Course Number: MAT 281  
Course Name: Calculus III  
Credits: 4 semester hours  
Co/Prerequisites: MAT 182 with grade of “C” or better, OR MAT 181/171 with grade of “B” or better and concurrent registration in MAT 182

Objectives:  
After successful completion of this course a student will be able to demonstrate:

- Ability to represent functions of several variables using algebraic, table, and graphical forms, including 3-D projections, section graphs, contour graphs, and appropriate computer technology.
- Procedural facility with vectors and vector operations of dot and cross products.
- Extension of fundamental calculus concepts and procedures such as limits, derivatives, and integration to analogous concepts for functions of several variables, such as partial derivatives and multiple integrals.
- Knowledge of the gradient as an extension of the concept of derivative.
- An ability to use multivariable calculus to solve optimization and constrained optimization problems.
- Basic ability to integrate using polar, cylindrical, and spherical coordinates.
- Extension of parametric curves to three and higher dimensions.
- Knowledge of vector fields and the concept of a line integral.

Description: The study of multivariable and vector calculus, including partial derivatives, multiple integrals, and applications. Space curves, vector fields, and line integrals will be introduced. Students will be expected both to become proficient with basic skills and to demonstrate an understanding of the underlying principles of the subject. Students should expect to make appropriate use of technology in this course. Graphical, numerical and algebraic points of view will be emphasized.  
Prerequisite: MAT 182 with grade of “C” or better, OR MAT 181/MAT 171 with grade of “B” or better and concurrent registration in MAT 182.
Course Outline:

I. Prerequisite Material:
   A. Basic understanding of the derivative as a rate of change and the definite integral as a Riemann sum, related by the Fundamental Theorem of Calculus.
   B. Facility with derivative and antiderivative formulas from Calculus I/II.
   C. Parametric equations in two dimensions.
   D. Facility with some computer system with calculus applications.

II. Requisite Material:
   A. Function of Several Variables
      i. 3-Dimensional Graphs
      ii. Sections
      iii. Contour Diagrams
      iv. Linear Functions
   B. Vectors
      i. Geometric and Numerical Representations
      ii. Elementary Operations
      iii. Dot and Cross Products
   C. Derivatives of Functions of Several Variables
      i. Partial Derivatives
      ii. Local Linearity
      iii. Directional Derivatives
      iv. The Gradient
      v. Optimization
   D. Integrals of Functions of Several Variables
      i. The Definite Integral
      ii. Iterated Integrals
      iii. Other Coordinate Systems: Polar, Cylindrical, Spherical
   E. Parametric Representations
      i. Curves and Surfaces
      ii. Motion
   F. Line Integrals
      i. Vector Fields
      ii. Computing Line Integrals
      iii. Gradient Fields & Green’s Theorem

III. Optional Topics
   A. Divergence, Curl, and Stokes’ Theorem
   B. Vector Applications
   C. The Differential
   D. Quadratic Approximations
   E. Applications of Integration
   F. Applications of Parametric Representations