

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2026

(CBCSS - UG)

CC19UMTS2B02 / CC20UMTS2B02 - CALCULUS OF SINGLE VARIABLE - I

(Mathematics - Core Course)

(2019 to 2023 Admissions - Supplementary)

Time : 2.5 Hours

Maximum : 80 Marks

Credit : 4

Part A (Short answer questions)Answer *all* questions. Each question carries 2 marks.

- Determine whether the function $h=f \circ g$ is even, odd, neither even nor odd if
(a) both f and g are even (b) g is even and f is odd
- Find $\lim_{x \rightarrow 2} \frac{\sqrt{x+2}-2}{x-2}$.
- Let the functions f and g are continuous at a . Prove that the function fg is continuous at a .
- Find the derivative of the function $f(x) = \frac{-2}{\sqrt{x}}$. What is its domain?
- Find the differential of the function $f(x) = 2x^2 - 3x + 1$ at the point $x = 1$.
- Using Rolle's theorem verify the function $f(x) = \cos 2x - 1$; $[0, \pi]$ and find c .
- Define limit of a function at infinity.
- How many horizontal asymptote can the graph of a function have?
- Define antiderivative of a function.
- Define regular partition.
- Find the derivative of the function $F(x) = \int_{-1}^x \frac{1}{1+t^2} dt$.
- Evaluate $\int_{-1}^1 (x^2 + 2) dx$.
- Find the volume of the solid obtained by revolving the region between y -axis and the curve $x = \frac{2}{y}, 1 \leq y \leq 4$ about the y -axis.
- Write the formula for finding the surface area of the surface obtained by revolving the graph of f about the x -axis.
- Find the work done by the force $F(x) = 2x - 1$ pounds in moving an object along the x -axis from $x = -2m$ to $x = 4$ (x is measured in feet).

(Ceiling: 25 Marks)

Part B (Paragraph questions)

Answer **all** questions. Each question carries 5 marks.

16. Find the slope and an equation of the tangent to the graph of $f(x) = x^3 + x$ at the point $(2, 0)$.
17. The position of a particle moving along a straight line is given by $s = f(t) = 2t^3 - 15t^2 + 24t, t \geq 0$ where t is measured in seconds and s in feet
- (a) Find an acceleration function of the particle. What is the acceleration of the particle when $t = 2$?
- (b) When is the acceleration is zero? Positive? Negative?
- (c) Find the jerk of the particle?
18. (a) Explain the Extreme value theorem
- (b) Describe a procedure for finding the extrema of a continuous function f on a closed interval $[a, b]$.
19. Prove that f is differentiable on an open interval (a, b)
- (a) if $f'(x) > 0$ for all x in (a, b) , then f is increasing on (a, b) .
- (b) if $f'(x) < 0$ for all x in (a, b) , then f is decreasing on (a, b) .
20. (a) Find the points of inflection of $f(x) = x^4 - 4x^3 + 12$.
- (b) Determine where the graph of the $f(x) = x^2 + 1/x^2$ is concave downward and concave upward.
21. The betty moore company requires that itsbeef stew containers have a capacity of 64 in.^3 have the shape of right circular cylinders and be made of aluminum. Determine the radius and height of the container that contains the least amount of metal.
22. By using the definition of Riemann sum, check whether $\int_1^2 (3 - 2x^2)dx$ integrable.
23. Find the length of the graph $f(x) = \frac{1}{3}x^3 + \frac{1}{4x}$ on the interval $[1, 3]$

(Ceiling: 35 Marks)

Part C (Essay questions)

Answer any **two** questions. Each question carries 10 marks.

24. (a) State Squeeze Theorem. (b) Prove that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$
25. Using precise definition of limit prove that if $f(x) = \begin{cases} 1 & \text{if } x \text{ is rational,} \\ 0 & \text{if } x \text{ is irrational.} \end{cases}$ then $\lim_{x \rightarrow 0} f(x)$ does not exist.
26. Sketch the graph of the function $f(x) = 2x^3 - 3x^2 - 12x + 12$.
27. Find the area in the first quadrant that is bounded above by the curve $y^2 = x$ and below by the x - axis and the line $y = x - 2$ by integrating (i) with respect to x (ii) with respect to y .

(2 × 10 = 20 Marks)
