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.

1. Find the critical points, inflection points and asymptotes (if any) for the function $f(x) = \frac{x^2+3}{x^2-4}$. Determine the region where the function increase or decrease and also discuss its concavity. Also, sketch the curve.

2. Evaluate the following limits using L'Hopital's rule

$$\lim_{x\to b} \frac{x^b - b^x}{x^x - b^b} \text{ and } \lim_{x\to\infty}[x - \ln(x^5 - 10^{10})].$$

3. Find the volume of the solid obtained by revolving the region bounded by the curves $y = 2x^2 + 1$ and $y = 3 - 2x^2$ about x-axis. Also find the length of the plane curve $y = 2x^2 + 1$ over the interval [1, 3]

4. Sketch the graph of $r^2 = \theta^2, 0 \le \theta$ in polar coordinates.

5. Let $f(x,y) = \begin{cases} \frac{xy^n}{x^3+y^{3n}}, & (x,y) \neq (0,0) \\ 0, & (x,y) = (0,0) \end{cases}$ where $n > 1$.

Discuss the continuity of $f(x,y)$. And show that $f_x(x,y)$ and $f_y(x,y)$ exist at all points (x,y).

6. Find the equation of parabola which has axis parallel to y-axis and which passes through the points $(0,2), (-1,0)$ and $(1,6)$. And plot this parabola.

An ellipse circumscribes a rectangle whose sides are given by $x = \pm 2$ and $y = \pm 4$. If the distance between the foci is $4\sqrt{6}$ and major axis is along y-axis, then find the equation of the ellipse. Also, plot this ellipse.

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Duration	: **3 hours**
Maximum Marks	: **75 Marks**

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5. If $w = \ln(x^2 + y^2 + z^2)$, $x = ue^v \sin u$, $y = ue^v \cos u$ and $z = ue^v$, find $\frac{\partial w}{\partial u}$ and $\frac{\partial w}{\partial v}$ using chain rule at the point $(u, v) = (-2, 0)$.

6. 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.