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MATH 5109W/MAT 5142
ALGEBRA II: GROUPS AND GALOIS THEORY
Winter 2025

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We, the people of the Faculty of Science at Carleton University, acknowledge that our campus is located on the traditional, unceded territories of the Algonquin Anishinabeg people. Miigwetch for your hospitality and stewardship of this territory and the teachings that come from it. We are grateful for this land, the air that we breathe, and the water that sustains us all as well as for the animals, plants and other living beings: these enable us to research, teach, mentor, support, study, and learn. We recognize our responsibility to our natural environment and to reconciliation with Indigenous peoples.

Course Instructor: Colin Ingalls	**Office Location:** Room 4229, Herzberg Laboratories
Email: ColinIngalls@cunet.carleton.ca	**Class Location:** Loeb A B243
Student Hours: TBA	**Class Time:** T Th 2:30-4pm
Best ways to contact: in class,	**Gender Pronouns:** (he/him/his)
via email or during student hours	**Department/Unit:** Mathematics and Statistics

Topics Covered and Learning Outcomes

Inclusive teaching statement:

- I am committed to fostering an environment for learning that is inclusive for everyone regardless of gender identity, gender expression, sex, sexual orientation, race, ethnicity, ability, age, class, etc.

- All students in the class, the instructor, and any guests should be treated with respect during all interactions.

- It is my hope that our class will support diversity of experience, thought, and perspective.

- Please feel free to contact me via email or in person to let me know about any experiences you have had related to this class that have made you feel uncomfortable.

- I will continually strive to create inclusive learning environments and would therefore appreciate your support and feedback.

- I welcome emails or in-person communications to let me know your preferred name or pronoun.

Topics to be Covered: Group actions, class equation, Sylow theorems, central, composition and derived series, Jordan-Holder theorem, field extensions and minimal polynomials, algebraic closure, separable extensions, integrality, Galois groups, fundamental theorem of Galois theory, finite fields, cyclotomic field extensions, fundamental theorem of algebra, transcendental extensions.

Tentative Schedule

Week	Topic/content	Reading/Prep for Class
Jan. 7-9	Group Actions, Orbits and Stabilizers	Ash 5.1-2, DF 4.1-2
Jan. 14-16	Sylow Theorems, Applications	Ash 5.3-4, DF 4.3-6
Jan. 21-23	Composition Series, Solvable, Nilpotent Groups	Ash 5.6-7, DF 3.4, 6.1
Jan. 28-30	Generators and Relations, Field Extensions	Ash 5.8,3.1, DF 13.1-3
Feb. 4-6	Splitting Fields, Algebraic Closure	Ash 3.2-3, DF 13.4
Feb. 11-13	Separability, Normal Extensions	Ash 3.4-5, DF 13.5-6
Feb. 18-20	Break	No classes
Feb. 25-27	Review, Midterm	
Mar. 4-6	Fixed Fields and Galois Groups, Galois Theorem	Ash 6.1-2, DF 14.1-2
Mar. 11-13	Computing Galois Groups, Finite Fields	Ash 6.3-4, 14.3, 14.8
Mar. 18-20	Finite Fields, Cyclotomic Fields	Ash 6.4-5, DF 14.3, 14.5
Mar. 25-27	Cyclic and Kummer extensions	Ash 6.7, DF 14.5
Apr. 1-3	Solvability by Radicals, Transcendental Extensions	Ash 6.8-9, DF 14.9
Apr. 8	Review	

Important dates and deadlines can be found here: link, including class suspension for fall, winter breaks, and statutory holidays.

Assessments

Grade Breakdown

Component	Grade Value	Date
Assignment 1	5%	Jan. 23
Assignment 2	5%	Jan. 30
Assignment 3	5%	Feb. 6
Assignment 4	5%	Feb. 12
Assignment 5	5%	Mar. 13
Assignment 6	5%	Mar. 20
Assignment 7	5%	Mar. 27
Assignment 8	5%	Apr. 3
Midterm	15%	Feb. 27
Final	45%	

Late and Missed Work Policies

You are expected to do all the assignments. No make up, early, or delayed assignments. Any missing assignments will be counted as zero.

The assignments must be your own work. In particular, you must cite everything you are taking from the literature or that you discussed with someone else.

Learning Materials and other Course/Lab Resources

Students are not required to purchase textbooks or other learning materials for this course.

The following books are useful resources:

Dummit and Foote, "Abstract Algebra"

Ash, "Abstract Algebra: The Basic Graduate Year"

Stewart, "Galois Theory"

Cox, "Galois Theory"

Rotman, "Galois Theory"

Garling, "Galois Theory"

Academic Accommodations and Regulations

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes are outlined on the Academic Accommodations website (https://students.carleton.ca/course-outline/).

Statement on Chat GPT/Generative AI usage

As our understanding of the uses of AI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of AI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course.

Statement on Academic Integrity

Students are expected to uphold the values of academic integrity, which include fairness, honesty, trust, and responsibility. Examples of actions that that compromise these values include but are not limited to plagiarism, accessing unauthorized sites for assignments or tests, unauthorized collaboration on assignments or exams, and using artificial intelligence tools such as ChatGPT when your assessment instructions say it is not permitted.

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in Carleton University's Academic Integrity Policy (see here). A list of standard sanctions in the Faculty of Science can be found here. Additional details about this process can be found on the Faculty of Science Academic Integrity website. Students are expected to familiarize themselves with and abide by Carleton University's Academic Integrity Policy.

Student Rights and Responsibilities

Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the 7 Rights and Responsibilities Policy for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.

Student Concerns

If a concern arises regarding this course, your first point of contact is me: Email or drop in during student hours and I will do my best to address your concern. If I am unable to address your concern, the next points of contact are (in this order):

1. Your professor for the course

2. The Undergraduate Chair of the Department (if applicable)

3. The Departmental Chair or Director

4. Office of the Dean of Science (odscience@carleton.ca)

Note: You can also bring your concerns to Ombuds services.