Graduate Course Description

Fall 1997

Course Title: Methods of Applied Mathematics I

Course and unique no.: M383C (53245)

Instructor: Hans Koch **Hour:** TTH 11:00–12:30 RLM 12.166

Syllabus: This is the first of two courses designed to help students prepare for the preliminary examination in applied mathematics. It should be useful to many other students as well, because of the basic nature of the topics covered. In particular, students from other departments are encouraged to enroll.

The course is specifically addressed to first–year graduate students. It is an introduction to the basic theory of normed linear spaces, Hilbert spaces, and continuous linear maps between these spaces. The abstract concepts are illustrated with applications on more concrete levels. Included are topics of special importance in applied mathematics, such as differential and integral equations, fixed point theorems, the Fourier transform, etc. But the main emphasis is on developing a good understanding of the basic concepts in linear functional analysis. The goal is to become well prepared for the study of more advanced and/or specialized subjects in analysis and applied mathematics.

The topics include: The geometry and topology of normed linear spaces, compactness, the contraction mapping theorem, continuous linear functionals and mappings, the Hahn–Banach theorem, the principle of uniform boundedness, the closed–graph and open–mapping theorems, seminorms and weak convergence; applications to differential equations and integral equations. The geometry of inner product spaces, Hilbert spaces, linear operators and adjoints, the Riesz representation theorem, the spectral theorem for compact Hermitian operators, the Fourier transform; applications to the Sturm–Liouville problem.

(The topics for the second semester usually include distributions, fundamental solutions of linear partial differential operators, Sobolev spaces, boundary value problems, differential calculus and calculus of variations; and many applications.)

Prerequisites: A good command of undergraduate mathematics

Textbook(s): Course notes by E.W. Cheney (for part I) and H. Koch (for part II) are available for photocopying from M. Combs, RLM 8.124.

Consent of instructor required: No

Apr 30, 1997