

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2022

(CBCSS - UG)

(Regular/Supplementary/Improvement)

CC19U MTS2 B02 / CC20U MTS2 B02 - CALCULUS OF SINGLE VARIABLE - I

(Mathematics - Core Course)

(2019 Admission onwards)

Time : 2.5 Hours

Maximum : 80 Marks

Credit : 4

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

- Find the function of the transformed graph if
 - $f(x) = x^2 + x - 1$: shifted vertically upward by 3 units.
 - $f(x) = x^2 - 4$: shifted horizontally to left by 2 units.
- Find $\lim_{x \rightarrow 2} \frac{\sqrt{x+2} - 2}{x-2}$
- Evaluate $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\tan^2 x}{1 + \cos x}$
- What is a removable discontinuity? Give an example for it.
- Find the rate of change of $y = \sqrt{2x}$ with respect to x at $(x=2)$.
- Find the rate of change of $y = 2x^3 + 2$ with respect to x at $(x=2)$.
- Suppose that $y = 2x^3 - x + 1$. Use the differential (dy) to approximate (Δy) when (a) (x) changes from 3 to 3.01 (b) (x) changes from 3 to 2.98
- Find the linearization of $f(x) = x^3 + 2x^2$ at $(a=1)$
- Find the relative maxima and relative minima of $f(x) = x^3 - 3x^2 - 9x + 6$.
- Define the inflection point of the graph of a function.
- Discuss on infinite limit.
- The vertical asymptote of the graph of $f(x) = 1/(x - 1)$
- Find $\int (3x^5 - 2x^3 + 2 - 3x^{-1}) dx$
- Find the area of the region between the curves $(y=2x)$ and $(y=x^2)$ from (3) to (4)
- Find the work done in lifting a (25) -lb object (4) ft off the ground.

(Ceiling: 25 Marks)**Part B** (Paragraph questions)Answer **all** questions. Each question carries 5 marks.

- Let $f(x) = x + 2$ and $g(x) = 2x^2 + \sqrt{x}$.
 - $(g \circ f)(0)$
 - $(f \circ f)(2)$
 - $(f \circ g)(4)$
 - $(g \circ g)(1)$
- Let $s(t) = (t^2 - 1)^2$ be position of a body moving along a coordinate line. Find the position, velocity and acceleration of the body at $(t=1)$.
- (a) Find the absolute maximum and minimum values of $f(x) = x^2$ on $[-2, 1]$.
(b) Find the critical numbers of $f(x) = x - 3x^{1/3}$
- Use the definition of area, find the area of the region under the graph of $(f(x) = 3x - 1)$, on $([1, 3])$, by choosing (C_k) as the mid point.
- Compute the Riemann sum for $(f(x) = -2x + 1)$, on $([-1, 2])$ using the five subintervals $(n = 6)$ and choosing (C_k) as the left end point.
- A solid has a circular base of radius 2 and its parallel cross sections perpendicular to its base are rectangles of height 2. Find the volume of the solid.
- Find the area of the surface obtained by revolving the graph of $(x = y^3)$ on the interval $([0, 1])$ about the (y) -axis
- Find the center of mass of a system comprising three particles with masses 4, 3, and 5 grams, located at the points $(-3, -2)$, $(-1, 2)$ and $(2, 4)$ respectively. (Assume that all distances are measured in centimeters)

(Ceiling: 35 Marks)

Part C (Essay questions)

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

24. State and prove the Mean Value Theorem.
25. Sketch the graph of the function $f(x) = 2x^3 - 9x^2 + 12x - 3$.
26. State and prove both Part 1 and Part 2 of Fundamental Theorem of Calculus.
27. Find the length of the astroid $(x^{2/3} + y^{2/3} = 1)$

(2 × 10 = 20 Marks)
