UNIVERSITY OF TORONTO SCARBOROUGH
MATD01 FIELDS AND GROUPS
SYLLABUS - WINTER 2020

Course Description: The ultimate goal of the course is to prove that there is no general formula for the roots of a polynomial of degree ≥ 5. The theory used to prove this statement is called Galois theory (named after the French mathematician Évariste Galois (1811-1832)). Before we get to Galois theory, we need to learn about rings and fields. We will also learn some more about groups (note that we will assume that students are comfortable with group theory to the extent covered by MATC01). For a list of topics see the tentative weekly schedule at the end of this document.

Prerequisite: MATC01H3

Exclusion: (MAT302H), MAT347Y, (MATC02H3)

Recommended Preparation: MATC34H3

Lectures Location and Time: Mondays 12-1 and Wednesdays 1-3. Check the timetable for location.

Instructor: Payman Eskandari, office: ?, email: payman@math.utoronto.ca

Office Hours: To be announced.

Teaching Assistant: Pourya Memarpanahi, email: pourya.memarpanahi@utoronto.ca

Course Webpage: `http://www.math.utoronto.ca/payman/MATD01/main.html`
We will use Quercus for the purposes of announcements and recording grades.

Textbook (Required): Galois Theory by Joseph Rotman, Second Edition.
We may however treat things differently at times. It is the student's responsibility to be aware of what is discussed in lectures.

Grading Scheme:
Note: This section was updated after a new grading scheme was approved by the majority of the class in a vote that took place between March 21-24 on Quercus.

Final course grade = the maximum of the two grades calculated based on the two formulas A and B below.

- Formula A:
  - Best 6 of Assignments 1-9, in total worth 45 %
  - Midterm (Wed Feb 26 in class.), worth 30 %
  - Takehome Exam, due during the exam period, to be posted 1 week before its due date on Crowdmark, worth 25 %
- Formula B:
  - Best 6 of Assignments 1-9, in total worth 45 %
  - Midterm, worth 40 %
  - Takehome Exam, due during the exam period, to be posted 1 week before its due date on Crowdmark, worth 15 %

The original tentative due dates for the Assignments 1-9 were Jan 17, Jan 24, Jan 31, Feb 7, Feb 14, Mar 6, Mar 13, Mar 20, Mar 27. The midterm took place on Wed Feb 26 in class.

More on Assignments: The assignments form a very important part of the course. The purpose of them is to complement the lectures, improve your understanding of the material, and prepare you for the midterm and final. In addition to the assignments that are to be submitted for grading, most weeks you will be provided with a list of extra practice problems. You are expected to work on these as well. (They might be relevant for the test or exam.)

Assignments may include new material at times. Anything covered in (the mandatory part of) the assignments is considered a part of the course and is to be treated the same as material covered in the lectures. (So you are expected to know them.)

Note that only a selected number of questions will be graded on each assignment (due to time limitations).

Policies:

Policy for Late/Missed Assignments: Each assignment must be submitted before its deadline. Assignments submitted late (or not submitted) will be recorded with a grade of zero. The lowest three assignments will be dropped in the end.

Policy for Missed Midterm due to an Emergency: Students who miss the midterm for reasons beyond their control must submit a request for special consideration to the instructor no later than 5 days after the midterm, explaining the reason for missing the test. The request must be accompanied with the appropriate supporting documentation, such as the Verification of Illness or Injury Form (`http://www.illnessverification.utoronto.ca/`) in the case of a medical emergency. If the request for special consideration is approved, the weight of the midterm will be transferred to the final exam.

Policy for Conflicts: Since the midterm is scheduled during class time conflicts are not considered a valid reason for missing the midterm.

Policy for Term Work Regrade: Regrade requests for any piece of term work must be submitted within a week after the grades of the assessment in question are posted on Quercus.

Collaboration versus Plagiarism: You are encouraged to discuss the problems sets with each other, but each of you must write up your own solutions independently. If you find the solutions in books or on the internet, you must quote your source, and still write up the solution in your own words. You are expected to be be familiar with the University's Code of Behaviour on Academic Matters, available at the following link:

`http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppjun011995.pdf`

You are also expected to have read the document *How Not to Plagiarize* available at the following link:

`http://www.writing.utoronto.ca/advice/using-sources/how-not-to-plagiarize`

Accessibility Services: The University of Toronto is committed to accessibility. If you have any accessibility concerns about the course, or require any accessibility-related accommodation, please contact the Accessibility Services (`www.studentlife.utoronto.ca/as`) as soon as possible.

Email Policy: Math questions will likely not be answered over email. Emails are mainly to be used for administrative purposes. Please use your @mail.utoronto.ca or @utoronto.ca email account to contact the teaching staff, and include MATD01 in the subject line. If the answer to an email is included in the syllabus, the email might not receive a response.

Tentative Weekly Plan of Lectures: The chapter numbers are from the textbook. Note that this schedule is just to serve as a rough guideline. Students are responsible to know what is covered in lectures each week.

- Week 1: Rings, fields and domains (Ch. 2 and 3)
- Week 2: Homomorphisms, ideals and quotient rings (Ch. 4 and 5)
- Week 3: Polynomial rings over fields (Ch. 6)
- Week 4: Prime and maximal ideals (Ch. 7)
- Week 5: Irreducible polynomials, classical formulas for roots of quadratic, cubic, and quartic polynomials (Ch. 8 and 9)
- Week 6: Field extensions, splitting fields (Ch. 10)
- Week 7 (only one hour lecture because of the midterm): The Galois group (Ch. 11)
- Week 8: The Galois group, Roots of unity (Ch. 11 and 12)
- Week 9: Solvability by radicals (Ch. 13)
- Week 10: Independence of characters (Ch. 14)
- Week 11: Galois extensions and the fundamental theorem of Galois theory (Ch. 15 and 16)
- Week 12: Catching up, or perhaps another topic.