

**Course Title:** Single Variable Calculus

**Course Code:** MATH-101

**Course Type:** Major Math

**Prerequisites:** N/A

**Credit Hours:** 3 (3 + 0)

**Course Objectives:** After completion of this course, the students will be able to:

- Master the concepts of limits, continuity, and differentiation of functions.
- Apply derivatives to solve problems involving rates of change, extremum, and curve sketching.
- Evaluate indefinite and definite integrals, utilizing techniques such as substitution and integration by parts.
- Use calculus to solve geometric problems involving area, volume, and arc length.

**Course Contents:**

**Preliminaries:** Real numbers and the real line, Inequalities, Function, Families of functions (Bijective, Floor, Ceiling, Characteristic, Extension and restriction) , Inverse functions, Graph of functions.

**Limits and Continuity:** Limit of a function, Left hand and right hand limits, Continuity.

**Differentiable functions:** Differentiation of a polynomial, Rational and transcendental functions, Higher derivatives, Leibniz's theorem, Taylor's and Maclaurin's theorems with their remainders.

**Applications of Derivatives:** Rate of change, The chain rule, Extremum problems, L'Hôpital's rule, Mean value theorem, Asymptotes, Curve sketching.

**Indefinite Integration:** Techniques of evaluating indefinite integrals, Integration by substitutions, Integration by parts.

**Definite Integrals:** Riemann sum, Definite integral, Fundamental theorem of calculus.

**Applications to Geometry:** Area, Volume, Arc length, Improper integrals.

**Recommended Books:**

1. Anton, H., Bevens, I. and Davis S., *Calculus*, John Wiley & Sons, Inc., 12th edition, 2022.
  2. Edward, C.H., *Calculus and Analytic Geometry*, Prentice Hall College Div., 3rd edition, 1990.
  3. Hallett, D. H. and Gleason A. M., *Calculus: Single and Multivariable*, Wiley, 8th edition, 2020.
  4. Mendelson, E. and Ayres, F., *Calculus, Schaums outlines series*, McGraw-Hill, 4th edition, 1999.
  5. Thomas, G. B. and Finney, R. L., *Calculus*, Addison Wesley Publishing Company, 11th Edition, 2005.
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