 + 2x + e^{-x} \sin y + y$ at the point $(0, \frac{\pi}{2}, 1 + \frac{\pi}{2})$.