

**SCHOOL OF ADVANCED SCIENCES**

**Department of Mathematics**

**Fall Semester 2023-2024**

**Continuous Assessment Test – I**

Programme Name & Branch – B.Tech. (All Branches)

Slot: E2 + TE2

Course Name & code: Calculus & BMAT101L

Exam Duration: 90 Min.

Maximum Marks: 50

General instruction(s): Answer all the Questions

Q. No.	Question	Marks
1.	(i) If Rolle's theorem holds for $f(x) = x^3 + bx^2 + cx, -2 \leq x \leq 2$ at the point $x = 1$ . Find the values of b and c. (ii) Find the local extreme values of the given function $f(x) = x^2 e^{-x}.$	10
2.	Find the intervals in which the following curve is concave upward or concave downward. Also find the points of inflection. $f(x) = 3x^4 + 4x^3 - 6x^2 + 12x + 12$	10
3.	The region bounded by the curve $y = x^2 + 1$ and the line $y = -x + 3$ is revolved about the x – axis to generate a solid. Find the volume of the solid.	10
4.	Show that the following function is not continuous at $(0, 0)$ but its partial derivatives $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ exist at $(0,0)$ . $f(x, y) = \begin{cases} \frac{xy}{x^2 + 2y^2}, & (x, y) \neq (0, 0) \\ 0, & (x, y) = (0, 0) \end{cases}$	10
5.	Given the transformations $u = e^x \cos y$ and $v = e^x \sin y$ is a function of u and v, prove that $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} = (u^2 + v^2) \left( \frac{\partial^2 f}{\partial u^2} + \frac{\partial^2 f}{\partial v^2} \right).$	10

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