## **Course Description**

This course is a rigorous study of the ideas underlying calculus and an introduction to the real numbers. Rather than the computational focus of your previous calculus classes, our class will be devoted almost entirely to theory. We'll study the foundations of the real numbers, sequences and series of real numbers and the concept of a limit, continuity, derivatives, the Riemann integral considered rigorously, and sequences and series of functions.

## **Essential Information**

Professor:	David Maxwell
Office:	Chapman 308C
Phone:	474-1196
Email:	david.maxwell@uaf.edu
Web:	http://www.math.uaf.edu/~maxwell
Prerequisites	ENGL 111X; ENGL 211X or ENGL 213X; MATH 215 and 202X;
	or my permission

## **Course Texts**

The required text is: Understanding Analysis, Stephen Abbott, Springer-Verlag

There are lots of other nice texts out there. There are two older classics that I recommend in particular.

**Calculus**, by Michael Spivak, is a lovely calculus text with a mathematical viewpoint. It has lots of nice problems, a clear exposition, and covers material similar to that of Abbott as well as some more sophisticated topics (e.g.  $\pi$  is irrational).

**Principles of Mathematical Analysis**, by Walter Rudin, is a classic text. It's harder book than our course text, and has a more general approach via metric spaces. But it has very clean tidy proofs and is a joy to read. If you end up finding you like analysis, you might enjoy using this text for self study.

# **Class** Time

There will be three hours of class lecture each week and a one hour recitation. Class time will be spent on traditional mathematics lectures, whereas the recitation will be devoted to problem solving and working on homework solutions.

We will decide on the recitation time on the first day of class.

Lecture Times MWF 1:00-2:00 45 Gruening 410

# Office Hours

I have scheduled 2 hours a week of formal office hours.

Office Hours T 1:00-2:00 W 2:15-3:15

These times may be adjusted if I hear from students that these times don't work. 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 every Friday at 4:30pm in my box. Homework will be listed on my web page, and will be assigned on as we progress through each day's lectures. Your first homework has been posted.

The course web page will also contain solutions to the less routine problems for each week's homework. If you are interested in the solution of a problem that is not listed on the web site, please come by office hours.

Regarding late homework, I will accept from each student a single late homework with no questions asked. 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.

Most of your homework will be graded by our TA, Anna Bulanova. Usually, you will also be asked to hand a couple of problems in separately for me to grade on each assignment.

### Midterms

There will be two midterm exams. They are tentatively scheduled to be held on Friday, October 19 and Monday, November 19. There will be two components to each midterm – a take-home exam that focusses on harder proofs, and an in-class exam with an emphasis on definitions, statements of theorems, and shorter proofs.

### **Final Exam**

The final exam will have a take home and in-class component. Both will be comprehensive. The written portion will be to be held on Monday, December 17, 1:00–3:00.

## **On Proofs**

You will be expected to write proofs on every homework and on every exam. Lots of them. Unlike the proofs class you have taken, the main focus of our course is not how to write a proof – we have new mathematical ideas to learn! Nevertheless, this is a writing intensive (W) class, and one of the goals of the class is to give you experience in writing proofs and more broadly in clear mathematical exposition. Your homework and exams will be graded for both mathematical content and exposition.

### Evaluation

Course grades will be determined as follows:

Homework	35%
Midterms	35%
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	$\leq 59$
A	93-96%	С	73-76%		
A-	90-92%	C-	70-72%		
B+	87-89%	D+	67–69%		
В	83-86%	D	63-66%		
B-	80-82%	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
9/7	Rationals and Reals
9/10 - 9/14	Completeness and its consequences. Countability.
9/17 - 9/21	More on countability. Start sequences and series.
9/24 - 9/28	Sequences and series continued. Bolzano-Weierstrass Theorem.
10/1 - 10/5	Cauchy Criterion. Properties of Series.
10/8 - 10/12	Topology of $\mathbb{R}$ . Compact sets.
10/15 - 10/19	Limits of Functions. Continuity.
	Friday: Midterm
10/22 - 10/26	Intermediate Value Theorem
10/29 - 11/2	Differentiation
	Friday: Last day to withdraw with a W
11/5 - 11/9	More on differentiation.
11/12 – 11/16	Sequences and series of functions. Uniform convergence.
11/19 - 11/23	Power series. Taylor series.
	Wednesday: Midterm
	Thursday: Thanksgiving
11/26 - 11/30	Start Riemann integral
12/3 - 12/7	Riemann integral
12/10 - 12/14	Catch-up and review

### **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. Despite this fact, it is in your best interest to attend every class.

### **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.