

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

*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
  - $\lim_{x \rightarrow 0} (\operatorname{cosec} x - \cot x)$ ,
  - $\lim_{x \rightarrow 0} \left( \frac{1}{e^x - 1} - \frac{1}{x} \right)$ ,
  - $\lim_{x \rightarrow 1} (1 - x) \tan \frac{\pi x}{2}$ .
- Use cylindrical shells to find the volume of the solid generated when the region bounded by curves  $y = 4x - x^2$ ,  $y = 3x$  revolved about line  $x = 1$ .
- Find the area of surface generated by the revolving the curves
  - $x = \sqrt{16 - y^2}$ ,  $0 \leq y \leq 2$  about  $y$ -axis,
  - $y = \sqrt{x - 1}$ ,  $2 \leq x \leq 3$  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
 
$$r(t) = (t - \sin t)i + (1 - \cos t)j, 0 \leq t \leq 2\pi.$$