

SOUTHEAST COMMUNITY COLLEGE
DIVISION OF ARTS AND SCIENCES
Mathematics
Revision Date: 07-01-24

I. CATALOG DESCRIPTION

Course Number: MATH2080
Course Title: Calculus & Analytical Geometry III
Prerequisite(s): MATH1700
Catalog Description: Study of calculus and analytic geometry for functions of two or more variables. Coordinates, three-dimensional vectors, three-dimensional analytic geometry, differentiation and integration of functions of many variables and integration in vector fields. Use of some mathematical software may be required.

Credit Hours: 4.0
Class Hours: 60
Lab Hours: 0
Total Contact Hours: 60

II. COURSE OBJECTIVES: *Course will:*

- A. Investigate vectors, vector operations, and applications of vectors to curves and surfaces in space.
- B. Investigate functions of two or more variables using geometric, numerical, and algebraic techniques.
- C. Investigate applications of Differential and Integral Calculus to functions of two or more variables.
- D. Introduce and develop concepts for Calculus in Vector Fields.

III. STUDENT LEARNING OUTCOMES AND GENERAL EDUCATION LEARNING OUTCOMES

- A. Student Learning Outcomes: *Student will be able to:*
 - 1. Identify basic surface from equation, and write equations for basic curves and surfaces in three dimensions.
 - 2. Perform basic vector operations (sum, difference, scalar multiplication, dot products, cross product, and box product) algebraically and interpret the operations graphically.
 - 3. Write equations for lines and planes in space.
 - 4. Compute and interpret derivatives, and integrals for vector valued functions.
 - 5. Compute limits and derivatives for functions of two or more variables.
 - 6. Use limits and derivatives to analyze functions of two or more variables.
 - 7. Use various tools to find extrema of a function on the interior of its domain, and on the boundary of its domain.
 - 8. Write, evaluate, and interpret iterated integrals (double and triple integrals).
 - 9. Use triple integrals to determine the mass, moments, and center of mass for solids in space.
 - 10. Use iterated integrals in cylindrical and spherical coordinates.
 - 11. Evaluate line integrals.
 - 12. Use line integrals in a vector field to compute flow, work, circulation, and flux.
 - 13. Use Green's Theorem to evaluate line integrals to compute flux, and circulation in a vector field.
 - 14. Evaluate surface integrals.
 - 15. Use surface integrals to compute surface area, and the flux of a vector field through a surface.
 - 16. Compute the Curl and Divergence of a vector field.
 - 17. Use Stokes Theorem, and the Divergence Theorem to evaluate surface integrals in a vector field.

- B. General Education Learning Outcomes**
1. GELO #3: Critical Thinking & Problem Solving
 Outcome: Collect, identify, interpret and analyze data.
 Outcome: Synthesize information to arrive at reasoned solutions to problems.
 Outcome: Evaluate the validity of arguments, alternatives, data, outcomes, and/or impacts of actions.
 Outcome: Acquire and integrate knowledge and construct relationships across disciplines.
 2. GELO #5: Analytical, Quantitative, and Scientific Reasoning
 Outcome: Apply mathematical and scientific methods to solve problems from an array of contexts and everyday situations.
 Outcome: Understand and create logical arguments supported by quantitative and scientific evidence and communicate those arguments in a variety of formats.
 Outcome: Effectively develop strategies, algorithms, or experiments (or performing experiments) to better describe the systems or to solve the problems.
 Outcome: Manipulate formulas, data sets, graphs, tables, etc. in a way to produce a meaningful outcome.

IV. CONTENT/TOPICAL OUTLINE (*course outline may provide more detailed information*)

- A. Three-Dimensional Coordinate Systems
- B. Vectors
- C. The Dot Product
- D. The Cross Product
- E. Lines and Planes in Space
- F. Cylinders and Quadratic Surfaces
- G. Vector Functions and Their Derivatives
- H. Integrals of Vector Functions
- I. Functions of Several Variables
- J. Limits and Continuity in Higher Dimensions
- K. Partial Derivatives
- L. The Multivariable Chain Rule
- M. Directional Derivatives and Gradient Vectors.
- N. Tangent Planes and Differentials
- O. Extreme Values and Saddle Points
- P. Lagrange Multipliers
- Q. Taylor's Formula for Two Variables (Optional)
- R. Double and Iterated Integrals
- S. Double Integrals over General Regions
- T. Area by Double Integration
- U. Double Integrals in Polar Form
- V. Triple Integrals in Rectangular Coordinates
- W. Moments and Center of Mass
- X. Triple Integrals in Cylindrical and Spherical coordinates
- Y. Line Integrals
- Z. Vector Fields, Work, Circulation, and Flux
- AA. Path Independence, Potential Functions, & Conservative Fields
- BB. Green's Theorem in the Plane
- CC. Surface Integrals and Flux
- DD. Stokes' Theorem
- EE. The Divergence Theorem & Unified Theory

V. INSTRUCTIONAL MATERIALS

- A. Required Text(s):
 - 1. Hass, *University Calculus, Early Transcendentals*, 4th Edition, Pearson, 2020. With Inclusive Access.
- B. Additional resources:
 - 1. A graphing calculator is required.

VI. METHODS OF PRESENTATION/INSTRUCTION

- A. Methods of presentation typically include a combination of the following:
 - 1. Lecture
 - 2. Small group discussions
 - 3. In-class activities
 - 4. MyMathLab assignments and supplements
 - 5. Topics are discussed algebraically, graphically, and numerically. A graphing calculator may be used for graphical, and numerical points of view.

VII. METHODS OF EVALUATION

- A. Methods of evaluation typically include a combination of the following:
 - 1. Quizzes
 - 2. Hour exams
 - 3. Group Projects
 - 4. Comprehensive final
- B. SCC GRADING SCALE

A+	95-100	C+	75-79	F	59 or less
A	90-94	C	70-74		
B+	85-89	D+	65-69		
B	80-84	D	60-64		

VIII. SPECIFIC COURSE REQUIREMENTS

- A. Students need to have completed the equivalent of MATH1700 (Calculus II) with a grade of C or better.