SUFFOLK COUNTY COMMUNITY COLLEGE
COLLEGE-WIDE COURSE SYLLABUS
MAT203 (formerly MA89)

I. COURSE TITLE:

Calculus with Analytic Geometry III

II. CATALOG DESCRIPTION:

Study of vectors and solid analytical geometry, vector calculus, partial derivatives, calculus of several variables, and multiple integration. Special topics may include Green's Theorem, Stoke's Theorem and other topics which may be of special interest to the class. Prerequisite: C or better in MAT142.

A-E-G / 4 cr. hrs.

III. COURSE GOALS:

A. Introduce the basic concepts of multivariable calculus
B. 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. an understanding of the basic concepts of three-dimensional Euclidian space, including rectangular, spherical and cylindrical coordinate systems;
B. an understanding of geometrical concepts in three dimensions, such as: level curves, level surfaces, equations and graphs of lines, curves, planes, cylindrical surfaces, surfaces of revolution and quadric surfaces;
C. an understanding of the basic concepts of vectors in 2-space and 3-space, including: vector projections, dot product, cross product, triple scalar product and direction cosines;
D. an understanding of the properties of a real vector space;
E. an understanding of vector-valued functions, including: limits, continuity and calculus of vector-valued functions;
F. an understanding of functions of several variables, including: limits, continuity, partial derivatives, total differential, directional derivatives and multiple integrals;
G. the ability to create and solve mathematical models using the tools of this course, chosen from work problems, arc length, volume, curvature, linear motion, motion along a curve and optimization problems;
H. a level of mathematical maturity that includes the ability to analyze and produce proofs of some of the basic facts presented in this course.

V. Topics Outline with Timeline

Topics	Approximate Time (Including Examinations)
A. <u>The Cartesian Coordinate System</u> 1. definition of l-space, 2-space, 3-space, right-handed coordinate system 2. distance and midpoint formulas in 3-space; equation of a sphere 3. cylindrical surfaces in 3-space: their equations and graphs	½ week
B. <u>Vectors</u> (in 2-space and 3-space) 1. definition of a vector: its magnitude (norm), its direction. Definition of zero vector and unit vector 2. expressing a vector as a scalar times a unit vector in the same direction 3. definition of dot product 4. definition of orthogonal vectors 5. vector projections, scalar projections 6. proofs of elementary statements about vectors	1 ½ weeks
C. <u>Three-dimensional Space</u> 1. parametric equations 2. equations of a line in 3-space (parametric and symmetric forms) 3. direction angles and direction cosines 4. work problems (Work = $\vec{F}\cdot\vec{d}$) 5. cross product, triple scalar product and their uses 6. normal to a plane, equation of a plane 7. surfaces of revolution: equations and graphs 8. quadric surfaces: equations and graphs 9. spherical and cylindrical coordinates a. graphs b. convert from one system to another	2 ½ weeks
D. <u>Vector-Valued Functions</u> 1. definition 2. eliminate the parameter t to obtain a Cartesian equation 3. domain and range 4. limits 5. continuity 6. definition of the derivative 7. proofs of some of the rules for derivatives 8. finding derivatives of all orders of parametric equations without eliminating the parameter. 9. integrals 10. arc length 11. velocity, acceleration and plane motion problems 12. unit tangent and unit normal vectors 13. curvature and radius of curvature	3 weeks

E. <u>Functions of Several Variables</u> 1. definition 2. range, domain, graphs, and contour diagrams 3. limits (including ε,δ proofs) and continuity 4. partial derivatives and higher-order partials 5. definition of a differentiable function 6. total differential 7. chain rule 8. directional derivatives and gradients 9. tangent planes and normals to a surface 10. extreme values of functions of 2 variables; second partials test 11. Lagrange multipliers	4 weeks
F. <u>Multiple Integrals</u> 1. definition 2. double integrals in Cartesian and polar coordinates 3. triple integrals in Cartesian, spherical and cylindrical coordinates	2 weeks
G. Line integrals, Green's Theorem	1 ½ weeks
Optional Topics:	
H. Vectors: **R**3 is a vector space.	
I. Vector Valued Functions 1. arc length as parameter 2. tangential and normal components of acceleration	
J. Vector Calculus: Stoke's Theorem	

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

VII. Programs that require this course:
Computer Science/AS (recommended)
Engineering Science/AS
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:
PHY245

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, Montaukett LRC 224).