Multivariable Calculus

Course Description

Multivariable calculus: analytic geometry, scalar and vector products, partial differentiation, multiple integration, change of coordinates, gradient, optimization, line integrals, Green's theorem, elements of vector calculus.

Prerequisites

BC Calculus

Objectives

After completing Multivariable Calculus the student should be able to

- Gain an intuitive understanding of functions of several variables via level curves and surfaces, and related concepts of limit, continuity and differentiability.
- Perform partial differentiation and multiple integration of functions of several variables.
- Change from Cartesian co-ordinates to polar, cylindrical or spherical co-ordinates and vice versa, perform differential (partial or ordinary) and integration (multiple or single) in curvilinear co-ordinate systems and effect transformation via the Jacobian..
- Utilize vectors to deal with spatial curves and surfaces, and calculus of several variables
- Understand and use the concepts of vector calculus: gradient, curl, divergence, line and surface integrals, Green's, Stokes' and the divergence theorem.
- Apply calculus of several variables to solve problems of optimization, differential geometry and physics

Expected outcomes

Students should be able to demonstrate through written assignments, tests, that they have achieved the objectives of Multivariable Calculus.

Method of Evaluating Outcomes

Evaluations are based on homework, class participation, short tests and scheduled examinations covering students' understanding of topics covered in Multivariable Calculus.

Textbook

- Calculus by Larson, Hostetler, and Edwards *(Hardcopy)*
- Calculus III by Paul Dawkins (Online / PDF)

VECTORS AND THE GEOMETRY OF SPACE

- Three-Dimensional Coordinate Systems & Vectors
- The Dot Product
- The Cross Product
- Equations of Lines and Planes
- Cylinders and Quadric Surfaces
- Vector Functions and Space Curves
- Arc Length and Curvature
- Motion in Space: Velocity and Acceleration

PARTIAL DERIVATIVES

- Functions of Several Variables
- Limits and Continuity
- Partial Derivatives
- Tangent Planes and Linear Approximations
- The Chain Rule
- Directional Derivatives and the Gradient Vector
- Maximum and Minimum Values
- Lagrange Multipliers

MULTIPLE INTEGRALS

- Double Integrals over Rectangles
- Double Integrals over General Regions
- Double Integrals in Polar Coordinates
- Applications of Double Integrals
- Triple Integrals
- Triple Integrals in Cylindrical Coordinates
- Triple Integrals in Spherical Coordinates
- Change of Variables in Multiple Integrals

VECTOR CALCULUS

- Vector Fields
- Line Integrals
- The Fundamental Theorem for Line Integrals
- Green's Theorem
- Curl and Divergence
- Parametric Surfaces and Their Areas
- Surface Integrals
- Stokes' Theorem
- The Divergence Theorem & Additional Material