



Continuous Assessment Test (CAT) – I- August 2024

Programme	: B.Tech.	Semester	: FALL 2024-2025
Course Code & Course Title	: BMAT101L Calculus	Slot	: B1+TB1
Faculty	: Dr. Om Namha Shivay Dr. Mini Ghosh Dr. Ankit Kumar Dr. Somnath Bera Ms. Yuvarani C Dr. Sandip Dalui Dr. Kriti Arya Dr. Durga Nagarajan Ms. Sivagami Sundari Kannan Dr. Mohit Kumar	Class Number	: CH2024250103448 CH2024250103456 CH2024250103556 CH2024250103457 CH2024250103455 CH2024250103460 CH2024250103459 CH2024250103462 CH2024250103461 CH2024250103463
Duration	: 90 Minutes	Max. Mark	: 50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Use statistical tables supplied from the exam cell as necessary
- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

Answer all questions (5×10=50)

Q. No	Sub Sec.	Description	Marks
1.		Find the critical points of $f(x) = (x^2 + 3x + 3)e^x$. Identify the intervals on which f is increasing, decreasing, concave up and concave down. Find the function's local and absolute extreme values.	(2+3+3+2)
2.	(a)	Determine all the number(s) c which satisfy the conclusion of Mean Value Theorem for $f(x) = 8x + e^{-3x}$ on $x \in [-2, 3]$.	(5)
	(b)	Find the volume of the solid generated by rotating $y = x^2 + 2$, $y = x + 4$ about x -axis.	(5)
3.		Find the area of the region bounded by the curves $y = \frac{1}{x+2}$, $y = (x+2)^2$, $x = -\frac{3}{2}$ and $x = 1$.	(10)
4.	(a)	If $\frac{x^2}{a^2+u} + \frac{y^2}{b^2+u} + \frac{z^2}{c^2+u} = 1$ then show that $\left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial y}\right)^2 + \left(\frac{\partial u}{\partial z}\right)^2 = 2\left(x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}\right)$	(7)
	(b)	Verify the following functions are functionally dependent, if so, find the relation between them	(3)

$$u = \frac{x+y}{1-xy}, \quad v = \tan^{-1} x + \tan^{-1} y.$$

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(a)

$$\text{If } f(x, y) = \begin{cases} \frac{x^3 + x^4 y - y^5}{x^3 + y^5}, & (x, y) \neq (0, 0) \\ 0, & (x, y) = (0, 0) \end{cases}$$

(5)

Check the continuity of $f(x, y)$ at the point $(0, 0)$.

(b)

If $u = f(x^2 + 2yz, y^2 + 2xz)$ then find the value of

(5)

$$(y^2 - xz) \frac{\partial u}{\partial x} + (x^2 - yz) \frac{\partial u}{\partial y} + (z^2 - xy) \frac{\partial u}{\partial z}$$

***** All the best *****