

MID-SEMESTER EXAMINATION, FEBRUARY-2023
CALCULUS-A (MTH - 1101)

Semester: 1st Semester

Full marks: 30

Branch: ALL

Time: 2 Hours

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Use limit laws to evaluate the limit of a function and demonstrate the existence of limit and continuity of functions .	L1,L1,L3	1.a,b,c	2,2,2
Compute slope of tangent lines and derivatives by different techniques of functions and solve various physical and Engineering problems .	L1,L3,L3	2.a,b,c	2,2,2
	L1,L1,L3	3.a,b,c	2,2,2
Discuss the Mean Value Theorems and study maximum and minimum values of a function as well as apply L' Hospital's rule to evaluate limits of functions and sketch curves of functions	L3,L3,L3	4.a,b,c	2,2,2
Compute indefinite integrals using techniques of integration and apply it to physical and Engineering problems	L1,L1	5.a,b	2,2
Apply the concept of integration to find volume, work done, surface area and average value of an integral and study numerical integration using different methods.	L1	5.c	2

*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1. (a)	Determine the infinite limit $\lim_{x \rightarrow 3^+} \frac{2x}{x-3}$	2
(b)	Evaluate: $\lim_{x \rightarrow -1} \frac{x^2 - 4x}{x^2 - 3x - 4}$	2
(c)	Use the ε , δ definition of limit to prove: $\lim_{x \rightarrow 2} (\frac{x}{2} + 3) = 2$.	2
2. (a)	Use the definition continuity to show that the function $f(x) = (x + 2x^3)^4$ is continuous at $a = -1$.	2
(b)	Find the horizontal and vertical asymptotes of the function $y = \frac{2x+1}{x-2}$	2
(c)	Find equation of tangent line and normal line to the curve $y = \sec x$ at $(\frac{\pi}{3}, 2)$	2
3. (a)	Find $\frac{d^{35}}{dx^{35}}(x \sin x)$.	2
(b)	At what point in the 1 st quadrant is the tangent line to the folium $x^3 + y^3 = 6xy$ horizontal?	2
(c)	Find the domain and differentiate the function $f(x) = \sqrt{2 + \ln x}$.	2
4 (a)	When a cold drink is taken from a refrigerator, its temperature is 5°C . After 25 mins, in a 20°C room its temperature has increased to 10°C . What is the temperature of the drink after 50 mins? When will its temperature be 15°C ?	2

(b)	Find the local maximum and minimum values of $f(x) = \sin x + \cos x$; $0 \leq x \leq 2\pi$	2
(c)	Compute $\lim_{x \rightarrow 1} \frac{\ln x}{x-1}$ using L'Hospital's rule.	2
5.(a)	If $f(x) = \int_0^{\sin x} \sqrt{1+t^2} dt$ and $g(y) = \int_3^y f(x) dx$, find $g''(\frac{\pi}{6})$.	2
(b)	Find the area of the region bounded by curves $y = 5x - x^2$ and $y = x$.	2
(c)	Find the approximate value of $\sqrt[100]{100}$ by Newton Raphson method correct up to 2 decimal places using $x_0 = 1.2$.	2

****End of the question****