

SVKM'S NMIMS
MUKESH PATEL SCHOOL OF TECHNOLOGY MANAGEMENT &
ENGINEERING

Academic Year: 2024-2025

SET-C

Program: B. Tech. Integrated

Stream : All

Year: III

Semester: V

Subject: Calculus

Time: 45 Minutes.

Date: : 23/08/2024

Max. Marks: 10

Test-I

Instructions: Candidates should read carefully the instructions.

- 1) **Q1** is compulsory
- 2) Answer any two from Q2-Q4
- 3) Figures in brackets on the right hand side indicate full marks.
- 4) Assume Suitable data if necessary.

Q1.	Answer briefly. Each question carries 02 marks.	[04]	
a.	Evaluate $\lim_{x \rightarrow a} \log \left[2 - \frac{x}{a} \right] [\cot(x - a)]$		CO- 2; SO1; BL-2
b.	Verify Rolle's Theorem for $f(x) = \sin x$ in $[0, 2\pi]$.		CO-1; SO1, BL-2
Q2.	If $u = \sin r$, $r^2 = x^2 + y^2$, prove that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = -\sin r + \frac{1}{r} \cos r$	[03]	CO- 1; SO1, BL-3
Q3.	Considering the functions $\frac{1}{x^2}$ and $\frac{1}{x}$, Find 'c' of Cauchy's mean value theorem in the interval $[a, b]$ where $a, b > 0$.	[03]	CO- 1; SO1; BL- 3
Q4.	(a) Test the convergence of the sequence $a_n = 1 + \frac{(-1)^n}{n}$ (b) Expand $f(x) = \cos x$ about $x = \frac{\pi}{2}$ (upto three terms in the series)	[01+02]	CO-2; SO1; BL- 2

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Q1.	Answer briefly. Each question carries 02 marks.	[04]	
a.	Evaluate $\lim_{x \rightarrow 0} (\cot x)^{\sin x}$		CO- 2; SO1; BL-2
b.	Verify Rolle's Theorem for $f(x) = x^3 - 4x$ in $[-2, 2]$.		CO-1; SO1, BL-2
Q2.	If $z = x^2 \tan^{-1}\left(\frac{y}{x}\right) - y^2 \tan^{-1}\left(\frac{x}{y}\right)$, Find $\frac{\partial^2 z}{\partial x \partial y}$	[03]	CO- 1; SO1, BL-3
Q3.	Verify and find c in Cauchy's MVT for $f(x) = e^x$ and $g(x) = e^{-x}$ in $[a, b]$, $a, b > 0$	[03]	CO- 1; SO1; BL- 3
Q4.	<p>(c) Test the convergence of the sequence $a_n = \left(\frac{n}{n-1}\right)^2$</p> <p>(d) Expand $f(x) = \sin x$ about $x = \frac{\pi}{2}$ (upto three terms in the series)</p>	[01+02]	CO-2; SO1; BL- 2