Course Syllabus: Math 4310A
Topology
Department of Mathematics and Computer Science
University of Lethbridge, Fall 2014

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Office: UHall C530 **Course website:** via moodle.uleth.ca
Office hours: M 3:30-4:30 pm, TR 2:00-3:00 pm, WF 10:30-11:30 am
Lectures: MWF, 5:00-5:50 pm in UHall D634

Course Description

This is a course in metric and point-set topology. In other words, this is classical topology: the results we will consider are those that arise from the attempt to find the right abstraction of the notion of continuity from calculus/analysis. The idea here is to consider continuity as abstractly as possible in order to distill its essential properties.

From the calendar:

> Topological spaces. Topology of metric spaces. Continuity. Open covers and compactness. Separation. Connectedness.

Like many areas of mathematics, many different ideas were tried before people converged to the modern definition of topology. What people discovered was that one can understand the continuity of a function by understanding what it does to open sets (such as open intervals on the real line). In most undergraduate courses we usually only encounter one topology - the one determined by the usual Euclidean distance on the real line/plane/space/etc. (In an advanced analysis course it's necessary to introduce new topologies once infinite-dimensional spaces are encountered, such as spaces of functions.) We will generalize in two ways: first, we generalize the notion of distance, and study general *metrics*. This will seem exotic for about a week, until we discover that every metric ends up determining the same open sets, so that they're all the same as far as topology is concerned. At that point, we'll throw all concreteness and intuition out the window and consider general topologies, where the meaning of "open set" is limited only by imagination (and a few rules required for logical consistency).

The topics listed in the calendar are mostly motivated by problems in analysis, which is where topology has its beginnings. These days, a large part of the field of topology (which is a *massive* field) is more geometric in nature. At some point we make the transition of thinking of continuity not in terms of functions, but in terms of the spaces on which they are defined. One then starts thinking about ways that different spaces (or objects within) those spaces can be "continuously deformed" — that is, by bending and stretching, but never tearing. (A good context for this is transformations of $\mathbb{R}^2$ – think back to change of variables, and changing squares into circles or yet more complicated shapes.) If time permits, we'll explore some of these more geometric aspects of topology in the final weeks of the course.

Required Textbook:

Introduction to Metric & Topological Spaces, 2nd ed. by Wilson Sutherland.

I have not worked with this textbook before, but it appears to be fairly user-friendly. I tried to find something that was not too expensive, and a bit more basic, in the sense that it's sufficient for covering the topics in the course calendar, but doesn't go too far beyond this. (You could also read "basic" as code for "easier" – the same material can be covered at levels ranging from beginner to impossible.) If you're really interested in this subject, or thinking about grad school, you'll probably want to supplement this text. Fortunately there are a few books that you can download for free thanks to a library subscription, and some decent books published by Dover that should cost you less than $20. I've compiled a list of suggested texts and posted them to our Moodle page.

Evaluation

Your grade will be determined according to the following table (see below for explanations of each component):

Component	Assignments	Presentation	Tests	Final
Weight	30	10	30	30

Assignments:

There will be a problem set due every Friday, no later than the *beginning* of lecture (i.e., at 5 pm), beginning with Friday, the 12th of September. Your grade will be based on the best 10 out of 12 assignments.

Term tests:

There will two in-class term tests, written on **Wednesday, the 15th of October** and **Monday, the 17th of November**. There will not be any make-up tests. If you miss a test due to illness or athletics, I will add the value of the test to the final exam.

Presentations:

Each student will be required to give a 20 minute presentation on any topic related to the course. (For example, you could discuss an application or generalization of something covered in class, or a topic that goes beyond the material we'll be covering). I may also be willing to allow a 30 minute presentation by a pair of students. Your choice of topic will be due by the end of the day on October 31st. Depending on class preferences, we will either use the last week of lectures for presentations, or have a separate presentation date (which would probably have to be a Saturday). If enough people are willing to do presentations on a Saturday, I'll book a room and povide lunch. The whole thing should take three to four hours. If you do not feel that a presentation would allow for a fair assessment of your learning for your choice of topic, I may, after making an attempt to convince you otherwise, be willing to allow you to submit a written paper instead. (Generally the option of submitting a paper will be more work and less fun.)

Final exam:

The final exam for this course will be a take-home exam. You will have three days (72 hours) to complete the exam. As per university policy, the exam must be submitted on or before the scheduled date and time for an in-class exam. I will give the exact period in which the exam can be written once the December exam schedule has been released. Most likely I will make the exam available on a Friday and ask you to submit the exam the following Monday.

Letter grade conversions:

The percentage grades earned in this class will be converted to letter grades according to the following table:

Letter grade:	A^+	A	A^-	B^+	B	B^-	C^+	C	C^-	D^+	D	F
Minimum % required:	95	85	80	77	73	70	67	63	60	55	50	0

Course policies

Lecture:

I will try to stick fairly closely to the order of the material in our course textbook, and recommend that you read ahead. That is, you should cover each topic in the book before I cover it in class. This usually leads to more interactivity and discussion and so forth. Your feedback is also important because I will be adjusting pace at which we cover the material based on how the class seems to be progressing. To allow for this flexibility in the pace of the course, I haven't set a weekly topics schedule, but you'll be able to keep track of where we're at in the book based on the lecture material.

Homework:

Like most math courses, the only way to really learn the material is to do as many practice problems as possible. I recommend doing as many of the problems in your textbook as you have time for, in addition to the assignment problems. In case you get stuck on a problem, I've set up a discussion forum on Moodle where you can ask questions about the course material and homework problems without having to wait for the next lecture or office hour. (For assignment problems, I would ask that you do not use the discussion forum to share full solutions, although hints are acceptable.)
Note: Right now I've set up our Moodle page to use one of the built-in discussion forums. It's a fairly standard format, organized by discussion thread (posts + replies). The advantage with this is that you don't have to leave Moodle to use it. One downside is that the equation editor in Moodle is broken, and you may want to enter math symbols sometimes. (Although if you know LaTeXcode you can enter it directly.) An alternative is an external site called Piazza, which has better math support and also allows anonymous posting. It also integrates partially with Moodle. I'm using Piazza for my other courses and am willing to create a site for this course as well, if there's demand for one. I'll put a poll on Moodle to see which option people prefer.

Communication:

Communication between students and myself can take place in several ways:

- Announcements on Moodle. Any updates and reminders will be posted on Moodle. These announcements will be sent to your uleth.ca email address by default, so be sure to monitor that account. It is also highly recommended that you log into Moodle on a regular basis to keep up to date on the course.
- In person, during office hours. (Recommended, especially if you are having trouble with a concept.)
- Online discussion forum.
- Email. You are welcome to email me with questions about the course, and I will do my best to answer as soon as I can. I do, however, have a few email etiquette rules:
  - Include the course number in your subject heading, and your full name in the message text. Since I teach several classes at once, this will help to ensure a prompt reply. (For example, if your email consists only of "Yo prof, when's the test?" I won't be able to give you an answer since my courses have tests at different times.)
  - Questions about how to solve a particular homework problem should be directed to the discussion forum rather than email: the discussion forum can properly display math symbols, and it's usually the case that several students will have the same question.
  - Questions that can be answered by reading this syllabus (e.g. "When's the test?") will usually not be answered in a timely fashion, and the replies will generally be grumpy/sarcastic in nature.

Special arrangements:

If you are a student who has registered for accommodations with the Accommodated Learning Centre, please ensure that I am informed of the necessary arrangements as soon as possible, and please feel free to meet with me if there are any adjustments I can make to improve your learning experience.

Academic honesty:

Students are expected to be familiar with, and abide by, the rules laid out in the Academic Calendar regarding academic honesty, cheating, etc. and the penalties assessed for disregarding those rules. In particular, collaboration on assignments is acceptable, but copying is not. If you're not sure what the difference is, see me.