



PRESIDENCY UNIVERSITY

BENGALURU

Roll No.														
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Mid - Term Examinations – October 2025

Date: 07-10-2025

Time: 02.00pm to 03.30pm

School: SOE & SOCSE	Program: B. Tech	
Course Code: MAT2301	Course Name: Calculus and Differential Equations	
Semester: I	Max Marks: 50	Weightage: 25%

CO - Levels	C01	C02	C03	C04	C05
Marks	38	12	--	--	-

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks.

5Q x 2M=10M

1	What are the conditions for Rolle's theorem to hold?	2 Marks	L2	C01
2	Is $u = x^2y + xy^2$ homogeneous? If yes, what is its degree?	2 Marks	L2	C01
3	If $u = f(x, y)$, where $x = x(t)$ and $y = y(t)$, write $\frac{du}{dt}$.	2 Marks	L2	C01
4	If $u = x^2 - y^2$, $v = 2xy$ then find $\frac{\partial(u, v)}{\partial(x, y)}$	2 Marks	L2	C01
5	Evaluate $\int_0^{\pi} \sin^9\left(\frac{x}{2}\right) dx$.	2 Marks	L2	C02

Part B

Answer the Questions.

Total Marks 40M

6.	a.	Verify Rolle's theorem for the function $f(x) = \frac{\sin x}{x}$ in $[0, \pi]$.	10 Marks	L3	CO1
Or					
7.	a.	Evaluate $\lim_{x \rightarrow 0} \frac{e^x + e^{-x} - 2 \cos x}{x \sin x}$.	10 Marks	L3	CO1

8.	a.	If $z = \tan^{-1}\left(\frac{x^2 + y^2}{x + y}\right)$, prove that $x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} = \sin 2z$.	10 Marks	L3	CO1
Or					
9.	a.	If $u = x^2 - y^2$, $v = 2xy$ and $x = r \cos \theta$, $y = r \sin \theta$ then find $\frac{\partial(u, v)}{\partial(x, y)}$.	10 Marks	L3	CO1

10.	a.	If $z = xy^2 + x^2y$, where $x = at^2$ and $y = 2at$, find $\frac{dz}{dt}$, Verify the result by direct substitution.	10 Marks	L3	CO1
Or					
11.	a.	Find the extreme values of the function $f(x, y) = x^3 + y^3 - 3x - 12y + 20$.	10 Marks	L3	CO1

12.	a.	Evaluate $\int_0^{\frac{\pi}{4}} \sin x \cos x \, dx$.	5 Marks	L3	CO2
	b.	Evaluate $\int_0^a x^2 (a^2 - x^2)^{\frac{3}{2}} \, dx$.	5 Marks	L3	CO2
Or					
13.	a.	Evaluate $\int_0^{\frac{\pi}{6}} \cos^4(3x) \sin^3(6x) \, dx$.	5 Marks	L3	CO2
	b.	Evaluate $\int_0^{\infty} \frac{x^5}{(1+x^2)^6} \, dx$.	5 Marks	L3	CO2