MAT1101: Algebra II
Winter 2025
University of Toronto

I. Instructor

Course Instructor Name:
Daniel Litt
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Office Hours: 4pm Tuesdays, Huron 1018

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II. Course Overview

Course Description
Fields: Algebraic and transcendental extensions, normal and separable extensions, fundamental theorem of Galois Theory, solution of equations by radicals.

Commutative Rings: Noetherian rings, Hilbert basis theorem, invariant theory, Hilbert Nullstellensatz, primary decomposition, affine algebraic varieties. Structure of semisimple algebras, application to representation theory of finite groups.

Course Objectives
The primary goal of this course will be to learn the basics of Galois theory, some commutative algebra, and the basics of the representation theory of finite groups.

Textbooks/ Course Readings
Dummit and Foote, Abstract Algebra
Grillet, Abstract algebra
Jacobson, Basic Algebra, Volumes I and II.
Lang, Algebra, 3rd ed.
Serre, Linear representations of finite groups

How this course is organized:
This course will consist of two weekly meetings and a regular tutorial, starting the week of January 20. Homeworks will be disseminated via Crowdmark.

II. Evaluation/ Grading Scheme

Mark Breakdown

Assignments	40%
Term Test	25%
Final Assessment	35%

Assignments
There will be 5 assignments, of which the one with lowest grade will be dropped (late submissions will receive a mark of zero unless an extension is received from the instructor). Tentative due dates can be found in the lecture schedule at the end of this document.

Term Test
There will be one term test, which will be 1.5 hours long, on February 13 in class.

Final Assessment
The final assessment will be held during the final assessment period in April 2024 and will be scheduled by the registrar.

III. Course Policies

Policy on Missed Term Work

Late work will receive a 0, unless an extension is given by the instructor beforehand.

Students who are absent from class for prolonged periods and who require consideration for missed academic work *should contact the instructor and verify their absence(s) through either the Absence Declaration tool, Verification of Illness or Injury (VOI) form, College Registrar Letter, or Letter of Academic Accommodation from Accessibility Services, as appropriate to their situation*.
https://www.artsci.utoronto.ca/current/academics/student-absences

The absence declaration can be used once per term. Outside of the one time absence declaration use, students must adhere to the alternate processes for absences listed above, as well as the missed work policy as set out in each course's syllabus.

If you miss a term test, then you must inform your course Instructor within 72 hours of the test. No exceptions. If your request is approved, you may receive an accommodation. The accommodation to be used will be decided by your instructor. Some examples of accommodations may include: an oral exam, written make-up test, or a re-weighting of your assessments. *(Academic Handbook Section 7 Missed Term Work or Tests)*

Re-marking Policy
A student who believes an individual item of work has been incorrectly or unfairly marked may ask the person who marked it for a re-evaluation. With evidence to back their appeal, students should make such requests as soon as reasonably possible after receiving the work back, but no later than 2 weeks after it was returned.
(Academic Handbook Section 5.14 Requests to Re-mark Assignments & Term Tests)

Email Policy
Should you have a question that is not answered on the course site (please check there first!) please note that all communications with the Course Instructor or TA's must be sent from your official utoronto email address, with the course number included in the subject line. If these instructions are not followed, your email may not be responded to. Please write in a professional manner.
(Academic Handbook Section 2.21 Online Communication Policy)

IV. Institutional Policies and Support

Academic Integrity
All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters (https://governingcouncil.utoronto.ca/secretariat/policies/codebehaviour-academic-matters-july-1-2019). If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, please reach out to your Course Instructor. Note that you are expected to seek out additional information on academic integrity from me or from other institutional resources (for example, the University of Toronto website on Academic Integrity http://academicintegrity.utoronto.ca/).
(Academic Handbook Section 12 Academic Integrity)

Accessibility
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 office 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/
(Academic Handbook Section 13 Accessibility/Disability Issues)

Equity, Diversity and Inclusion
The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. U of T does not condone discrimination or harassment against any persons or communities.

Important Academic Dates & Deadlines
The academic dates include enrolment dates, drop deadlines, exam periods, petition deadlines and more.
https://www.artsci.utoronto.ca/current/dates-deadlines/academic-dates

Other Academic and Personal Supports

- Writing Centre https://writing.utoronto.ca/writing-centres/arts-and-science/
- U of T Libraries https://onesearch.library.utoronto.ca/
- Student Code of Conduct: https://governingcouncil.utoronto.ca/secretariat/policies/code-studentconduct-december-13-2019
- Feeling Distressed? https://studentlife.utoronto.ca/task/support-when-you-feel-distressed/
- Academic Success Centre https://studentlife.utoronto.ca/department/academic-success/
- College/Faculty Registrars https://future.utoronto.ca/current-students/registrars/

V. Rough Schedule of Lectures

Week 1 (Jan 6-10) Galois theory, field extensions
Week 2 (Jan 13-17) Algebraic closures, algebraic extensions, splitting fields, normal extensions, first homework due
Week 3 (Jan 20-24) Normal closures, separability, perfect fields, Frobenius, separable degree
Week 4 (Jan 27-31) primitive element theorem, fundamental theorem of Galois theory, examples, homework 2 due
Week 5 (Feb 3-7) Finite fields, radical extensions, solvability by radicals
Week 6 (Feb 10-14) Unsolvability of the quintic, term test
Week 7 (Feb 17-21) Reading week
Week 8 (Feb 24-28) Noetherianity, Hilbert basis theorem, finite/finite type extensions, homework 3 due
Week 9 (March 3-7) Zariski's lemma, Nullstellensatz, Spec and Zariski topology
Week 10 (March 10-14) irreducible components, minimal primes, Nakayama lemma, homework 4 due
Week 11 (March 17-21) Semisimple modules and rings, Artin-Wedderburn
Week 12 (March 24-28) Representation theory of finite groups
Week 13 (March 31-April 4) More representation theory of finite groups, homework 5 due