MATH 304 Vector Analysis

1. <u>Catalog Description</u>

   MATH 304 Vector Analysis   **4 units**
   GE Area B6

   Prerequisite: <u>MATH 206</u> or <u>MATH 244</u>, and <u>MATH 241</u>.

   Differential and integral calculus of vector-valued functions. Green's Theorem, Stokes' Theorem, and the Divergence Theorem. Applications and generalizations. 4 lectures. Fulfills GE B6.

2. <u>Required Background or Experience</u>

   Math 206 or Math 244, and Math 241.

3. <u>Learning Objectives</u>

   The student should:

   a. Be able to formulate mathematical statements in the language of vector analysis.
   b. Be able to apply vector algebra and vector calculus to problems in science and engineering.
   c. Be ready to take a course on differential geometry

4. <u>Text and References</u>

   To be chosen by instructor. Suggested texts include:

   - Colley, Susan J., <u>Vector Calculus</u>
   - Marsden, Jerrold E. and Tromba, Anthony J., <u>Vector Calculus</u>
   - Schey, H. M., <u>Div, Grad, Curl and All That</u>
   - Shifrin, Theodore., <u>Multivariable Mathematics</u>

5. <u>Minimum Student Materials</u>

   Paper, pencils, and notebook.

6. <u>Minimum University Facilities</u>

   Classroom with ample chalkboard space for class use.

7. <u>Content and Method</u>

    a. Review of cylindrical and spherical coordinates, gradients, directional derivatives, vector fields, divergence and curl, path and line integrals.
    b. The derivative as a linear map, matrix form of the chain rule
    c. Determinant; area and volume
    d. Inverse and implicit function theorems (statements and examples)
    e. Change of variables formula for multiple integrals
    f. Parametrized surfaces and surface integrals of scalar and vector fields
    g. The integral theorems of vector analysis:
        1. Green's Theorem
        2. Stokes' Theorem
        3. Conservative fields
        4. Gauss' Theorem
    h. Applications such as electromagnetism, mechanics and fluid dynamics
    i. Differential forms and higher dimensions (*optional*)
    j. Exterior differentiation and relation to grad, curl and div operators (*optional*)
    k. Orientation and the integration of forms (*optional*)
    l. Generalized Stokes' theorem (*optional*)
    m. Advanced Topics selected by instructor

8. <u>Methods of Assessment</u>

    The primary methods of assessment are: essay examinations, quizzes and homework. Typically, there will be one or more hour-long examinations during the quarter, and a required comprehensive final examination. Students are required to show their work and are graded not only on the correctness of their answers, but also on their understanding of the concepts and techniques.