VIT
Vellore Institute of Technology

School of Advanced Sciences
Department of Mathematics
Fall Semester 2023-24
Continuous Assessment Test – I

Course Name & Code: Calculus & IMAT101L | Programme : B. Tech.
Class Number: VL2023240106443/6032/6030/6464/6028 | Slot: G2+TG2
Faculty Name: Dr. T Yogalakshmi | Maximum Marks: 50

Answer all the questions: (General Instruction(s): Calculator is permitted)

Q.No.	Questions	Max Marks	CO	BL
1.	a) Verify Rolle's theorem for the function $f(x) = \sqrt{2x} - \left(\frac{2x}{3}\right)$ on $[0,8]$. (5 Marks) b) Identify the intervals where the function $h(x) = 3x^4 - 16x^3 + 18x^2$ is increasing and decreasing. Also, find at which points the local extremum occurs. (5 Marks)	10	1	1 2
2.	Find the point of inflection and discuss the concavity of the curve $f(x) = x^4 - 4x^3 + 10$.	10	1	2
3.	a) Find the area of the region enclosed by the curves $y = 3x^2 - 10$ and $y = 5 - 4x$. (5 Marks) b) Find the volume of the solid generated by revolving the region between the y-axis and the curve $x = \frac{2}{y}$, $1 \le y \le 4$, about y-axis. (5 Marks)	10	1	3 3
4.	a) Verify the continuity of the function $f(x) = \begin{cases} \frac{xy}{\lvert xy \rvert}, & (x,y) \neq (0,0) \\ 0, & (x,y) = (0,0) \end{cases}$ about the origin. (5 Marks) b) Find the derivative $\frac{dy}{dx}$ of the implicit equation $xy^2 = e^x - e^y$ (5 Marks)	10	2	2 1
5.	a) If $u = x^3 + y^3 - 4xy$; $x = 5t^3$; $y = 3t$, find the total derivative $\frac{du}{dt}$. (5 Marks) b) If $f(x,y,z) = e^{3x+4y}\cos 5z$, then prove that $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} + \frac{\partial^2 f}{\partial z^2} = 0$. (5 Marks)	10	2	2 2