NORMANDALE COMMUNITY COLLEGE **3/19/2012**
COMMON COURSE OUTLINE
MATH 2510, CALCULUS 3: MULTIVARIABLE CALCULUS

I. EFFECTIVE DATE OF OUTLINE

Spring Semester, 2009. To be reviewed by the department annually.

II. CATALOG DESCRIPTION

A. MATH 2510
B. Calculus 3: Multivariable Calculus
C. 5 credits
D. Offered Fall and Spring Semesters
E. Prerequisite: MATH 1520 with a grade of C or higher, or approved equivalent preparation.
F. Multivariable functions, three-dimensional analytic geometry, vectors, partial derivatives, optimization, multiple integrals, curves and surfaces, vector fields, divergence, curl, line and surface integrals, Green's Theorem, Stokes' Theorem, and the Divergence Theorem. Applications include – but are not limited to – science, engineering, economics, and ecology. Satisfies MnTC Goal 4.

III. RECOMMENDED ENTRY SKILLS/KNOWLEDGE

Students are expected to have mastered and retained the material covered in a standard first-year Calculus sequence: functions of one variable and their properties and graphs, two-dimensional analytic geometry, the definition and development and applications of differentiation and integration. In addition, high-level problem solving ability will be assumed as well as mastery of algebraic manipulations, graphical visualization, and numerical computations. To do well in this course, students should have excellent work habits and be dedicated to a complete understanding of concepts and their application.

IV. OUTLINE OF MAJOR CONTENT AREAS

A. Functions of several variables
B. Three-dimensional analytic geometry
C. Vectors
D. Partial derivatives, directional derivatives and the gradient
E. Optimization
F. Multiple integrals
G. Curves and surfaces
H. Vector fields
I. Line integrals and surface integrals
J. Vector calculus

V. LEARNING OUTCOMES

Upon successful completion of MATH 2510, students will be able to: (Letters in parentheses refer to student competencies of the Minnesota Transfer Curriculum, Goal 2–Critical Thinking, and Goal 4–Mathematical/Logical Reasoning.)

A. Analyze multivariable functions defined numerically, graphically, or algebraically. (2a,2c,4a,4b,4c,4d)
B. Extend the main concepts of two-dimensional analytic geometry to three dimensions. (4a,4b,4c,4d)
C. Use vectors, vector operations, and vector algebra to model and solve problems. (4a,4b,4c,4d)
D. Calculate and interpret partial derivatives, directional derivatives, and gradients. (4a,4b,4c,4d)
E. Set up and solve maximum/minimum problems involving several variables. (2a,4a,4b,4c,4d)
F. Set up and interpret double and triple integrals as area, volume, mass, charge, etc. (2a,4a,4b,4c,4d)
G. Calculate integrals in rectangular, cylindrical, or spherical coordinates. (4a,4b,4d)
H. Represent curves and surfaces parametrically. (4a,4b,4c,4d)
I. Calculate velocity and acceleration vectors for parameterized curves. (4a,4b,4d)
J. Describe vector fields both graphically and algebraically and determine the flow lines of a vector field. (4a,4b,4c,4d)
K. Set up, calculate, and interpret line integrals as work or circulation and flux integrals as flow across a surface. (2a,4a,4b,4c,4d)
L. Calculate line and surface integrals. (4a,4b,4d)
M. Calculate curl and divergence and interpret them as rates of change of a vector field. (4a,4b,4c,4d)
N. Solve problems using Green's, Stokes', and the Divergence Theorems. (2c,4a,4b,4c,4d)

VI. METHODS USED FOR EVALUATION OF STUDENT LEARNING

The instructor will choose from among various evaluation techniques including – but not limited to – in-class testing, take-home testing, assignments, quizzes, attendance, group or individual projects, and research. The instructor will also choose a method for end-of-the-semester evaluation.

VII. SPECIAL INFORMATION

Instructors will require some type of technology. This may include the use of one or more of a graphing calculator or computer algebra tools (such as the TI-89, MAPLE, Mathematica, or Wolfram Alpha).