Revised 10/00

NVCC COLLEGE-WIDE COURSE CONTENT SUMMARY

MTH 277 - VECTOR CALCULUS (4 CR.)

COURSE DESCRIPTION

Presents vector valued functions, partial derivatives, multiple integrals and topics from the calculus of vectors. Lecture 4 hours per week.

GENERAL COURSE PURPOSE

This course is primarily for students in mathematics, engineering the sciences and other areas requiring strong mathematical backgrounds. The purpose is to give students a basic understanding of the concepts of calculus of several variables.

ENTRY LEVEL COMPETENCIES

Prerequisite: MTH 174 - " Calculus with Analytic Geometry" or equivalent.

COURSE OBJECTIVES

As a result of the learning experiences provided in this course, the student should be able to:

A. determine the equation of lines, planes, spheres, cylinders, and quadric surfaces in 3-dimensional space
B. define a three-dimensional vector function and compute its higher order derivatives
C. determine the arc length of a vector function and determine the tangent, normal, binormal, velocity and acceleration vectors and curvature for a vector function at a given point
D. define limit and continuity of a function of two or three variables
E. define and compute the partial derivative, total derivative, directional derivatives and extrema of functions of two and three variables
F. compute exact differentials and line integrals
G. compute double integrals in Cartesian and polar coordinates
H. compute triple integrals in Cartesian, cylindrical, and spherical coordinates
I. apply Green's Theorem to the solution of line integrals
J. compute area, volume, mass and center of mass using double and triple integrals
K. obtain competency in the use of a graphing utility and CAS in the topics below

MAJOR TOPICS TO BE INCLUDED

A. Three-Dimensional Geometry and Vector Functions
    1. Definition
    2. Vector algebra (dot and cross products, direction cosines)
    3. Equations of lines, spheres, cylinders and quadric surfaces
    4. Derivatives and definition of vector functions
    5. Arc Length
    6. Tangent, normal, binormal, velocity and acceleration vectors
B. Partial Derivatives
    1. Limit and continuity of functions of two and three variables
    2. Partial and total derivatives: directional derivatives
    3. Extrema of functions of two and three variables

4. Exact differentials

C. Double and Triple Integration
   1. Definition
   2. Double and triple integrals in various coordinates (Cartesian, cylindrical and spherical)
   3. Line Integrals
   4. Green's Theorem
   5. Area, volume, mass and center of mass using double and triple integrals