Name of Course : **CBCS(LOCF) Generic Elective**

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. What do you understand by horizontal and vertical asymptotes? Explain with graphs.
   Given that $\lim_{n\to\infty} f(x) = 3$ and $\lim_{n\to\infty} g(x) = -5$. Find the limit $\lim_{n\to\infty} \frac{6\,f(x)}{5f(x)+3g(x)}$, if exists.
   Evaluate $\lim_{n\to-\infty} \frac{7x^4-2x^2+1}{3x^2+5}$.
   Sketch the curve $r = \frac{1}{2} + cos\theta$ in polar coordinates.

2. Find the absolute maximum and absolute minimum values of $f(x,y) = 2x^2 - 4x + y^2 - 4y + 1$ on the closed triangular plate in the first quadrant bounded by the lines $x = 0, y = 2, y = 2x$.
   Find the area of the surface generated by revolving the curve $3x = y^2$, $0 \le y \le 1$, about the y-axis.
   Find the total derivative of the function $t^{3sint} + (sint)^{t^3}$ with respect to t.

3. Show that the function $f: \mathcal{R}^2 \to \mathcal{R}$ defined by

$$f(x,y) = \begin{cases} \frac{xy^2}{x^2+y^4}, & if\ x^2 + y^4 \neq 0 \\ 0 & , if\ x = 0 = y \end{cases}$$

   possess first order partial derivatives everywhere including the origin but the function is discontinuous at the origin.
   Find the volume of the solid that results when the region enclosed by $x = y^2$ and $\frac{x}{2} = y$ is revolved about the line $y = -2$.

4. Sketch and label the centre, vertices, foci and asymptotes of the curve

$$9\,x^2 - 4y^2 - 18x + 45 = 0$$

   Find the equation of parabola whose vertex is (1,2) and focus (-3,2). Also find its directrix.
   Find the equation of ellipse having length of major axis 26 and foci $(0, \pm 12)$.

5. Find the equation of the tangent plane and normal line to the surface $z = e^y sin3x + 2$ at the point $P_0\, (\frac{\pi}{6}, 0,3)$. Find the parametric equations for the tangent line to the curve of intersection of the given surface and $x^2 + y^2 + z^2 = 9$ at P_0.
   Let $\vec{R}$ (t)= $ln(t)\,\hat{\imath} + \frac{t^3}{2}\,\hat{\jmath} - t\,\hat{k}$ be the position vector of a particle in space at time t. Find its velocity, speed, acceleration and direction of motion at time t.

6. Find curvature and radius of curvature for the graph of vector equation
   $\vec{r}\,(t) = e^t\, cos\ t\ \hat{\imath} + e^t\, sin\ t\ \hat{\jmath} + 2\ \hat{k}$ at t=0.

   Determine for what values of t the vector valued function $f(t) = \langle ln(t+1), |t+2|, [t] \rangle$ is continuous?

   Find the arc length parametrization of the curve:
   $\vec{r}\,(t) = cos\ 3t\ \hat{\imath} + sin\ 3t\ \hat{\jmath} + 4t\ \hat{k}$, $\quad 0 \le t \le 2\,\pi$.