Detailed Course Contents

MATH-111 Calculus-I

Credit Hours: 3-0

Prerequisite: None

Course Objectives: Calculus serves as the foundation of advanced subjects in all areas of mathematics. The objective of this course is to introduce students to the fundamental concepts of limit, continuity, differential and integral calculus of functions of one variable. This FIRST course of Calculus covers in depth the differential calculus portion of a three-course calculus sequence.

Core Contents: Functions in numerical, graphical, and analytical forms, continuity, limits, derivatives and integrals, derivatives and integrals, Riemann Sum.

Detailed Course Contents: Functions and Their Graphs, Combining Functions; Shifting and Scaling Graphs, Trigonometric Functions, Rates of Change and Tangent Lines to Curves, Limit of a Function and Limit Laws, The Precise Definition of a Limit, One Sided Limit, Continuity, Limits Involving Infinity; Asymptotes of Graphs, Tangent Lines and the Derivative at a Point, The Derivative as a Function, Differentiation Rules, The Derivative as a Rate of Change, Derivatives of Trigonometric Functions, The Chain Rule, Implicit Differentiation, Linearization and Differentials, Extreme Values of Functions on Closed Intervals, The Mean Value Theorem, Monotonic Functions and the First Derivative Test, Concavity and Curve Sketching, Antiderivatives, Area and Estimating with Finite Sums, Sigma Notation and Limits of Finite Sums, The Definite Integral, The Fundamental Theorem of Calculus, Indefinite Integrals and the Substitution Method, Definite Integral Substitutions and the Area Between Curves, Volumes Using Cross-Sections, Arc Length, Areas of Surfaces of Revolution, Inverse Functions and Their Derivatives, Natural Logarithms, Exponential Functions, Indeterminate Forms and L'Hopital's Rule, Inverse Trigonometric Functions, Hyperbolic Functions

Course Outcomes: After completing this course, students should have developed a clear understanding of the fundamental concepts of single variable calculus and a range of skills allowing them to work effectively with the concepts.

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Sketch the graph of a function using asymptotes, critical points, the derivative test for increasing/decreasing functions, and concavity.
- Apply differentiation to solve applied max/min problems.
- Apply differentiation to solve related rates problems.

Textbook: J. Hass, C. Heil and M. E. Weir, Thomas' Calculus, 14th Edition, Pearson, 2017

Reference Books:

- James Stewart, Single Variable Calculus: Early Transcendentals 6th edition, Pacific Grove, Ca: Brooks/Cole, Thompson Learning, 2008.
- H. Anton, I. Bevens, S. Davis, Calculus, 8th Edition, John Wiley & Sons, Inc. 2005.
- Hughes-Hallett, Gleason, McCallum, et al, Calculus Single and Multivariable, 3rd Edition, John Wiley & Sons, Inc. 2002.
- Frank A. Jr, Elliott Mendelson, Calculus, Schaum's outlines series, 4th Ed. 1999.
- C. H. Edward and E. D. Penney, Calculus and Analytics Geometry, Prentice Hall, 1988.
- E. W. Swokowski, Calculus and Analytic Geometry, PWS Publishers, Boston, Massachosetts, 1983.

Weekly Breakdown		
Week	***Section***	***Topics***
1	1.1, 1.2	Functions and Their Graphs, Combining Functions; Shifting and Scaling Graphs
2	1.3, 2.1, 2.2	Trigonometric Functions, Rates of Change and Tangent Lines to Curves, Limit of a Function and Limit Laws
3	2.3-2.5	The Precise Definition of a Limit, One Sided Limit, Continuity
4	2.6	Limits Involving Infinity; Asymptotes of Graphs
5	3.1, 3.2	Tangent Lines and the Derivative at a Point, The Derivative as a Function
6	3.3, 3.4, 3.5	Differentiation Rules, The Derivative as a Rate of Change, Derivatives ofTrigonometric Functions
7	3.6, 3.7, 3.9	The Chain Rule, Implicit Differentiation, Linearization and Differentials
8	4.1, 4.2,	Extreme Values of Functions on Closed Intervals, The Mean Value Theorem
9	**Mid Semester Exam**	
10	4.3, 4.4, 4.7	Monotonic Functions and the First Derivative Test, Concavity and CurveSketching, Antiderivatives
11	5.1, 5.2,	Area and Estimating with Finite Sums, Sigma Notation and Limits of FiniteSums,
12	5.3	The Definite Integrals
13	5.4, 5.5	The Fundamental Theorem of Calculus, Indefinite Integrals and the SubstitutionMethod
14	5.6, 6.1, 6.3	Definite Integral Substitutions and the Area Between Curves, Volumes Using Cross-Sections, Arc Length
15	6.4, 7.1, 7.2	Areas of Surfaces of Revolution, Inverse Functions and Their Derivatives, Natural Logarithms
16	7.3, 7.5	Exponential Functions, Indeterminate Forms and L'Hopital's Rule
17	7.6, 7.7	Inverse Trigonometric Functions, Hyperbolic Functions
18	**End Semester Exam**	