

# Topics in functional analysis

## MA 1270-01, Fall 2008

MWF 11:00–11:50 am

Barus & Holley 165

**Instructor:** Prof. Sergei Treil,  
**office:** 216 Kassar, ph.: x1122  
**e-mail:** [treil@math.brown.edu](mailto:treil@math.brown.edu)  
**Web:** <http://www.math.brown.edu/~treil>

**Office hours:** MWF 1:00–2:00 pm and by appointment.

The course is an introduction to functional analysis, which can be thought of as an extension of linear algebra to infinite dimensions. The most important examples of the infinite-dimensional spaces are function spaces (like the space of continuous functions or the space of square integrable functions), which explains the name functional analysis .

The course starts with the introduction of some functions spaces, which will motivate the study of abstract structures like metric spaces, Banach spaces and Hilbert spaces. The fundamental theorems of functional analysis will be introduced and applied. The primary area of applications will be the signal processing and time-frequency analysis: we will consider Fourier series and Fourier transform, as well modern tools like wavelets and frames.

**Text:** *Functional Analysis: An Introduction* by Yuli Eidelman, Vitali D. Milman, Antonis Tsolomitis, AMS, 2004, **ISBN:** 0821836463.

The book *Theory of functions of real variable* by Shlomo Sternberg (available at his homepage <http://www.math.harvard.edu/~shlomo/>) will be used for some topics. It is a huge book, but do not afraid, we will be using only a small part of it.

Also, some handouts concerning Fourier analysis and wavelets will be posted on *My Courses*.

**Course material on the web:** You will be able to find a syllabus, course outline, homework assignments, announcements etc on my home page at <http://www.math.brown.edu/~treil> (under construction at the present time). Some material (mostly what I want to be accessible only by the students in the class) will be put on the *My Courses*. However, since *My Courses* is not math friendly, I prefer to put most of the material on my home page, where I have full control over the content.

**Grading:** Your grade will be determined by several homework assignments (20%), one midterm (30%) and the final exam (50%); all the percentages here are tentative.

**Collaboration:** You can talk to each other about any of homework problems, but when you write up the problems to be handed in, *you must work alone*.

**Midterm** There will be one midterm exam during the semester, the date will be announced later. It will consist of the in-class part (closed book and closed notes) and the take-home part.

Make-ups will not be permitted except for a severe medical problem or dire family emergency. A written note from an appropriate person (doctor, parent, etc.) is required. If at all possible, you should notify me *before* the exam.

**Final:** In-class, Dec. 16 at 9 am. The location will be announced later. The exam is closed book and closed notes.

**Calculators:** You can use computers/calculators when doing homework (although I doubt they will be very helpful in this course). However they are not permitted (and would not help you) on the tests.

**Questions:** *Mathematical* questions are appreciated any time during the class.

**Notes:** Taking good notes is essential for advanced mathematical classes, in particular for this class. While I like the textbook a lot, I will often explain things a bit differently. Even when I follow the textbook, you will see that the blackboard presentation is quite different from a printed page. Lectures and the textbook will augment each other, so it is essential to get good notes.

In this course I would like you to learn basics of mathematical note-taking as well. For each lecture I'll assign persons responsible for note-taking. They should take notes, check them after the lecture, and present a neatly written (or typed) version before the beginning of next class. I'll check the notes, correct if necessary, and post it on my home page. This way, at the end of the course, you will have a complete collection of notes, in addition to your own.

Everyone will be a "note-taker" for one of the lectures.

**Attendance:** Many college students treat class attendance as optional. This may be fine for some classes. However, in math. classes you can get way behind very fast. I would not penalize you for non-attendance, but you should come to class every time unless you are seriously ill.

And remember: office hours are not replacements for missing classes!