DETAILED COURSE DESCRIPTION:
MULTIVARIABLE CALCULUS AND VECTOR ANALYSIS FOR PHYSICISTS (PHYS 201)

Course Number PHYS 201

Course Title Multivariable Calculus and Vector Analysis for Physicists

Target Audience Sophomore level physics majors and minors, and majors in some engineering programs.

Prerequisites MATH 142 or 148

Catalog Description Introduces multivariable calculus and vector analysis with a focus on applications in the physical sciences. Topics covered include: Calculus for functions of more than one variable, Taylor expansions, coordinate systems, vector-valued functions, Nabla operator (div, grad, curl), flow of vector field through a surface, potentials and conservative fields, line integrals and surface integrals.

Expected Previous Knowledge

Concepts Vector vs Scalar fields, flow through surfaces, coordinate systems and symmetries

Skills Able to calculate derivatives and integrals in 3D, apply the nabla operators to scalar and vector valued functions, solve line integrals and surface integrals

Course Objectives

After successfully completing this course, students should be able to: 1) Calculate integrals involving various variables. 2) switch to a different coordinate system when it simplifies the solution of a problem, 3) use the nabla operator.

Sample Text

Weltner, John, Weber, Schuster, Grosjean: Mathematics for Physicists and Engineers
Boas: Mathematical Methods in the Physical Sciences

Minimum Material Covered

Multivariable calculus – integrals over more than one variable

Taylor expansions – carry out a one dimensional or multidimensional Taylor expansion

Coordinate systems – spherical and cylindrical coordinates

Vector calculus – Nabla operator, div, grad, curl in Cartesian and curvilinear coordinates, potential and conservative forces

Line integrals and surface integrals – parametrization, Jacobian, flow through surface