C-ID Descriptor
Multivariable Calculus

Descriptor Details

- **Descriptor Title**: Multivariable Calculus
- **C-ID Number**: 230
- **Units**: 4.0
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General Description

Vector valued functions, calculus of functions of more than one variable, partial derivatives, multiple integration, Green's Theorem, Stokes' Theorem, divergence theorem.

Prerequisites

One year of Single Variable Calculus (C-ID MATH 210 and MATH 220 OR C-ID MATH 211 and MATH 221 OR C-ID MATH 900S)

Corequisites

None

Advisories

None

Content

1. Vectors and vector operations in two and three dimensions;
2. Vector and parametric equations of lines and planes; rectangular equation of a plane;
3. Dot, cross, and triple products and projections;
4. Differentiability and differentiation including partial derivatives, chain rule, higher-order derivatives, directional derivatives, and the gradient;
5. Arc length and curvature; tangent, normal, binormal vectors;
6. Vector-valued functions and their derivatives and integrals; finding velocity and acceleration;
7. Real-valued functions of several variables, level curves and surfaces;
8. Limits, continuity, and properties of limits and continuity;
9. Local and global maxima and minima extrema, saddle points, and Lagrange multipliers;
10. Vector fields including the gradient vector field and conservative fields;
11. Double and triple integrals;
12. Applications of multiple integration such as area, volume, center of mass, or moments of inertia;
13. Change of variables theorem;
14. Integrals in polar, cylindrical, and spherical coordinates;
15. Line and surface integrals including parametrically defined surfaces;
16. Integrals of real-valued functions over surfaces;
17. Divergence and curl; and
18. Green's, Stokes', and divergence theorems.

Lab Activities

No information provided

Objectives

Upon successful completion of the course, students will be able to:

1. Perform vector operations;
2. Determine equations of lines and planes;
3. Find the limit of a function at a point;
4. Evaluate derivatives;
5. Write the equation of a tangent plane at a point;

6. Determine differentiability;
7. Find local extrema and test for saddle points;
8. Solve constraint problems using Lagrange multipliers;
9. Compute arc length;
10. Find the divergence and curl of a vector field;
11. Evaluate two and three dimensional integrals; and
12. Apply Green's, Stokes', and divergence theorems.

Evaluation Methods

Tests, examinations, homework or projects where students demonstrate their mastery of the learning objectives and their ability to devise, organize and present complete solutions to problems.

Textbooks

A college level textbook designed for science, technology, engineering and math majors, and supporting the learning objectives of this course.