GRADUATE LIBERAL STUDIES
Wesleyan University
Summer 2016

Multivariable Mathematics
MTHS 638
SYLLABUS & COURSE INFORMATION

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Text:
Multivariable Mathematics - Linear Algebra, Multivariable Calculus, and Manifolds
By Theodore Shifrin
Publisher: John Wiley & Sons, Inc.
ISBN: 0-471-52638-X
9780471526384

Course Description:
This is a course in the calculus for functions of several variables; but the material will be taught by combining linear algebra with multivariable calculus to emphasize the interconnectedness of these two subjects.

Each topic in the calculus will be re-introduced for functions of a single variable and then extended to functions of several variables: limits, continuity, derivatives, integrals and the Fundamental Theorem of Calculus. Topics in linear algebra will be introduced *as needed* to understand the calculus for functions of several variables: vectors, matrices, linear independence, basis and dimension. Major goals of the course are to understand the Inverse Function Theorem, the Implicit Function Theorem, and Green's Theorem, which is a multidimensional analogue of the Fundamental Theorem of Calculus.

There are no specific prerequisites for the course; all the essential topics will be introduced in the course itself, and the course should be accessible to any student with a modest background in mathematics. Our text will be *Multivariable Mathematics / Linear Algebra, Multivariable Calculus, and Manifolds* by Theodore Shifrin. Grades will be based on regularly assigned problem sets that will be roughly an equal mixture of computational problems and theoretical problems. (Problems will be assigned at one class, we'll go over them at the next class and the written solutions will be due at the class after that.)

CLASS #1:
Vectors in R^n, dot product, subspaces of R^n, linear transformations, matrix algebra.
Text: Chapter 1, sections 1,2,3,4.

CLASS #2:
Determinants, cross product, scalar-valued functions, vector-valued functions, limits, continuity.
Text: Chapter 1, section 5. Chapter 2

CLASS #3:

Derivatives, partials derivatives, directional derivative.
Text: Chapter 3, sections 1,2.

CLASS #4:
Differentiability, differentiation rules, gradient; Extreme Values in higher dimensions
Text: Chapter 3, sections 3,4 (more if time)

CLASS #5:
Some Linear Algebra material from Chapter 4. Max/min problems.
Text: Some of Chapter 4 very quickly; Chapter 5, sections 1,2.

CLASS #6:
The Inverse Function Theorem and The Implicit Function Theorem
Text: Some of Chapter 6.

CLASS #7:
Integration, multiple integrals, iterated integrals, Fubini's Theorem (more if time).
Text: Chapter 7: sections 1 and 2 (more if time).

CLASS #8:
More on integration, introduction of Green's Theorem
Text: Parts of Chapter 7 and parts of Chapter 8

CLASS #9:
Proof of Green's Theorem. Discussion of Stokes's Theorem.
Text: Chapter 8, section 3; some of sections 4 and 5.

CLASS #10:
Catching up since we will surely fall behind! Final thoughts to summarize the course.

GRADING AND HOMEWORK:
To help students practice, at each class "homework exercises" will be assigned. These will be routine problems designed to give the students practice with computational problems. The homework exercises do not need to be written up or handed in. Solutions to the homework exercises will be given at the class after which they are assigned.

Grades in this class will be based entirely on Problems Sets. A Problem Set will be assigned at each of the first 9 classes. In the next class, students can ask questions and get help on the Problem Set, and the Problem Set will be due at the class *after* that (second class after it was assigned). We'll make an exception for Problem Set #9 which will be due at Class #10.