Course Description

This course is an introduction to linear functional analysis, with an emphasis on Hilbert spaces and applications. In some sense, functional analysis is an extension of linear algebra: we will be studying linear maps between vector spaces. The vector spaces involved will typically be infinite dimensional and equipped with a norm. With the norm comes a notion of continuity and topology, and it is the interplay between the topology and the linear structure differentiates the content of this course from your previous work in linear algebra. Along the way we'll visit some important topics from analysis that you might have missed in previous courses, including the Baire Category Theorem and some essential inequalities. The second half of the course will be devoted to applications of functional analysis to topics in differential equations, wavelets, and other topics as time allows.

Essential Information

Professor	David Maxwell
Office	Chapman 308C
Email	`damaxwell@alaska.edu`
Phone	474-1196
Web	`http://www.math.uaf.edu/~maxwell`
Required Text	**Introduction to Hilbert Spaces with Applications** , *Debnath and Mikusinski*, Academic Press

Prerequisites:

MATH F641 **or** permission of instructor.

Class Time

There will be three hours of class lecture each week.

Lecture Times

MWF	9:15–10:15	Gruening 308

Office Hours

I will schedule 3 hours a week of formal office hours after consultation with my students.

My office hours will always be posted on my web site and on my office door. I have an open door policy; if I'm in my office and my door is open, please feel free to drop by with questions. You are also welcome to schedule a meeting outside of my formal office hours by sending me an email.

Homework

There will be a homework assignment due roughly every week, usually on Wednesdays. Each week's assignment and due date will be announced in class and will be posted on my web page. I will also post solutions after each homework has been handed in (see below for more information concerning solutions).

Regarding late homework, I will accept from each student a single late homework with no questions asked. Simply hand in a note indicating you are using your free late homework in place of your actual assignment. You must notify me no later than the time the homework is

due that you intend to take advantage of this opportunity, and you must hand in the homework no later than one week after it was due Subsequent late homeworks will be accepted only under extenuating circumstances to be determined at my discretion.

Homework Solutions

In an exercise in collaborative mathematics, the class will create solutions for each week's homework. The hope here is that the process of creating the solutions will make the solutions themselves more valuable. Here are the ground rules:

1. Students can expect to contribute a solution at a rate of two a week. I'll write solutions to the remainder of the problems (and often the hard ones).
2. The solutions must be written in LaTeX.
3. I will assign problems to students in a pseudo-random fashion. That is, I'll try to assign them randomly, but I'll also keep an eye out to ensure that you don't get a hard problem twice in a row. Students who didn't get a problem to submit the week prior will be assigned problems first.
4. Submit your solutions (by email) to me by at least 3:00pm the day before the assignment is due. I'll review your work and ask for changes if need be.
5. Participation in this exercise is included in your homework grade (and is equivalent to another homework assignment).

Midterm

There will be one in-class midterm exam. It is tentatively scheduled to be held on Friday, March 9.

Final Exam

There will be a two-hour final exam on Wednesday, May 9, 8:00am–10:00am. There will also be a take-home portion of the final exam to be handed out in the last week of class and due on May 9 at the start of the in-class exam. Details on the take-home exam will be announced closer to the end of the semester. The in-class exam will be consist of definitions, statements of theorems, and easy proofs. The take-home exam will be focussed on solving harder problems.

Evaluation

Course grades will be determined as follows:

Homework	40%
Midterm	30%
Final	30%

Letter grades will be assigned according to the following scale. This scale is a guarantee; I also reserve the right to lower the thresholds.

A+	97–100%	C+	77–79%	F	≤ 59
A	93–96%	C	73–76%		
A-	90–92%	C-	70–72%		
B+	87–89%	D+	67–69%		
B	80–86%	D	63–66%		
B-	Not given%	D-	60–62%		

Tentative Schedule

The following is a tentative list of the topics to be covered in this class. As we proceed in the course, the course web page will list specific sections to be read for each week.

Week	Topics and Events
1/20	Chapter 1
1/23 – 1/27	Chapter 1
1/30 – 2/3	Chapter 3
2/6 – 2/10	Chapter 3
2/13 – 2/17	Chapter 4
2/20 – 2/24	Chapter 4
2/27 – 3/2	Linear Functionals and the Hahn Banach Theorem
3/5 – 3/9	The Baire Category Theorem and its consequences Friday: Midterm
3/12 – 3/16	No Classes Spring Break
3/19 – 3/23	Catch up for theory half of material.
3/26 – 3/30	Chapter 5
4/2 – 4/6	Chapter 5
4/9 – 4/13	Chapter 6
4/16 – 4/20	Chapter 6
4/23 – 4/27	Chapter 8 Friday: Spring Fest
4/30 – 5/4	Chapter 9 or Catch up
5/7 – 5/11	Exam Week Monday: Final Exam

Rules and Policies

Collaboration
You are encouraged to work together in solving homework problems. But each student must write up his or her own solutions independently. If you receive significant help solving a problem, it is customary to make a note in your homework to give the person who helped you credit.

Makeup Exams
You can make up an exam if certain extenuating circumstances prevent you from taking it and if you inform me in advance. Contact me as soon as possible if you are going to miss an exam.

Attendance
Attendance is not included directly as part of your grade.

Cell Phones
Turn off your cell phone before you come to class.

Disabilities Services
I will work with the Office of Disabilities Services (203 Whitaker, 474-7043) to provide reasonable accommodation to students with disabilities.

Incomplete Grade
Incomplete (I) will only be given in Computer Science, Mathematics or Statistics courses in cases where the student has completed the majority (normally all but the last three weeks) of a course with a grade of C or better, but for personal reasons beyond his/her control has been unable to complete the course during the regular term. Negligence or indifference are not acceptable reasons for the granting of an incomplete grade. (Note: this is essentially the old University policy.)

Late Withdrawals
A withdrawal after the university deadline from a Department of Mathematical Sciences course will normally be granted only in cases where the student is performing satisfactorily (i.e., C or better) in a course, but has exceptional reasons, beyond his/her control, for being unable to complete the course. These exceptional reasons should be detailed in writing to the instructor, department head and dean.

Academic Dishonesty
Academic dishonesty, including cheating and plagiarism, will not be tolerated. It is a violation of the Student Code of Conduct and will be punished according to UAF procedures.