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 all vertical and horizontal asymptotes of the graph of the function $f(x) = \frac{4x+5}{8-x}$.

   Also, find the interval in which $f(x)$ is,

   (i)   increasing and decreasing
   (ii)   concave up and concave down.

   Determine points of inflection, if any and give a rough sketch of the graph.

2. Find the indeterminate form and evaluate the following limits using L'Hôpital's rule
   (i) $\lim_{x \to 0} \left(\frac{1}{\sin 3x} - \frac{1}{3x} \right)$
   (ii) $\lim_{x \to +\infty} \left(\frac{\log x}{x^7} \right)$
   (iii) $\lim_{x \to +\infty} (x)^{1/2x}$.

3. Find the volume of the solid generated when the region enclosed between $y = \sqrt{x}$, $x = 1$, $x = 4$ and the x- axis is revolved about the y- axis using washer method and cylindrical shell method.

4. Describe the graph of the following
   (i) $x^2 + 8y - 6x - 23 = 0$
   (ii) $y^2 - x^2 - 6y - 4x + 4 = 0$.

   Also label the vertices, foci, directrix or asymptotes in each case.

5. Determine the largest region on which the following functions are continuous. Justify your answer.

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

   (ii) $g(x,y) = \frac{\sin x + \cos y}{2 + \sin x}$, $(x,y) \in \mathbb{R}^2$.

6. Locate all relative maxima, relative minima and saddle points, if any of the following functions.
   (i) $f(x,y) = 3x^2 + 12x + 8y^3 - 12y^2 + 38$
   (ii) $g(x,y) = \frac{1}{x} + \frac{1}{y} + xy + 13$.