STATE UNIVERSITY OF NEW YORK !
COLLEGE OF TECHNOLOGY !
CANTON, NEW YORK !

MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
MATH 161 - CALCULUS I

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Canino School of Engineering Technology !

Department: MATHEMATICS DEPARTMENT !

Semester/Year: Fall/2018 !

A. **TITLE**: CALCULUS I

B. **COURSE NUMBER:** MATH 161

C. **CREDIT HOURS: (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)**

 # Credit Hours: 4
 # Lecture Hours: 4 **per week**
 # Lab Hours: 0 **per week**
Other: **per week**

Course Length: 15 **Weeks**

D. **WRITING INTENSIVE COURSE**: Yes ☐ No ☒

E. **GER CATEGORY: None:** ☐ **Yes:** GER !
***If course satisfies more than one*:** GER !

F. **SEMESTER(S) OFFERED: Fall** ☐ **Spring** ☐ **Fall & Spring** ☒

G. **COURSE DESCRIPTION:**

This course is the first of a three-semester sequence of Calculus courses developed for students in Engineering Science. Other qualified students may also take this sequence. Topics include: Quick review of functions and graphs; limit and continuity; the derivative and its properties; differentiation of algebraic and trigonometric functions; curve sketching; related rates; applied extrema problems; other applications of differentiation; numerical methods; antidifferentiation.

H. **PRE-REQUISITES: None** ☐ **Yes** ☒ **If yes, list below:**

Pre-requisite(s): Precalculus Algebra and Trigonometry (MATH 123) or College Trigonometry (MATH 131) with a grade of C or better, or 3 years of high school mathematics with a grade of 75 or above on the third New York State Regents mathematics examination, or permission of instructor.

CO-REQUISITES: None ☒ **Yes** ☐ **If yes, list below:**

I. STUDENT LEARNING OUTCOMES: (*see key below*)

By the end of this course, the student will be able to:

Course Student Learning Outcome [SLO]	***Program Student Learning Outcome [PSLO]***	***GER** [If Applicable]*	***ISLO & SUBSETS***	
Intuit the limit of a function from a sketch, compute the limit at a point and at infinity, and determine where it is continuous		GER 1	3-Found Skills ISLO ISLO	QTR Subsets Subsets Subsets
Compute derivatives of functions using sum, difference, product, quotient and chain rules, and use implicit differentiation for relations		GER 1	3-Found Skills ISLO ISLO	QTR Subsets Subsets Subsets
Use derivatives to investigate the properties of functions and sketch the graph		GER 1	3-Found Skills ISLO ISLO	QTR Subsets Subsets Subsets
Use derivatives to solve optimization problems		GER 1	3-Found Skills ISLO ISLO	QTR Subsets Subsets Subsets
Use implicit differentiation to solve related rates problems		GER 1	3-Found Skills ISLO ISLO	QTR Subsets Subsets Subsets
Compute anti-derivatives and use the Fundamental Theorem of Calculus to compute the area under a curve		GER 1	3-Found Skills ISLO ISLO	QTR Subsets Subsets Subsets
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KEY	**Institutional Student Learning Outcomes [ISLO 1 – 5]**
ISLO #	**ISLO & Subsets**
1	**Communication Skills** Oral [O], Written [W]
2	**Critical Thinking** *Critical Analysis [CA] , Inquiry & Analysis [IA] , Problem Solving [PS]*
3	**Foundational Skills** *Information Management [IM], Quantitative Lit,/Reasoning [QTR]*
4	**Social Responsibility** *Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]*
5	**Industry, Professional, Discipline Specific Knowledge and Skills**

*Include program objectives if applicable. Please consult with Program Coordinator !

J. APPLIED LEARNING COMPONENT: Yes ☐ No ☒

If YES, select one or more of the following categories:

- ☐ Classroom/Lab
- ☐ Internship
- ☐ Clinical Placement
- ☐ Practicum
- ☐ Service Learning
- ☐ Community Service
- ☐ Civic Engagement
- ☐ Creative Works/Senior Project
- ☐ Research
- ☐ Entrepreneurship (program, class, project)

K. TEXTS:

Calculus, the Classic Edition, 5th Edition; by Swokowski; Brooks/Cole Cengage Learning

L. REFERENCES:

Many materials in the Math Lab and online will aid the students with mastery of this subject

M. EQUIPMENT: None ☒ Needed:

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

- **Homework**
- **Quizzes**
- **Exams**
- **Projects**

P. DETAILED COURSE OUTLINE:

I. Functions and Limits

A. Slope of Lines
  1. Calculate slope of a line and between two points
B. Writing equations of lines
C. Definition of a Function.
  1. Review basic functions: algebraic, trigonometric. Review rules for combining functions.
D. Limits of Functions
  1. Intuitive understanding of limit as the behavior of a function.
  2. Finding one sided limits
  3. Determine when the limit of a function exists at a point.
  4. Estimate limits using tables and graphs
  5. Computing limits of functions from algebraic expressions.
  6. Determine limits at infinity.
  7. Determine horizontal and vertical asymptotes.

E. Continuity

1. **Intuitive understanding of the concept of continuity of a function at a point.**
2. **Determine if a function is continuous at a point**
3. **Determine intervals of continuity**
4. **Removable and non-removable discontinuity**

Differentiation

The Limit Definition of Derivative. Finding the derivative of a function at a point.
The Derivative Function. Finding a new function to give the derivative at any point.

C. Tangent Lines

1. **Use the derivative to develop the equation of the tangent line to a curve at a point.**

D. Derivative of a Function Using Basic Rules

1. **Find the derivative of algebraic functions and trigonometric functions.**
2. **Derivative of a constant**
3. **Power Rule**
4. **Derivative of sum/difference of Functions**
5. **Derivative of the composition of algebraic functions and the chain rule.**
6. **Derivatives of trigonometric functions.**
7. **The Chain Rule applied to trigonometric functions.**

E. Higher Derivatives

1. **Find the second and third (higher) derivative of a function.**
2. **Instantaneous Velocity as First Derivative**
3. **Acceleration as Second Derivative**

F. Implicit Differentiation

III. Applications of the Derivative

A. Related Rates

1. **Use implicit differentiation with time as the independent variable to solve real world problems.**

B. Graphing using derivatives.

1. **Use the first and second derivative to identify critical points, extrema of a functions of one variable, and inflection points.**
2. **Provide a sketch of a function which includes, relative extrema, intervals of increase and decrease, inflection points, concavity, vertical and horizontal asymptotes.**
3. **Apply Rolle's Theorem and Mean Value Theorem for a function of one variable.**

C. Max/Min Problems

1. **Apply the First Derivative Test and Second Derivative test (as needed) to analyze critical points.**
2. **Solve real world optimization problems.**

D. Newton's Method (Optional)

1. **Approximate a zero of a function using Newton's Method.**

E. The Differential (Optional)

1. **Compare the value of the differential dy , with the actual change in Δy.**

IV. Antidifferentiation

Antiderivatives.
Introduce the concept of the antiderivative. !
Find the antiderivative of algebraic functions and trigonometric functions.
Evaluation of indefinite integral.

B. Definite Integrals and the Fundamental Theorem of Calculus

1. Evaluation of definite integrals using the Fundamental Theorem of Calculus
2. Find the average value of function using the Mean Value Theorem for Integrals.
3. Find the area under a curve using the Fundamental Theorem of Calculus.

C. (Optional) Numerical Integration

1. Find the area under the curve using the Trapezoidal Rule and Simpson's Rule.

Q. <u>LABORATORY OUTLINE</u>: None ☒ Yes ☐