DEPARTMENT OF MATHEMATICAL AND COMPUTATIONAL SCIENCES UNIVERSITY OF TORONTO MISSISSAUGA

MAT309H5F LEC0101 Introduction to Mathematical Logic Course Outline - Fall 2019

Class Location & Time Wed, 03:00 PM - 05:00 PM MN 3150

Fri, 01:00 PM - 02:00 PM MN 3150

Instructor Alex Rennet

Office Location

Office Hours WE 2:30-3, FR 12-1, and by appointment

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Course Web Site https://q.utoronto.ca

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Course Description

The nature of axioms, proofs and consistency. Introduction to the theory of recursive functions. Gdel's incompleteness theorems and related results. This course emphasizes rigour. [36L, 12T]

Prerequisite: MAT102H5, MAT134H5/MAT136H5/MAT134Y5/MAT135Y5/MAT137Y5/MAT157Y5, MAT224H5/MAT240H5

Exclusion: CSC438H1,CSC309H1,MATC09H3 (SCI)

Distribution Requirement: SCI

Students who lack a pre/co-requisite can be removed at any time unless they have received an explicit waiver from the department. The waiver form can be downloaded from here.

Learning Outcomes

By the end of this course, students will be able to:

- 1a. Clearly and confidently give an oral presentation and explanation of their written mathematical work.
- 1b. Thoughtfully respond to feedback on their work, whether given by peers synchronously in class, or asychronously via written commentary by a marker.
- 1c. Respectfully give effective feedback to peers on their oral presentations of their written work.
- 2a. Write rigorous mathematical proofs using clear and consise argumentation, correct course-specific terminology, and the typesetting software LaTeX (or equivalent.)
- 2b. Effectively read a semi-scaffolded mathematical text on an advanced topic using advanced techniques such as: stopping to type-check, create examples and counterexamples, formulating questions and testing conjectures, considering modified definitions, carefully parsing notation and wording, etc.
- 3a. Analayze a novel definition or concept (related to the course material), conjecture whether a related statement is true or false, and (respectively) prove or disprove the statement.
- 3b. Explain or define basic concepts and give examples to illustrate them from Proof Theory, Computability Theory and Model Theory (e.g. languages and formulas, deductions and basic semantics, computable and computably enumerable sets of natural numbers, standard and non-standard models of arithmetic and various other theories.)
- 4a. Recall the key steps in a proof of Godel's Incompleteness Theorems, and elaborate on further details of those steps and the concepts and definitions involved.
- 4b. Recognize the historical context and evaluate the importance of Godel's Incompleteness Theorems in relation to the foundations of mathematics.

5. Effectively collaborate with a team of peers to analyze and solve problems involving topics from the course material.

Textbooks and Other Materials

The textbook for this course was written by the instructor, and is specifically tailored to the content and style of this course.

The textbook is free, and will be made available in sections, throughout the term, on Quercus.

Assessment and Deadlines

Type	Description	Due Date	Weight
Term Test	In-Class Midterm (110 minutes)	2019-10-30	15%
Assignment	5 Hand-In Assignments	On-going	20%
Final Exam	Final Exam	TBA	35%
Presentations		On-going	25%
Class Participation		On-going	5%
		Total	100%

More Details for Assessment and Deadlines

Midterm Info

There will be one 110-minute midterm written during class time on Wednesday, October 30th (and so starting at ~3:10pm) in the usual class room.

If you have a conflict with the timing of the midterm (for instance, if you have another course with a midterm scheduled during this time), then you need to bring this to my attention by September 20th (please email or bring a copy of your timetable and the syllabus of the course with the conflicting midterm). But note that since our midterms take place during class time, the issue would have to be resolved with the *other course*, typically.

There will not be a make-up midterm.

Assignment Info

There will be five hand-in assignments, due on the dates listed below, at 11:59pm (~midnight), by uploading a .pdf file to Quercus.

Your work <u>must</u> be typeset using LaTeX (or equivalent). Hand-written documents, or documents written in other word processing software will not be accepted. Note that one of the learning outcomes for the course centres around writing math, and in particular, writing math using LaTeX.

- 1. September 21st
- 2. October 3rd
- 3. October 19th
- 4. November 9th
- 5. November 23rd

Assignments will be posted approximately one week before they are due. Your marked work will (barring unforeseen circumstances) be returned within one week of submission.

Assignment Responses

Approximately two weeks after the original assignment due date, you will be able to submit an"Assignment Response". This is a document which fixes major and minor errors in your original submission, and specifically addresses comments and concerns brought up by the marker of your assignment. Up to the discretion of the marker, you will be able to recoup up to half of the lost marks from the assignment.

For example, if you received 15/20 on an Assignment, your mark could increase to 17.5/20 if the marker thought your response was thorough and correct.

Further instructions will be given during the semester.

Participation

Students' participation mark will be determined by the instructor at the end of the course, and will take into account the extent to which they attended and participated in class discussions and in any in-class group work, as well as their efforts tomaintain an inclusive atmosphere in the classroom by treating fellow students with respect.

Penalties for Lateness

Late assignments will not be accepted unless you obtain explicit permission in writing (i.e. by email) from the instructor. Requests for extensions made within 24 hours of when the assignment is due are much less likely to succeed!

There are no make-up midterms, assignments, or presentations.

Procedures and Rules

Missed Term Work

If you have a legitimate reason (e.g. illness, other impairment, etc.) for being unable to attend class or complete some other aspect of the course work then you need to submit documentation to the instructor as soon as possible. If this is a recurring situation for whatever reason, you should speak to the instructor about your situation as soon as possible.

• In all cases of illness etc, you must use the official UTM medical certificate. The certificate must specify the period during which you were unable to carry out your academic work.

Missed Final Exam

Students who cannot write a final examination due to illness or other serious causes must file an<u>online petition</u> within 72 hours of the missed examination. Original supporting documentation must also be submitted to the Office of the Registrar within 72 hours of the missed exam. Late petitions will NOT be considered. If illness is cited as the reason for a deferred exam request, a U of T Verification of Student Illness or Injury Form must show that you were examined and diagnosed at the time of illness and on the date of the exam, or by the day after at the latest. Students must also record their absence on ACORN on the day of the missed exam or by the day after at the latest. Upon approval of a deferred exam request, a non-refundable fee of \$70 is required for each examination approved.

Academic Integrity

Honesty and fairness are fundamental to the University of Toronto's mission. Plagiarism is a form of academic fraud and is treated very seriously. The work that you submit must be your own and cannot contain anyone elses work or ideas without proper attribution. You are expected to read the handout How not to plagiarize (http://www.writing.utoronto.ca/advice/using-sources/how-not-to-plagiarize) and to be familiar with the Code of behaviour on academic matters, which is linked from the UTM calendar under the link Codes and policies.

Students are encouraged to work on assignments in groups.

When working on an assignment, students are nevertheless required to followthree simple rules:

- 1. If working in a group, then on each copy of the assignment handed-in, students should record their group members and which questions they worked on. (Yes, that is sometimes complicated to do, but do your best.)
- 2. Students should cite any and all sources they look at in their work. (Copying or submitting someone else's work, letting someone copy or submit your work, writing a solution for another student, or having another student write a solution for you are all cases of Academic Dishonesty.)
- 3. **Students must each write-up their own answer to each question.**(This includes using Wikipedia, other websites, textbooks or articles from outside the course, etc.)

Final Exam Information

Duration: 3 hours Aids Permitted: None

Additional Information

This class will be conducted using an inquiry-based learning approach.

This means that most of the class time will be devoted to student presentations and discussion. Students are expected to work regularly on the assigned exercises, and present their (complete or partial) solutions on the board in front of the class. Presentations will generally be followed by a discussion with the class.

Every student is expected to present their work regularly (approximately, at least once every two weeks.)

Regarding Prerequisites

I strongly recommend that in addition to the course's listed prerequisites, you should have also completed at least one other 300-or 400-level MAT course and one of MAT157/240/202 with a mark of at least 70%.

Please speak to me if you are unsure about whether you are well-prepared for this course (and note that if you have *less* than the required prerequisites, I am highly unlikely to support an application to waive the prerequisites).

I typically tell people that the wider the range of mathematics they've seen, and the more mathematically mature they are, the better prepared they will be for the course.

Last Date to drop course from Academic Record and GPA is November 7, 2019.