SUFFOLK COUNTY COMMUNITY COLLEGE
COLLEGE-WIDE COURSE SYLLABUS
MAT141 (formerly MA87)

I. COURSE TITLE:
Calculus with Analytic Geometry I

II. CATALOG DESCRIPTION:
Study of limits, continuity, theory and application of the derivative; related rate problems; maxima and minima; definite and indefinite integrals; and areas under curves. (5 contact hrs.) Prerequisite: C or better in MAT125 or MAT126. Note: *Credit given for MAT141 or MAT131, but not both.* A-E-G / 4 cr. hrs.

III. COURSE GOALS:
A. Introduce the basic concepts of one variable calculus.
B. Prepare students for advanced mathematics, physics and engineering courses.
C. This course satisfies the SUNY general education requirement for mathematics.

IV. COURSE OBJECTIVES:
Upon successful completion of this course, students will be able to:
A. Use the definition of limits to calculate the value of limits; use technology to calculate the value of limits.
B. Apply the relationship between infinite limits and asymptotes to the sketching of graphs of functions; use technology to simulate asymptotic behavior numerically.
C. Apply the concept of continuity to polynomial, rational, composite, trigonometric, exponential, and logarithm functions.
D. Show and apply the relationship among the tangent to a graph of a function, the difference quotient, the two forms of the definition of the derivative, continuity, and differentiability.
E. Compute the derivative of polynomial, rational, trigonometric, exponential, and logarithmic functions. Compute derivatives using the product rule, the quotient rule, and the chain rule.
F. Apply the concept of derivatives to related rates, optimization problems, curve sketching, higher order derivatives, implicit differentiation.
G. Calculate the Taylor polynomial (degree 1,2, & 3) approximation to a function.
H. Use summation formulae to evaluate Riemann sums. Use Riemann sums to approximate the definite integral.
I. Find antiderivatives of polynomial functions and those functions whose derivatives are known.
J. State and apply the results of the Mean Value Theorem, the Fundamental Theorem of the Calculus, and the average value of a function.
K. Use definite integrals to calculate the area between curves.

V. Topics Outline with Timeline

Topics	Approximate Time (Including Examinations)
A. Limits and Continuity 1. definition of limit of a function a. definition b. calculation of limit 2. limit theorems: a. calculation of limits b. proofs of some basic limit theorems (such as sum, product & quotient) 3. "one-sided" limits: a. definitions b. calculations 4. infinite limits: a. definitions b. calculations c. asymptotes, sketching 5. limits at infinity: a. definitions b. calculations c. asymptotes, sketching 6. continuity: a. definitions b. essential (non-removable) and removable discontinuities c. theorems on continuity (with applications) 7. continuity on an interval: a. arithmetic of continuous functions b. polynomial functions c. rational functions d. radical functions e. composite functions 8. continuity of trigonometric functions: a. the "squeeze" theorem b. limit and continuity theorems applied to sine and cosine justified using a numerical approach. i. $\lim_{t\to o}\frac{\sin t}{t}=1$ ii. sine and cosine functions are continuous at 0 iii. $\lim_{t\to 0}\frac{1-\cos t}{t}=0$ 9. continuity of log and exponential functions	2 ½ weeks

B. <u>The Derivative</u> 1. the tangent and normal lines to a curve: a. definitions b. calculations 2. the derivative: a. definition and relationship to tangent line b. alternative forms of the definitions of a derivative c. definitions of differentiability 3. relationship between differentiability and continuity: a. differentiability implies continuity b. "one-sided" derivatives 4. derivation of the rules for differentiation of algebraic functions 5. derivatives as rates of change 6. derivatives of all trigonometric functions 7. derivatives of exponential and log functions 8. derivatives of composite functions (the chain rule) 9. derivatives of power functions 10. implicit differentiation 11. higher order derivatives	4 ½ weeks
C. <u>Applications of the Derivative:</u> 1. differentiation applied to related rates 2. differentiation applied to finding maximum and/or minimum values of function: a. over the domain of real numbers b. on a closed interval c. absolute and relative extrema 3. Mean Value Theorem 4. increasing and decreasing functions a. definitions: increasing, decreasing, monotonic b. first derivative test for extrema c. second derivative test for extrema 5. concavity and inflection: a. definitions b. use of second derivatives c. points of inflection 6. curve sketching 7. Taylor Polynomial Approximations	4 week
D. <u>The Differential and Antiderivative:</u> 1. the differential a. definitions (dx, dy) b. approximation of values of functions 2. antidifferentiation a. definition of antiderivative b. "rules" of antidifferentiation c. "Chain Rule" for antidifferentiation	4 weeks

	3. applications: a. differential equations b. antidifferentiation applied to rectilinear motion E. <u>The Definite Integral:</u> 1. summation techniques 2. finding area under a curve by summation and limits 3. the definite integral a. definitions (Riemann sum, integrable, definite integral, limits of integration, area b. properties 4. Riemann Sum Approximations 5. the average value of a function 6. the Fundamental Theorem of the Calculus	
	F. <u>Applications of the Definite Integral</u> 1. area between curves a. horizontal increments of area b. vertical increments of area	

VI. Evaluation of Student Performance:
To be determined by the instructor

VII. Programs that require this course:
Computer Science/AS
Engineering and Technology: Electrical Engineering Technology/AAS (recommended before transferring)
Engineering Science/AS
Liberal Arts and Sciences: Adolescence Education/Biology Emphasis/AA
Liberal Arts and Sciences: Adolescence Education/Mathematics Emphasis/AA
Liberal Arts and Sciences: Mathematics Emphasis/AA
Liberal Arts and Sciences: Science Emphasis-Physics Option/AS

VIII. Courses that require this course as a prerequisite:
EEE117 (corequisite) MAT142, MAT205, PHY13

IX. Supporting Information:
Mathematics tutoring services, as well as video and computer aids, are provided for all students through the Math Learning Center (Ammerman Campus, Riverhead 235), the Center for Academic Excellence (Grant Campus, Health, Sports and Education Center 129), and the Academic Skills Center (Eastern Campus, Orient 213)