

Fall Semester 2022-2023
Continuous Assessment Test - I
Model Paper 1

Course Code: BMAT101L

Course Title: Calculus

Max. Time: 50 minutes

Max. Marks: 50**Slot:**

Answer all the questions

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| 1. Easy | 10 marks | CO1 | BT1 |
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Find the stationary points and the absolute maxima and absolute minima of $f(x) = x^4 - 16x^2$ in $[1, 2]$. Also, use Lagrange's mean-value theorem to find the constant $c \in (1, 2)$ such that $f'(c) = -15$.

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| 2. Medium | 10 marks | CO1 | BT1 |
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- (a) Using an appropriate substitution, find the area of the region enclosed by the curves $y = \sin x$ and $y = \cos x$ between the ordinates $x = 0$ and $x = \pi/2$.
- (b) If the region enclosed by the curve $y = x\sqrt{2-x}$ between the ordinates $x = 0$ and $x = 2$ is revolved about the x -axis, compute the volume of the solid so generated.

- 3. Easy** 10 marks CO2 BT2

- (a) Examine the continuity of

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

- (b) If $f(x, y, z) = xy^2 - yz^3 + 2zx^2$, where $x = \sin t$, $y = \cos t$, $z = t/2$. Find the total derivative of f with respect to t .

- 4. Tough** 10 marks **CO2** **BT2**

Consider $p = x - 2y + 3z$, $q = 2x + y - z$, $r = x - \frac{y}{3} + \frac{2z}{3}$. Compute the Jacobian $J\left(\frac{p,q,r}{x,y,z}\right)$ at any point (x, y, z) . Also examine the possibility of functional dependence of p , q and r . If so, find the relation among them.

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| 5. Medium | 10 marks | CO2 | BT1 |
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Find cubic approximation for $f(x, y) = xe^y$ at the origin, using Taylor's formula.