

Name of Course	: CBCS (LOCF) Generic Elective- Mathematics
Unique Paper Code	: 32355101
Name of Paper	: GE-1 Calculus
Semester	: I
Duration	: 3 hours
Maximum Marks	: 75 Marks

Attempt any four questions. All questions carry equal marks.

- Consider the function $f(x) = 2x - 3x^{2/3}$.
 - Find the intervals on which $f(x)$ is increasing and the interval on which $f(x)$ is decreasing.
 - Find where the graph of $f(x)$ is concave up and where it is concave down.
 - Find points of maxima, minima and inflection.
 - Find asymptotes, vertical tangents and cusps if any.
 - Sketch the graph of $f(x)$
- Evaluate the following limits:
 - $\lim_{x \rightarrow 0^+} x^m (\ln x)^n$; m, n are positive integers
 - $\lim_{x \rightarrow \pi/4} (2 - \tan x)^{1/\ln(\tan x)}$
- Sketch the graph of $r + \theta = c$, $\theta \in (-\infty, \infty)$ in polar coordinates.
- Find the volume of the solid obtained by revolving the region bounded by the curves $y = 4x$ and $y = x^2 + 3x/2$ for $x \geq 0, y \geq 0$ about x -axis using washer's method.
 - Find the volume of the solid obtained by revolving the region bounded by the curves $xy = 2, xy = 1, x = 1, x = 4$ about y -axis using cylindrical shell method.
- Discuss the continuity of the function $f = \begin{cases} \frac{\cos(x^4+y^4)}{x^4+y^4}, & (x, y) \neq (0, 0) \\ 1 & (x, y) = (0, 0) \end{cases}$
 Also find $f_x(x, y)$ and $f_y(x, y)$ for all $(x, y) \in R^2$.
- The Temperature (in degree Celsius) at a point (x, y) on a metal plate in xy -plane is
$$T = \frac{x^2 y^2}{1 + x^4}$$

A man at $(1, 2)$ wants to walk in the direction in which the temperature drops most rapidly. Find a unit vector in the direction.
 - Find the directions in which the function $f(x, y, z) = \ln xy + \ln yz + \ln xz$ increase and decrease most rapidly at the point $P_0(1, 1, 1)$. Then find the derivatives of the function in those directions.