Department of Mathematics
Johns Hopkins University

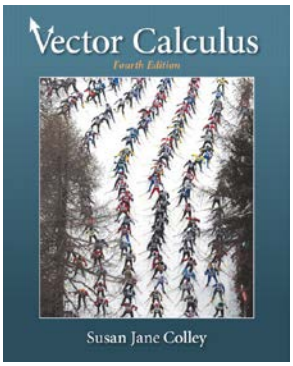
110.211 Honors Multivariable Calculus Course Syllabus

The following list of topics is considered the core content for the course 110.211 Honors Multivariable Calculus. Requisite courses:

- Prerequisites: **110.108 Calculus I** and **110.109 Calculus II**, or equivalent to a full year of single variable calculus.
- Co-requisite: **110.201 Linear Algebra** or equivalent.

Text: **Vector Calculus,** *4th Edition*, Colley, S.J., Pearson, October 2011, **ISBN-13**: 978-0-321-78065-2, **ISBN-10:** 0-321-78065-5.

Course Topics



- **Vectors and the geometry of Euclidean space (Assumed: 0 weeks)**
  - 1.1 Vectors in Two- and Three-Dimensions
  - 1.2 More About Vectors
  - 1.3 The Dot Product
  - 1.4 The Cross Product
  - 1.5 Equations for Planes, Distance Problems
  - 1.6 Some n-Dimensional Geometry
  - 1.7 New Coordinate Systems

- **Differentiation in Several Variables (3 weeks)**
  - 2.1 Functions of Several Variables; Graphing Surfaces
  - 2.2 Limits
  - 2.3 The Derivative
  - 2.4 Properties, Higher Order Partial Derivatives
  - 2.5 The Chain Rule
  - 2.6 Directional Derivatives and the Gradient

- **Vector-Valued Functions (2 weeks)**
  - 3.1 Parameterized Curves
  - 3.2 Arclength and Differential Geometry
  - 3.3 Vector Fields: An Introduction
  - 3.4 Gradient, Divergence, Curl, and the Del Operator

- **Maxima and Minima in Several Variables (1+ week)**
  - 4.1 Differentials and Taylor's Theorem
  - 4.2 Extrema of Functions
  - 4.3 Lagrange Multipliers

- **Multiple Integration (1+ week)**
  - 5.1 Introduction; Areas and Volumes
  - 5.2 Double Integrals
  - 5.3 Changing the Order of Integration
  - 5.4 Triple Integrals
  - 5.5 Change of Variables

- **Line Integrals (1+ week)**
  - 6.1 Scalar and Vector Line Integrals
  - 6.2 Green's Theorem
  - 6.3 Conservative Vector Fields

- **Surface Integrals and Vector Analysis (2- weeks)**
  - 7.1 Parameterized Surfaces
  - 7.2 Surface Integrals
  - 7.3 Stokes' and Gauss' Theorems
  - (Optional) 7.4 Further Vector Analysis: Maxwell's Equations

- **Vector Analysis in Higher Dimensions (1+ week)**
  - 8.1 An Introduction to Differential Forms
  - 8.2 Manifolds and Integrals of k-Forms
  - 8.3 The Generalized Stokes' Theorem