UNIVERSITY OF TORONTO
MAT246H1S LEC0101 and LEC5101,
Concepts in Abstract Mathematics, Winter 2024
Course Information,

as of January 16, 2024

1. LECTURES:

LEC0101 Tues. 13:00-15:00 Thurs. 13:00-14:00 MP 102
LEC5101 Mon. 18:00-20:00 Wed. 18:00-19:00 Wed 19:00-20:00 (Problem Session?) MP 103
Lecturer: Soheil Homayouni, email: homayoun at math.utoronto.ca
Office hours: Mondays and Wednesdays 10-11:30, zoom link posted in the course information module

LEC0201 Tues. 9:00-11:00 Thurs. 10:00-11:00 MC 252
Lecturer: Tonatiuh Matos Wiederhold t.wiederhold at mail.utoronto.ca
Office hours: Mon. 3:30-4:30, Fri. 10:30-11:30, more information to be posted on the information module

2. PRE-REQUISITES:

A full year course in Calculus: MAT133Y1/(MAT135H1, MAT136H1)/MAT137Y1, and MAT223H1 (with a high grade). Students with pre-requisites of 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 Robart's library**, also available in the bookstore.
- Solutions Manual for the first edition, to be found online, strongly recommended.
- **Extra readings:** 'Workbook Slides', 'Tutorial Preps', 'Soft Readings' and 'Puzzles' will be gradually posted on the various pages; these material are both supporting the textbook topics and ater to the course goals. As such the "extra readings" are all course requirements.

Warning:

1. Style of the textbook is sometimes intuitive, and brief. While this is the strength of the textbook, the course pursues goals **rigor**, **reflective**, and **Axiomatic approach**. The extra reading material, and various course activities supplement the textbook in the direction of such goals. As such we often go beyond the coverage and content of the textbook. Please keep in mind that to be fully prepared for the course, only textbook is not sufficient.
2. The first 9 chapters of the textbook seem familiar to many students. Please be aware that there are material that appear implicitly in the textbook, on which we shall elaborate in the extra readings. Please make sure not to miss the implicit ideas that will be discussed in the course, and appear in the tests and the Final Exam.
3. In the lectures, and in the workbook slides our attempt is to present arguments **more formal** than presented in the textbook.

4. Style of the Course:

It is important to note that the various course material appear in variety of formats and times to serve certain purpose. The timing of the review of these material is important for a more fulfilling experience in the course. Some of the activities seriously depend on the reading and preparation of the material beforehand.

- **Puzzles:** help with priming one's mind, and encourage certain style of thinking, in the natural, non-mathematical languages. Each puzzle is relevant to certain technical idea, discussed in the course, with the technical language of mathematics. They are posted one or two weeks earlier than the actual topic is discussed in the course. To fully benefit from these puzzles one is encouraged to think about them and try to solve them. And then, after learning about the relevant mathematics involved, trying to fit the puzzle in the technical language and solve them there.

- **Online Quizzes** serve as a preview of the upcoming week's lecture material. As such, they solely cover new material not covered in the lecture. To be successful in weekly online quizzes (due Monday afternoons) one must follow the quiz instructions and be prepared to read pages of the workbook slides.

- **Tutorial Prep Questions:** tutorials are given in the form of activities, in which students are expected to take part, and to discuss the "Tutorial Prep Questions." These questions range from puzzle like, to hands on problem solving, to technical and challenging questions. It is obvious that the more one has reviewed and reflected on these questions the more one benefits from Tutorials. Please note that Tutorials are most useful to those who get involved in the activities, for which one needs to have deepened on the Prep Questions. These questions are based on the technical details of the Lecture coverage that has taken place a week ago or it is taking place in the same week.

- **Lectures' Priming Questions:** sometimes a short list of questions will be published ahead of a lecture, with the purpose of giving a mental direction to the participants. During the lectures these questions shall appear in variety of shapes and formats. Students are expected to attempt these questions, when they are put to discussions. Often these questions are not technical, and so there may not be a concrete answer to them, so one may not be able to take "correct answer" home for the test prep. The only way to benefit from these questions is to be mentally prepared with them.

- **Lectures, and Lecture Slides:** Lectures will be given in a mix of slides and chalkboard presentations. Slides are far from including complete details. Most of the details will be discussed during the lectures, and students need to be prepared to take notes on these details and on the various new questions and directions that are suggested during the lectures.

- **Attendance and Attentiveness:** attendance and being attentive are mandatory in both Lectures and Tutorials. There are marks allocated for these items. Lecture Pop-up Quizzes are designed to measure both physical attendance and mental attentiveness. These are short, rather simple questions that appear at certain punchlines in the lecture. For a mentally present student it takes few minutes to answer such questions. The marking of such quizzes will be divided between a mark for attendance and a couple of marks for attentiveness. If consistently followed, this process can bring about a good stamina for focusing on the lectures during a math lecture.

5. 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; they each have their purpose. The biggest hurdle on the way of the performance of 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 learning and 'knowing' mathematical ideas. Once we reflect on each trend, and see them in action, by 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, and express complex ideas; this is the language of mathematics. Such process, of learning and working with mathematical concepts, opens the door to new cognitive frontiers. We add a toolkit of abstract mathematical concepts,

definitions and theorems, 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 stamina for a young person with ambitions for being in touch with Mathematics and Sciences for a long time.

6. GRADING SCHEME:

- Problem sets: 14% (PS1 and PS2 each worth 4% and PS3 is worth 6%)
- Lecture Pop Quizzes: 10%
- Tutorial quiz: 2%
- Tutorial attendance 5%
- Weekly Online quizzes 10%
- Midterm tests: 20%
- Final exam: 42%
- Reflective essay: 4%
- Piazza registration (no later than Jan 24) and involvement: 1%

Note:

- The weights add up to 108, so there are 8% bonus marks in the course. This extra mark can easily cover missing quizzes or a problem sets. Due to this extra mark **no make up** for a missing quizzes or problem sets shall be made.
- As we proceed in the course, some of the later assessments might include some bonus marks to compensate for a particularly challenging or extra questions, or possible low term marks. Such marks will appear in the second half of the course, where student develop a deeper wisdom about the course material and can benefit from more challenging content.
- Components of Tutorial Quiz 2, PS3, Online Quizzes 7, 8,9,10, final exam, and the last 4 weeks of lecture quizzes, together are worth 56-60 marks, while the rest of material will worth 48-52 marks. This means that the newer, more challenging material of chapters 10 and 12 are more heavily covered, and students should keep this in mind, and clearly plan for it.
- The marking of the term work is generally rigorous for the sake of good feedback to students. As such the term marks in the first half of the course might be much lower than expected. It is expected that the feedback start impacting the study habits and approaches of the students to the course. To compensate for this loss the second half of the course will include more bonus marks. It is reasonable to expect students are at their best stage of maturity at the end of the course, and can earn more bonus marks in the final exam and the last few assessments.
- Please be aware of the item "*Lecture Pop Quizzes*". This item encourages and measures two important attitude: **attendance** in lectures, and **being attentive** while attending the lectures. This is a valuable training, to attend in a focused and attentive way, and to prolong one's focus and attention span. Therefore, this item of evaluation might be more important contribution to the grade than just a numerical input. 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 to be adjusted, and the weight of it might become heavier. This means that a low mark in this category won't be strong enough to attract a bigger contribution to the possible adjustments. In simple words the message is that a consistent attendance and attentiveness could be rewarded in more ways than 10%.

- To prevent inflating of the grades, let's tentatively assume the extra marks in each category will remain in the same category. However, in extraordinary cases when the grades are low, we may want to allow the bonus marks to overflow from one category and to improve the overall grades. So please continue being active and earn the bonus marks as they might help the marks on other categories.

  Warning: in the last third of the course some of the most important of the course material will be studied, and the Final Exam will have a more important role in assessing the quality of one's experience in the course. Therefore, taking part in the Final exam is not optional, and a 30% on this component is needed for passing the course.

- **Missing term tests:** Make up tests will be given within a few days of the regular seating, at odd times that might not be convenient for everyone. It is possible that a candidate might have to miss another important activity in their schedule in order to make it to the make up session. And if a make up for the midterm is not written a mark of 0 will be assigned to the missing test. This means there will be no carrying over of the term test weight to other assessments. The missed Final Exam will be dealt with by the examination office.

- **Evaluations Explained:**

  Evaluations are designed to encourage a consistent and effective engagement with the course. This engagement is necessary for a full learning experience. Marks and Comments on each of the assessments serve as feedback (and not a judgment). Please understand the philosophy of each assessment, and plan to attend them with an appropriate mindset.

  - **Online Quizzes:** these are weekly quizzes based on reading of the posted workbook slides, either reviewing or previewing the material to be presented in the coming week. They aim at,
    - getting in the habit of the reading independently through pages of the Workbook,
    - preview of the next week material,
    - practice writing formal arguments, and receiving feedback.
  - **Problem sets:** These are deeper questions that help students with more reflection and deepening on the course material. Problem sets 1 and 2 will be lighter, and PS3 will be heavier due to the nature and complexity of the material. Problem sets will be administered on Crowdmark. See item below on Problem sets.
  - **Term Tests:** about 100 minutes long, these are the ultimate review and feedback opportunities in the course. Details to be posted (see the course schedule for date and time.) The second term test is given shortly before the drop deadline, and the the make up must be written on Saturday so that we can post the solutions for students to know how they have done and have a better judgment of their performance before the drop date.
  - **Final Exam:** Details and coverage will be posted at the end of the term. Please note that final exam heavily covers the material from after the mid term, that is, material from chapters 9, 10 and 12. Also material from chapters 1-8 that appear in the Final Assessment are of the nature of connecting the dots throughout the course.
  - **Reflection Essay:** 'Learning' is a process, with one foot in the conscious realm and another in the unconscious. 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 aspects of learning get nurtured. Students are asked to reflect on certain ideas, and in the end they are asked to write a reflective essay addressing a selection of the soft readings and course content.

Please be aware of the philosophy of each category, and make it your goal to learn how to prepare for each item. This is the first item of reflection: the beginning of a reflective journey that shall enhance one's learning experience in the course.

7. LECTURES:

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

- the personal take from an oral presentation, which is far richer than the packaged ideas that go 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 falls 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.

8. TUTORIALS:

- TUT0101 Mon 14:00-15:00 AB 107 Dong Hao
- TUT0501 Mon 15:00-16:00 AB 107 Dong Hao
- TUT5101 Tues 17:00-18:00 HS 106 Aditya
- TUT5201 Tues 18:00-19:00 SS 1072 Jacob
- TUT0201 Wed 12:00-13:00 AB 107 Patrice
- TUT0301 Wed 16:00-17:00 HS 106 Patrice
- TUT0601 Thu 12:00-13:00 WB 219 Jacob
- TUT0401 Fri 11:00-12:00 SS 2125 Aditya

Tutorials run in the form of 'Activities' based on pre-assigned questions. Technical ideas will be discussed, and more **challenging examples** will appear and be solved in details. But most importantly, in the tutorials students get to speak and to discuss the technical ideas. Activity questions are posted well in advance, and one is encouraged to reflect on them before the tutorial, and to discuss their ideas in groups during the tutorial. 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. In case of missed tutorial one is encouraged to attend another tutorial that same week to get exposure to the tutorial material. Unfortunately Tutorial attendance are not transferable to another tutorial.

9. PROBLEM SETS:

Problem sets take longer 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, crucial for the journey in the course, and for writing the various other quizzes and tests.

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 the final written answers will become similar, and any changes will be cosmetic, 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. There are two main reasons for this:

- the first reason is that the class can start working on a partially (but mostly) 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 and produce 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 marking scheme to the problem sets will become public before the markers could start marking the problem set, and solution become available for students to check the intended solutions while their minds are fresh. Therefore any individual extension will interfere with the marking and posting of the solutions.

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 this. 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.

10. 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/

11. 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 an assessment 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/winter2024/mat246h1s

12. PUZZLES, and recreational type questions:

There is a page named 'PUZZLES' containing puzzles and recreational type questions. They gradually appear almost a week prior to each relevant lecture. Students are asked to think about these questions before attending the lectures and tutorials. 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.

13. 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

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- **Email policy:**

  - Please post course content questions to **piazza** instead of asking them through an 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 highlighted 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 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.

14. 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/

Please note that Lecture Quizzes require attendance and attentiveness, and cannot be given in another centre, or the purpose of such evaluations will be defeated. Online Quizzes and Problem sets are posted well in advance, and for the reasons of marking schemes and solutions, as discussed earlier do not lend themselves to extensions. So please start earlier. An accommodations letter on the 11^{th} hour before a due date will not be accepted.

15. 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 Jan 8	Soft readings, Basics	self study, Online Quiz 1 due Monday Jan 8
Jan 8-12	Basics, Chap 1	Lectures and Tutorials begin
Jan 15-19	Chapter 2	Problem set 1 posted
Jan 22-26	Chapter 3,4	
Jan 29-Feb 2	Chapter 5	Problem Set 1 due 10:00 pm. Friday Feb. 2
Feb 5-9	Chapter 7	Test 1: Fri. Feb. 9, 4-6 pm.
Feb 12-16	Chapter 7, 8	
Feb 19-23	Reading week	no classes
Feb 26-Mar 1	Chapter 8, 12.3	Problem Set 2 due 10:00 pm. Friday Mar. 1
Mar 6-10	Chapter 9	Test 2, Friday Mar 8, 4-6 pm.
Mar 11-15	Chapter 10	Drop date Mar 11
Mar 18-22	Chapter 10	Tutorial Quiz
Mar 25-29	Chapter 12	
Apr 1-5	Chapter 12	PS3 due Fri. April 5, 10:00 pm.*
		Reflection essay due Fri. April 5, 10:00 pm.

* Please note, depending on the Final Exam's date, if later in the exam period, these due dates might be take a couple of days of extension. This is to be announced closer to the due dates.