

Math 8340: Functional Analysis 2
Section 001
Spring 2017

Class meetings: MWF 1:00-1:50 p.m. in HALE 235

Instructor:

Dr. Judith Packer
MATH 227
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<http://spot.colorado.edu/~packer/math8340.html>

Office hours: MWF, TBA, or by appointment

Prerequisites: Math 6320 (Graduate Real Analysis 1), or the equivalent, and Math 8330 (Functional Analysis 1).

Text: *A Course in Functional Analysis*, J. Conway, 2nd edition, Springer, 1997.

Course outline: This course is meant to familiarize the student with sufficient knowledge of Hilbert space theory and operator theory to lead to a proof of the spectral theorem for a normal operator on a Hilbert space and some applications. Topics to be covered include: Definition of Hilbert spaces and bounded operators on a Hilbert space, the adjoint of an operator, self-adjoint, normal, and unitary operators, orthogonal projections; Banach algebras, spectrum and resolvent of an element in a unital Banach algebra, the Gelfand representation theory for unital commutative Banach algebras; C^* -algebras, the Gelfand-Naimark Theorem for unital commutative C^* -algebras, the spectrum of a bounded operator on a Hilbert space and the continuous functional calculus; Projection-valued measures, definitions and basic properties, spectral measures for a normal operator and the spectral theorem for a normal operator, the Borel functional calculus; Study of applications of the spectral theorem, which will be chosen from the following topics: examples involving multiplication operators and the Fourier transform, types of spectrum: point, discrete, continuous, and residual; applications of the spectral theorem: positive operators, square roots of positive operators, partial isometries and the polar decomposition for a bounded operator; compact operators: definitions and basic properties, examples, including integral operators, spectral properties of compact operators, the Fredholm alternative, integral equations, spectral theorem for compact normal operators, integral operators and Mercer's theorem, the trace of certain integral operators.

Grading: Grades will be based on homework assignments every two to three weeks (60%), and a final project on a topic related to the course material, due the last week of classes in May (40%).

Homework: The homework will be assigned every two to three weeks. It is fine to work together on homework, although each student must submit an individual write-up. **Late homework will not be accepted.**

Final exam date:

The slot for the final exam for our class is Tuesday, May 9, 2017, 1:30 p.m. – 4:00 p.m. Please keep this time and date free for student presentations.

Friendly advice:

- **Come to class.** Things will often be said in class that are not covered in the text, and participating in classroom discussions is an important part of the learning process.
- **Read the book.** The text is intended to be read *in addition to* classroom lectures, and it contains many more details and examples than are possible to cover in lectures. Plus, Conway's book is comprehensive!
- **Do the homework.** Not only does it count for a significant portion of your grade, but this is one of the best ways to study and learn.
- **Come to office hours.** I am happy to help you with the homework (though I won't tell you how to do the problems), or discuss anything we've done in class.

Other important Dates:

- **February 1, (Wed.):** Last day to drop a course without Tuition/Fee charges and without a "W" appearing on your transcript.
- **March 24 (Fri.):** Last day to drop a course via MyCUInfo; Last day for students to make arrangements with their instructor if they have three or more final exams on the same day or two final exams scheduled to meet at the same time.
- **May 5 (Fri.):** Last day for students to withdraw from the university for Spring semester. All withdrawals are assessed 100% of tuition and fees (\$0 refund) and W grades are posted to transcripts.

Accommodations for disabilities: If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu.

If you have a temporary medical condition or injury, see Temporary Injuries under Quick Links at Disability Services website (<http://disabilityservices.colorado.edu/>) and discuss your needs with your professor.

Religious observances: Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, assignments will either be rescheduled or dropped from grading calculations depending on the nature of the conflict. If you have a conflict, please advise me as soon as possible so that arrangements can be made. See full details at <http://www.colorado.edu/policies/observance-religious-holidays-and-absences-classes-andor-exams>.

Miscellaneous University Rules & Regulations:

- **Honor Code:** All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at <http://www.colorado.edu/policies/honor.student-honor-code-policy> .
- **Student Classroom and Course-Related Behavior:** Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See polices at <http://www.colorado.edu/policies/student-classroom-and-course-related-behavior> .
- **Statement on Discrimination and Harrassment:** The University of Colorado Boulder (CU-Boulder) is committed to maintaining a positive learning, working, and living environment. The University of Colorado does not discriminate on the basis of race, color, national origin, sex, age, disability, creed, religion, sexual orientation, veteran status, political affiliation or political philosophy in admission and access to, and treatment and employment in, its educational programs and activities. (Regent Law, Article 10, amended 11/8/2001). CU-Boulder will not tolerate acts of discrimination or harassment based upon Protected Classes or related retaliation against or by any employee or student. For purposes of this CU-Boulder policy, "Protected Classes" refers to race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Individuals who believe they have been discriminated against should contact the Office of Institutional Equity and Compliance at 303-492-2127 or the Office of Student Conduct and Conflict Resolution (OSC) at 303-492-5550. Information about the OIEC, the above referenced policies, and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at <http://www.colorado.edu/institutionalequity/>