

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

Attempt any four questions. All questions carry equal marks.

- Let $f(x)$ be a function defined by $f(x) = x^5 + 5x^4$. Determine the intervals in which this function is increasing or decreasing. Further, determine the points of local maxima and local minima. Find the open intervals in which $f(x)$ is concave up and concave down. Also, determine the point of inflexion, if any.
- Find the following limits
 (i) $\lim_{x \rightarrow 0} (\operatorname{cosec} x - \cot x)$, (ii) $\lim_{x \rightarrow 0} \left(\frac{1}{e^x - 1} - \frac{1}{x} \right)$, (iii) $\lim_{x \rightarrow 1} (1 - x) \tan \frac{\pi x}{2}$.
- Use cylindrical shells to find the volume of the solid generated when the region bounded by curves $y = 4x - x^2$, $y = 3$ is revolved about line $x = 1$.
- Find the area of surface generated by the revolving the curves
 (i) $x = \sqrt{16 - y^2}$, $0 \leq y \leq 2$ about y -axis, (ii) $y = \sqrt{x - 1}$, $2 \leq x \leq 3$ about x -axis.
- Identify and sketch the conic $4y^2 + x^2 + 8y - 10x + 13 = 0$. Mark the coordinates of foci.
 Find the equation of the ellipse whose foci are $(2, 2)$ and $(2, 4)$ and major axis of length 2.
- If $r(t)$ is the position of a particle in plane at time t , find the time in the given interval when the velocity and acceleration are orthogonal, where

$$r(t) = (t - \sin t)i + (1 - \cos t)j, 0 \leq t \leq 2\pi.$$