UNIVERSITY OF TORONTO
MAT246H1F Concepts in Abstract Mathematics
Course Information, Fall 2023

as of September 4, 2023

1. TEACHING TEAM:

Section	Time	Room	Lecturer	Email	Office hours
LEC0101	T 13–15 R 13–14	BA1130	Shuyang Shen	shuyang.shen@mail.utoronto.ca	TBA
LEC5101	M 18–20 W 18–20	KP108	Soheil Homayouni	homayoun@math.utoronto.ca	TBA

Note: for LEC5101, the time slot Wed 19:00-20:00 is mostly used as a problem session in which examples relevant to the same week's lectures will be presented, but this hour is also used to catch up with the missing lecture hours on Thanksgiving, so that we can synchronize with LEC0101 earlier in the course and not at the end of the course, and can have the same evaluations throughout the term. Even though this hour is not mandatory, please plan to attend.

2. PRE-REQUISITES:

A full year course in Calculus: MAT133Y1/(MAT135H1, MAT136H1)/MAT137Y1, and MAT223H1 (with a high grade). Students with pre-requisites MAT133 or MAT135, or an average grade in MAT137 and/or MAT223, should know MAT246 is the beginning of a process of proof making and theory building. They may be missing essential mathematical reasoning, and will find this course very challenging. This group needs special focus and attention.

3. TEXTBOOK AND READING MATERIAL:

- 'A Readable introduction to Real Mathematics', by D & D & P. Rosenthal; **(Second edition)** publisher: Springer; **electronic copy available in Robarts library**, also available in the bookstore.
- Solutions Manual for the first edition, to be found online, strongly recommended.
- Extra readings such as 'Lecture Slides', 'Tutorial Preps', 'Soft Readings' and 'Puzzles' will be gradually posted on the various pages.

Warning:

1. The style of the textbook is sometimes very intuitive, and brief. While this is the strength of the textbook, the course goes beyond the content to introduce a certain approach, known as axiomatic approach, and builds the content from certain fundamental principles. Alongside introducing abstract concepts, the course pursues further goals of **background**, **reflections**, **axiomatic approach**, and **rigor.** Please keep in mind that it is not merely the content but it is also the style and soft details that are involved and one is being tested on.

2. The first 9 chapters of the textbook seem familiar to many students. Please see the slides on explicit-implicit to see what is not in the textbook that we cover in the course. Please make sure not to miss the implicit ideas that will be discussed in the course, and appear in tests and the Final Exam.

3. In the lectures, and in the slides, our attempt is to present arguments **much more formal** than presented in the textbook. Please refer to the examples presented in the lecture slides

4. GOALS OF THE COURSE:

- The primary goal is to identify three distinct trends of 'knowing' mathematics: intuitive, factual (or passive), and proof based (or active). See Soft Readings. These trends are not interchangeable; and one trend alone may not be sufficient all the time. The biggest hurdle for a reasonably hard working student is that these trends of 'knowing' have no clear definitions and boundaries, and in a way they are entangled. In this course we learn to un-entangle these ways of 'knowing'. Once we reflect on each trend, and see them in action, by attentive practice we can strengthen each trend.

- Along the way we learn how mathematical concepts enrich our language and our problem solving intuition. With this enriched language, and intuition, we can better think with, and express complex ideas; this is the magic of the language of mathematics. Such process, of learning and working with mathematical concepts, opens the door to new cognitive frontiers. We add a tool kit of abstract mathematical concepts to our language, which brings our thinking ability to a finer, more powerful, and of higher capacity.

- Also we learn how mathematical theories are built, and they facilitate generating/formulating new facts, and how the theory helps proving these facts.

- The course-work (problem sets and quizzes and tests) help with building mathematical maturity and stamina.

5. GRADING SCHEME:

- Five Problem sets: 16% PS1-PS4 worth 3% each, PS5 is worth 4%
- Lecture Pop Quizzes: 10%
- Weekly Online quizzes: 12%
- Two Midterm tests: 20%
- Final exam: 43%
- Reflective essay: 4%
- Piazza registration: 1%

GRADING ITEMS EXPLAINED

- Bonus marks: The weights add up to 106, so there are 6% bonus marks in the course. This extra mark can be used to cover for missing a quiz or a problem set. Due to this extra mark **no exemption/make up** for a missing quiz or problem set (for legitimate reasons of course) shall be made.

- Problem sets: These are deeper questions that help students with more reflection and deepening on the course material.

  Problem sets will be posted in stages and drafts, approximately two weeks before the due date. A first draft will appear first, and then the a presentation draft will be posted closer to the due date (the weekend before the due date). Problem sets will be administered on Crowdmark.

  Problem sets are designed to complement the lectures and textbook material, and to further extend, solidify and deepen one's understanding of the theory. They guarantee a deeper understanding of the subject; a deeper understanding that is crucial for the journey in the course.

- Lecture Quizzes: These very short quizzes cover the same day/week material, some fundamental, minimal ideas that the lecture has been about. There might be gradually more challenging pop quizzes, which carry bonus marks. Also, in the end, if we need to slightly adjust the grades, either in individual cases or as a whole, this item is the first item that might be adjusted with a heavier weight.

  This item encourages and measures two important attitudes: **attendance** in lectures, and **being attentive** while attending the lectures. This is a valuable training, to prolong one's focus and attention span.

- Weekly Online quizzes: these are weekly quizzes based on reading of the posted or textbook reading material, either reviewing or previewing the material either presented or to be presented in the coming week. The quiz questions are posted sometime Thursday afternoon, and are due on the next Monday at 1:00 pm. There are no extensions for these quizzes. There will be some office hours Monday morning to deal with the last minutes questions regarding the online quizzes.

  These quizzes aim at reflection on the past week's lectures and tutorials, and preview of the next week's material; also a good opportunity for practicing writing formal arguments, and receiving feedback.

- Midterm Tests: Two tests dated Friday Oct 13, 4-6 pm. and Friday Nov 24, 4-6 pm. locations and coverage will be posted. There will be no skipping of the midterms. In case of a documented illness or emergency we offer a make up within few days of the regular seating.

  Midterm tests would help us up to date our knowledge, and the feedback on the test shall be a good way for examining our understanding, to see if they meed the expectations; are we on the right track or we need to fine tune our study habits. For this reason there is no deferral of the midterm tests.

- Final Exam: Exam will be scheduled by the FAS and missing exams will be dealt with by the FAS Examinations office. We require at least 30% on the final exam for passing the course.

  Final exam cover the material from chapters 10 and 12 very heavily, and covers the material from earlier chapters in a way that is relevant to the material in chapters 10 and 12, and tried to bring idea together and paint a big picture of the course material and goals. So it is extremely important that students have the correct understanding about the nature of the coverage of the Final exam.

- Reflective essay: This item, due-dated Dec. 8, will be explained in a related document.

- Piazza registration: This item is to ensure everyone has chance to be on the receiving end of piazza discussions and to benefit from them. It happens very often that very important hints and explanations appear to those who ask on piazza, and this way everyone can benefit from such opportunities. The mark for this item will be finalized on Septmeber 25 and beyond that date no registration will earn the allocated mark.

  'Learning' is a process, with one foot in the conscious realm and another in the unconscious realm. While effective, conscious study habits help with the conscious part of the learning, the unconscious part is more of an intuitive nature. Reflecting on various components of the learning process, helps

with the unconscious part as well as an overall deepening in this process. In particular, the intuitive patterns and various underlying habits are strongly unconscious, it is through a continuous reflective process that these aspect of learning get nurtured.

- A note on the weight of the content in evaluation: The components online quizzes 11, 12, Lecture quizzes 9,10, PS5, final exam, and reflection essay together are worth almost 55 marks, while the rest of material will worth 50 marks. This means that the later, more challenging material from chapters 10 and 12, is heavily favoured; students should keep this in mind, and clearly plan studying the material at the end of the course.

6. LECTURES:

Each lecture is an introductory package, designed and delivered to be understandable for the average student. Without attending and participating, students will lack the following:

- The personal take from an oral presentation, which is far richer than the lecture notes that might be posted online.
- All the discussions, questions and answers, and interpretations, and nuances that can never get fully addressed in the online material.
- The purpose of the material, and the way they fit into the structure of the course,
- Where to start studying, and which textbook item is more important (and has to be highlighted,) and which item is less important, can be ignored.

Note: Without this knowledge, one would be confused and fall behind in the course. And without attending the lectures, and without a **focused attention** during the lectures, one may not have a complete access to the lecture ideas.

The attention is energy consuming, but this helps to expand the attention span. To help with this process, we have posted pages of the workbooks, which contain an expanded version of lecture material. Studying these notes, and reflecting on the inserted reflective questions, raise one's awareness during the lectures. Also we might post a closer version of our lecture notes shortly before a lecture together with some **objective questions**. Reviewing these questions would be an excellent way of becoming mentally prepared for the lectures, and consequently developing a **longer attention span** during the lectures.

7. TUTORIALS:

Please note that students in LEC5101 must be enrolled in one of Tutorials 5101, 5201, and 0301, while Tutorials 0101, 0201 and 0401 are reserved for students in LEC0101.

Section	Day	Time	Room
TUT0101	Mon	14:00-15:00	MS3278
TUT5101	Tues	17:00-18:00	UC52
TUT5201	Tues	18:00-19:00	SS1070
TUT0201	Wed	12:00-13:00	SS2125
TUT0301	Wed	16:00-17:00	SF3201
TUT0401	Fri	11:00-12:00	RW143

In the tutorials technical ideas will be discussed, and more **challenging examples** will be solved in details. But most importantly, in the tutorials students get to speak and to discuss the technical ideas.

Questions will be given to class and the class will be invited to discuss their ideas in groups. As such, tutorials will offer the experience of discussion, which may not be possible in the lectures.

Note: The tutorial material are necessary and complement the lecture material, but they are not covered in the lectures. If a tutorial missed please try to attend another tutorial that week to get exposure to the tutorial materil.

8. PROBLEM SETS:

Problem sets take a long time to complete, and they are worth relatively less than other assessments, so one might be tempted to skip them. However problem sets are designed to complement the lectures and textbook material, and to further extend, solidify and deepen one's understanding of the theory. They guarantee a deeper understanding of the subject; a deeper understanding that is crucial for the journey in the course.

Students are encouraged to work together on the general ideas, but the final answers must be written independently of one another. When discussing the main idea of a question please refrain from giving written details to one another, but be more intuitive, and only discuss the ideas in words. As soon as a written solution is shared as a hint the final written answers will become similar, and any changes will be cosmetic changes, which is very easy to detect. Please practice learning how to share verbal/intuitive ideas, and not the written details. Copying parts of the problem set answers will result in all parties involved to be dealt with according to the university regulations on plagiarism.

Problem sets will be posted in stages and drafts, approximately two weeks before the due date. A first draft will appear first, and then the a presentation draft will be posted closer to the due date (the weekend before the due date). There are two main reasons for this:

- the first reason is that the class can start working on a partially complete version of the questions before we are certain about our full coverage of the material.
- The second, more important reason is that one needs the presentation draft only after one has worked on the answers. Please don't use the presentation draft as a working draft, instead use it to enter your final, polished work.

Note: It is expected that each student writes a few versions of a solution before they are satisfied with their polished answers. There is sufficient time for finishing a problem set, and therefore there is no need for extensions or make-up for a problem set. The solutions/marking scheme to the problem sets will be posted shortly after the submission deadline, to help with the remarking process, therefore any individual extension will interfere with the posting of the solutions, and therefore all requests for individual extensions will be rejected.

NOTE: please be careful of the following:

- don't share any portion of your answers; they may get indiscriminately copied from, while you are completely unaware of their actions. You will be responsible for this infraction.
- if you wish to help someone with a question you must be able to distinguish between '*the idea*' and *'the details'*; if you are not sure about the distinction, then you may become responsible for plagiarism.
- academic offenses can be investigated and sanctions applied even after a student drops the course and even after the end of the course.

9. ACADEMIC INTEGRITY:

Plagiarism is an act which greatly impacts one's personality and could have extremely damaging future consequences. Moreover there is the important and sensitive question of fairness across the course. Above all, plagiarism is against university regulations. Therefore we shall be extremely vigilant to detect and to deal with such incidents.

- In our course 'plagiarism' can happen in the form of copying solutions and answers of Quizzes, Problem Sets, Tests and Exam. It can also happen that an individual seeks outside resources to answer a question in a Test, Quiz, or the Exam. (Our markers can easily detect such occurrences, and once detected, we will review all the past and the future work of the individuals involved, and the case will be referred to the university authorities.)
- The act of plagiarism can take place by one individual (seeking outside help), between two individuals or a group of individuals (sharing information.) Please note that an individual student may unknowingly become a member of a network of plagiarists by lending their work to a "trusted friend".

For more on this topic please consult: https://www.academicintegrity.utoronto.ca/

10. PIAZZA:

The course has a PIAZZA account. One can ask questions on this platform, to which your instructor, your TAs and your fellow classmates will answer. This is a very efficient way to pose your question and receive answers in relatively short time (sometimes within minuets.) Also this platform encourages discussions, and further exploration of your question. Indeed often very general and important administrative questions and questions regarding the nature of assessments and hints are discussed there. So please sign in this platform and use it as a source of information. Also, this platform allows for latex typesetting on which one can properly type mathematical notations, so the class is encouraged to sign on piazza and use it. The registration link:

https://piazza.com/utoronto.ca/fall2023/mat246h1

11. PUZZLES, and recreational type questions:

There is a page named 'PUZZLES' that contains a number of puzzles and recreational type questions. They gradually appear almost a week prior to each relevant lecture. Students are asked to answer these questions before attending the lectures. These light questions place the participant in the proper mind set where mathematical theories can be better absorbed and better appreciated. Indeed after learning the theory one can see how enriched ones thinking process has become.

12. POLICIES:

- University of Toronto Code of Behaviour on Academic Matters:

  https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-mattersjuly- 1-2019.
- **Policy on collaboration:** please note, while students are encouraged to work in small groups, trying to teach one another the main ideas of the course, when it comes to graded evaluations students are advised not to collaborate on the main ideas, structure or details of the submitted work.

  Please see University definitions of Academic Misconduct:

  www.artsci.utoronto.ca/The-rules/what-is-academic-misconduct

  www.artsci.utoronto.ca/The-rules/what-is-academic-misconduct
- **Email policy:**
  - Please post course content questions to **piazza** instead of asking them through email. This way the entire class can benefit from your questions. Your question can create a discussion, and various aspects of your questions may be hightlighte in these discussions.

  - Also please read the announcement page and course outline carefully for dates and various information. General inquiries about the course can also be posted on Piazza as they benefit everyone.
  - For **special considerations** beyond the grading policy of the course, or request for extensions or deferring evaluations please see course policies. Such requests are time sensitive. If you make such requests via email please don't expect an immediate answer and **do not stop working on your assignment hoping your request for an exemption will be granted.**
  - For all other issues, you are welcome to discuss your concerns over the email.

- **Late submissions:** Please note that Problem sets are not given any extensions for several reasons:
  - they are posted sufficiently in advance, and they need to be worked on in certain period of time, synchronized with the flow of material in the course.
  - any extensions will delay the process of marking. This is because certain sensitive information about which questions will get marked become available as the markers start marking. This can give unfair advantage to those who received extensions beyond half a day.
  - Sometimes solutions need to be posted shortly after the due date so that students can review them and get ready for their next project/assignment in the course. Any extension will interrupt this process and will not be appreciated by the majority of the class.

13. ACCESSIBILITY SERVICES:

The University provides academic accommodations for students with disabilities in accordance with the terms of the Ontario Human Rights Code. This occurs through a collaborative process that acknowledges a collective obligation to develop an accessible learning environment that both meets the needs of students and preserves the essential academic requirements of the University's courses and programs. Students with diverse learning styles and needs are welcome in this course. If you have a disability that may require accommodations, please feel free to approach your Course Instructor and/or the Accessibility Services as soon as possible. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course. Link to Accessibility Services website:
https://studentlife.utoronto.ca/department/accessibility-services/

14. COURSE SCHEDULE:

We cover chapters 1-5, 7-10, and 12. we may slightly deviate from this schedule by discussing material from sections 10.1 and 12.1 and 12.2, and 12.3 earlier in the course. But then we reorganize and get back on schedule. Please consider the lectures as a primary source for correcting this schedule.

Date	Tentative coverage	Events
Before Sep 7	Soft readings, Basics	self study
Sep 7-13	Basics, Chap 1	
Sep 18-21	Chapter 2	PS1 due Friday 22, 10:00 pm
Sep 25-28	Chapters 3,4	
Oct 2-5	Chapter 5	PS2 due Friday Oct 6, 10:00 pm
Oct 9-12	Chapter 7	Test 1: Fri. Oct. 13, 4-6 pm.
Oct 16-19	Chapter 7, 8	
Oct 23-26	Chapter 8, 12.3	PS3 due Friday Oct. 27, 10:00 pm
Oct 30- Nov 2	Chapter 9	
Nov 6-11	Reading week	Drop date Nov 6
Nov 13-16	Chapter 10	PS4 due, Friday Nov. 17
Nov 20-23	Chapter 10	Test 2 Fri. Nov 24, 4-6 pm.
Nov 27-30	Chapter 12	
Dec 4-7	Chapter 12	PS5 and Reflection essay due Fri. Dec 8