



VIT

Vellore Institute of Technology

DEPARTMENT OF MATHEMATICS  
SCHOOL OF ADVANCED SCIENCES

FALL SEMESTER 2022-2023

CONTINUOUS ASSESSMENT TEST - I

Programme Name : B.Tech  
Course Code : BMAT101L  
Course Name : Calculus  
Slot : B1+TB1  
Date of the Examination : 07.11.2022  
Duration : 90 minutes  
Max. Marks:50

Answer all the questions

S.No	Questions	Marks
1	a) Identify the region where the function $f(x) = 2x^3 - 3x^2 - 12x + 1$ is increasing or decreasing and determine its extreme values on $x \in [-2, 3]$ . b) Verify Rolle's theorem and find an appropriate constant $c$ of the function $f(x) = \sin(x)e^{-x}, x \in [0, \pi]$ . $(-\infty, -1) \cup (2, +\infty)$ $(-1, +1)$	6M 4M
2	Determine by integration the area bounded by three lines $y = 4 - x$ , $y = 3x$ and $3y = x$ . $4$	10M
3	Determine the volume of the solid generated by rotating the region bounded by $y = \sqrt[3]{x}$ and $y = \frac{x}{4}$ that lies in the first quadrant about the $y$ -axis. $5 \frac{1}{2} \pi$	10M
4	a) Examine the continuity of $f(x, y) = \begin{cases} \frac{x^2}{x^2+y^2} & (x, y) \neq (0, 0), \\ 0 & (x, y) = (0, 0) \end{cases}$ at $(0, 0)$ . <i>not continuous</i> b) Let $u = \frac{x}{z} + \frac{y}{z}$ , where $x = \cos^2 t, y = \sin^2 t, z = \frac{1}{t}$ . Find $\frac{du}{dt} = 1$	6M 4M
5	a) Find the value of $\mu$ in terms of $a$ and $b$ such that $f(x, t) = \sin(ax)e^{-bt}$ satisfies the heat equation $f_t = \mu f_{xx}$ . $\mu = \frac{b}{a^2}$ b) Let $u = \sqrt{x^2 + y^2}$ and $v = \sin(x^2 + y^2)$ . Find $J(\frac{u,v}{x,y})$ and determine its relation. $= 0$ $v = \sin(u^2)$	6M 4M