

Syllabus

Instructor: Prof. Abdelkader Boucherif

Course No.: Math.611

Course Title: Hilbert space methods in applied mathematics

Textbook: I. Stakgold and M. J. Holst, Green's Functions and Boundary Value Problems,
Third Ed., Wiley, New York, 2011

Objectives: This course is designed to expose the students to methods applicable to problems arising in the applied sciences.

The method of Green's functions is introduced through intuitive ideas and simple examples, and then applied to the systematic study of two-point boundary value problems for second order differential equations. Sturm Liouville theory, eigenfunction expansions are introduced to complement the Green's function approach.

Metric and Hilbert spaces shall be discussed in order to introduce the basic ideas of operator theory, spectral theory and some applications. The theory of distributions will be presented in an elementary way.

Learning Outcome: After completing the course a student should be able to:

1. Compute Green's function for second order boundary value problems
2. Convert a boundary value problem into an integral equation
3. Comprehend the theory and applications of Hilbert spaces
4. Solve abstract linear equations
5. Study the existence of weak solutions of boundary value problems

Week	Section #	Topic
1	Review	Second order linear differential equations
2-5	Chapters 1 and 3	Green's functions- One dimensional boundary value problems
6-8	Chapter 4	Metric and Hilbert Spaces
9-12	Chapter 5	Operator Theory, Spectral Theory and Applications
13-14	Chapter 2	Theory of distributions and related topics
15	Reviews	

Grading Policy: One Midterm Exam: **30 %**; Final Exam: **40 %**; Assignments: **30 %**.