MATH 0032 - ANALYTICAL GEOMETRY AND CALCULUS III

Catalog Description

Prerequisite: Completion of MATH 31 with grade of "C" or better
Hours: 72 lecture
Description: Continuation of MATH 31. Vectors and analytic geometry in the plane and space; functions of several variables; partial differentiation, multiple integrals, and application problems; vector functions and their derivatives; motion in space; and surface and line integrals, Stokes' and Green's Theorems, and the Divergence Theorem. (C-ID MATH 230) (CSU, UC)

Course Student Learning Outcomes

- CSLO #1: Calculate partial derivatives and multiple integrals of multivariable functions.
- CSLO #2: Translate, model, and solve applied problems utilizing vector functions, partial derivatives, Lagrange multipliers, Second Derivative Test for multivariable functions, Green's Theorem, Stokes' Theorem, and the Divergence Theorem.
- CSLO #3: Utilize graphs of multivariable functions to set up, evaluate, and solve double and triple integrals; including rectangular, cylindrical, and spherical coordinates.
- CSLO #4: Logically present clear, complete, accurate, and sufficiently detailed solutions to communicate reasoning and demonstrate the method of solving problems.

Effective Term

Spring 2021

Course Type

Credit - Degree-applicable

Contact Hours

72

Outside of Class Hours

144

Total Student Learning Hours

216

Course Objectives

1. Compute vector quantities such as the dot product, cross product, and the magnitude of a vector;
2. Write the equation of a line or a plane in space using vector methods;
3. Solve problems dealing with the motion of a particle in the plane or in space using vectors methods;
4. Calculate the length of a curve in 3-space;
5. Graph and identify quadric surfaces;
6. Sketch functions of two variables, level curves of functions of two variables, and level surfaces of functions of three variables;
7. Find maximum and minimum values of functions of two variables and solve applied max/min problems;
8. Compute partial derivatives of functions of more than one variable;
9. Use Lagrange multipliers to solve for the maxima and minima of constrained optimization applications;
10. Evaluate double and triple integrals using rectangular, polar, cylindrical, and spherical coordinates;
11. Compute area, volume, centers of mass, and moments of inertia using double and triple integration;
12. Evaluate line integrals and solve related applied problems;
13. Evaluate line integrals and areas using Green's Theorem;
14. Compute the divergence and curve of a vector field;
15. Compute the area of a parametric surface;
16. Evaluate surface integrals using Stokes' Theorem and the Divergence Theorem; and
17. Solve complex calculus problems using algebra and trigonometry skills.

General Education Information

- Approved College Associate Degree GE Applicability
  - AA/AS - Comm & Analyt Thinking
  - AA/AS - Mathematical Skills
- CSU GE Applicability (Recommended-requires CSU approval)
  - CSUGE - B4 Math/Quantitative Reasoning
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)
  - IGETC - 2A Math/Quan Reasoning

Articulation Information

- CSU Transferable
- UC Transferable

Methods of Evaluation

- Problem Solving Examinations
  - Example: 1. Find the maximum and minimum values of the function f(x,y) = x^2*y^3 over the region inside the triangle with vertices at (1,0), (1,1), and (0,0). This problem is graded based upon the correctness of the solution and the choice of technique. 2. Set up two double integrals to compute the area of the region bounded by the line y = x and the parabola y = 4x - x^2. This problem is graded based upon a correct sketch of the region, correctly setting the double integrals, and correctly evaluating the integral.

Repeatable

No

Methods of Instruction

- Lecture/Discussion
- Distance Learning

Lecture:

1. Instructor will use an interactive lecture style to develop the concept of optimizing functions in 3 dimensions. The instructor will incorporate algebraic analysis and visual analysis through graphing. Students will participate verbally and will work several examples. (Objective 9)
2. Following an instructor lecture on Green's and Stokes' theorem, students will write a report on the historical origins of Green's Theorem and Stokes' Theorem. Explain the similarities and

relationship between the theorems. Show how both theorems arose from the investigation of electricity and magnetism and were later used to study a variety of physical problems. (Objectives 13 & 16)

Distance Learning

1. Instructor will use video lectures to develop the concept of optimizing functions in 3 dimensions. The instructor will incorporate algebraic analysis and visual analysis through graphing. Students will then participate in a discussion board and will post work from several examples for peer review. (Objective 9)
2. Following an instructor video lecture on Green's and Stokes' theorem, students will submit a report on the historical origins of Green's Theorem and Stokes' Theorem. Explain the similarities and relationship between the theorems. Show how both theorems arose from the investigation of electricity and magnetism and were later used to study a variety of physical problems. (Objectives 13 & 16)

Typical Out of Class Assignments

Reading Assignments

1. Read in the textbook about how vector-valued functions and their properties can be used to prove Kepler's law of planetary motion and be prepared to discuss in class. 2. Research online topics such as Green's Theorem, Stokes' Theorem, the Divergence Theorem and their applications in the physical sciences and be prepared to discuss in class.

Writing, Problem Solving or Performance

1. Solve applied problems from physics and engineering. For example, find the magnitude and direction of the torque about a pivot on a pump handle given the force vector. 2. Work in groups to set up double and triple integrals used to compute the volume of a three dimensional region. Determine the best choice of a coordinate system and order of integration for the given situation. Write a summary of your solution technique, comparing the evaluation required for each order of integration.

Other (Term projects, research papers, portfolios, etc.)

Required Materials

- Calculus Early Transcendentals
  - Author: Briggs, Cochran, Gillett, Schulz
  - Publisher: Pearson
  - Publication Date: 2019
  - Text Edition: 3rd
  - Classic Textbook?: No
  - OER Link:
  - OER:
- Calculus Early Transcendentals
  - Author: James Stewart
  - Publisher: Cengage
  - Publication Date: 2016
  - Text Edition: 8th
  - Classic Textbook?: No
  - OER Link:
  - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.