

Functional Analysis (Math 920)

Spring 2008

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Text: Peter D. Lax, *Functional Analysis*, John-Wiley and Sons (2002)

Topics: Functional analysis is roughly speaking the analysis of linear operators on infinite dimensional linear spaces. It has many applications in analysis and applied mathematics. This course is an introduction to the subject, with selected applications as time allows. The topics covered will be selected from:

- Ch. 1-2: Linear spaces and operators
 - Ch. 3-4: Hahn Banach Theorem and applications
 - Ch. 5: Norms and normed spaces
 - Ch. 6-7: Hilbert space and applications
 - Ch. 8: Dual spaces and reflexive spaces
 - Ch. 10-11: Weak convergence and applications
 - Ch. 12: Weak and weak* topologies
 - Ch. 15-16: Bounded linear maps
 - Ch. 20: Spectrum of operators
 - Ch. 21-24: Compact operators and applications
 - Ch. 27: Index theory
 - Ch. 28-29: Spectral theory of compact symmetric operators and applications
 - Ch. 30: Trace class and trace formula
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Prerequisites: Math 828 (Real Analysis). It is helpful to know a little topology: definitions of a topological space, a metric space, open and closed sets, compact sets, and convergence. In practice much of what we will do can be understood using only undergraduate analysis and linear algebra. However, measure theory does come in at some decisive points.

Grading: There will be homework assignments.

The last two weeks of class will be devoted to student lectures. Each student will give a 20 minute talk on an application of functional analysis. A list of topics to choose from will be distributed later. If you have an idea of a good topic please feel free to make suggestions.

Grades will be determined roughly by 60% homework 40% presentation.