Calculus on Manifolds
MAT 434/734 Syllabus
Spring 2007

Lectures: M, W 19:45–21:25, Room G 327 .

Instructor: Yiannis Petridis, (718) 960-5112, Room 100 B.

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Office Hours: W 15:00-18:00 or by appointment.

Remark: This class has a web site, where you will be able to find the homework assignments and other information. The URL is:

http://comet.lehman.cuny.edu/petridis/434.html

Text:

Harold M. Edwards: Advanced Calculus: A Differential Forms Approach, Birkhäuser, Boston; ISBN: 0817637079

Prerequisite: MAT 226 and MAT 313 or equivalent. Although we will review material from Intermediate Calculus I and Linear Algebra, it is recommended that the students have a good knowledge of the following topics:

Multivariable Calculus: Equations of lines and planes in $\mathbb{R}^3$, Space curves (tangent vector, velocity, acceleration), Functions of two variables (level curves, partial derivatives, tangent plane, the chain rule), Double integrals.

References for Intermediate Calculus: Calculus: Early Transcendental Functions by Ron Larson, Robert P. Hostetler, Bruce H. Edwards, Lynda H. Durrant. Third Edition Chapters: 10–13, more precisely sections: 10.2–10.5, 11.1–11.5, 12.1, 12.3-12.7, 13.1–13.3.

Linear Algebra: Vectors in $\mathbb{R}^n$ (addition and scalar multiplication, dot product), Matrices (matrix addition and multiplication, transpose, invertible matrices), Systems of Linear Equations (Gaussian Elimination, homogeneous systems), Determinants of order 2 and 3 matrices.

References for Linear Algebra: Elementary Linear Algebra by H. Anton, Publisher: John Wiley and Sons, Inc.

Linear Algebra, S. Lipschutz, M. Lipson, Schaum's Outlines Third Edition, Publisher, McGraw Hill.

Reading: Every week specific pages, and examples are assigned for reading. It is of absolute importance that the students work on these BEFORE attempting homework problems and in order to prepare for the quizzes and exams.

Quizzes: There will be regular quizzes every other week.

Homework: Homework is assigned biweekly. The students are strongly advised to work on all the homework problems to make sure they are keeping pace with the class. Homework is not graded.

Exams: There will be two midterm exams: Wednesday, March 7 and Monday, April 16 (dates subject to change after consultation with the students). The exams are closed book and closed notes. Calculators are not needed and are not allowed.

Grading system: The best of the following three grading options will be your final grade:

	Option 1	Option 2	Option 3
Midterm 1	15%	15%	0%
Midterm 2	15%	15%	0%
Final exam	40%	50%	100%
Project	15%	20%	0%
Quizzes	15%	0%	0%

Unexcused absence from a midterm counts as zero.

Contents:

- Review of vectors in $\mathbb{R}^3$: addition, dot product, cross product.
- Functions of several variables: partial derivatives, double integrals, double integrals in polar coordinates, triple integrals.
- Constant forms, work, flux, pull-backs.
- Non-constant forms, integrals, independence of parameter.
- Vector functions, electrostatics, surface integrals.
- The fundamental theorem of calculus in one, two, and three dimensions.
- The divergence, Gauss' law, the divergence theorem (Gauss' theorem).
- Work and Line integrals, Path independence, curl, Stokes' Theorem.
- The Gradient and its significance.
- Affine mappings, Matrix notation of the chain rule, the implicit function theorem for affine maps and for differentiable maps.
- Differentiable manifolds, k-dimensional volume, manifolds with boundary, Stokes' theorem, properties of integrals.
- Applications, Laplace's Equation, Maxwell's Equations.