

Abstract Algebra II Syllabus

Department of Mathematics and Statistics

MATH 3032 winter 2024

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructor

Name	Email	Office Hours
Neil J. Ross	neil.jr.ross@dal.ca	M 12:00 - 13:30 W 15:30 - 17:00 Chase 213

Course Description

Rings, fields, integral domains, Fermat's theorem, Euler's theorem, ideals, quotient rings, prime and maximal ideals, factorization of polynomials, Gröbner bases, Unique Factorization Domains, Euclidean Domains and Gaussian integers, and applications as time allows.

Course Prerequisites and Exclusions

Prerequisites: MATH 3031.03; exclusions: MATH 3030X/Y.06

Student Resources

Students are encouraged to attend office hours. Comments, questions, and concerns can be addressed to the instructor by email. Emails will be answered within 2 business days.

Course Structure

Course Delivery

The course is lecture-based, with weekly assignments, a midterm, and a final. All lectures will be in-person. The course will have a presence on Brightspace, where assignments, solutions, grades, and announcements will be posted.

Lectures

The lectures will take place in person MWF, 14:35–15:25, in LSC C202.

Course Materials

We will cover Part II of David S. Dummit and Richard M. Foote's *Abstract Algebra* (3rd edition). Strictly speaking, the textbook is not required. Students are, however, encouraged to obtain a copy. A limited number of copies will be available from the instructor's office. Please reach out to the instructor via email if you would like to borrow one of these copies.

Assessment

The final grade for the course will be computed as follows:

- assignments: 30%,
- midterm: 30%, and
- final: 40%.

A student must obtain a grade of 50% or higher on the final exam in order to pass the course.

Assignments

There will be 10 assignments throughout the term. The assignment with the lowest grade will be dropped. The remaining 9 assignments will contribute equally to the final grade (i.e., each of the 9 assignments that count towards the final grade is worth $30/9\%$ of the final grade).

Dates for the assignments are detailed below.

- Assignment 1: posted 12/01; due 19/01.
- Assignment 2: posted 19/01; due 26/01.
- Assignment 3: posted 26/01; due 01/02.
- Assignment 4: posted 01/02; due 09/02.
- Assignment 5: posted 09/02; due 16/02.
- Assignment 6: posted 01/03; due 08/03.
- Assignment 7: posted 08/03; due 15/03.
- Assignment 8: posted 15/03; due 22/03.
- Assignment 9: posted 22/03; due 28/03.
- Assignment 10: posted 28/03; due 05/04.

Midterm

- The midterm will last one hour and will take place in class on Friday March 1st 2024.

Final exam

- The final will last three hours, will take place during the exam period, and will be scheduled by the registrar's office. The final exam is cumulative (i.e., it covers the material studied throughout the entire term).

Conversion of numerical grades to final letter grades follows the

[Dalhousie Grade Scale](#)

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

General Course Policies and Course Policies on Missed or Late Academic Requirements

- Students are not permitted to record the lectures.
- Students are expected to read the class announcements on Brightspace.
- Textbooks, course notes, and calculators are not permitted during the exams.
- Assignments must be submitted by 23:59 on the due date.
- Assignments can be submitted in person (only at the beginning of class) or virtually (by email as a single pdf file).
- Assignments must be legible. Marks will be deducted for poor readability.
- Late assignments will not be accepted and will be given a grade of 0, unless a prior arrangement was made.
- Similarly, missed exams will be given a grade of 0, unless a prior arrangement was made.
- A missed midterm cannot be written at another time. If you miss the midterm without prior permission, then it will count as a 0.
- Student declaration of absence forms are not accepted. In case of illness or emergency, please contact the instructor at your earliest convenience.
- If an academic requirement (such as an assignment or midterm) is missed (due to exceptional circumstances or with prior agreement of the instructor), the weight of that requirement will be shifted entirely to the final exam.

Course Policies related to Academic Integrity

Students are encouraged to work collaboratively on problems but their submissions should be prepared individually.

Learning Objectives

To understand the fundamental concepts of ring theory, to be able to write proofs about properties of rings, to be able to perform computations with polynomial and Grobner bases, to evaluate formal proofs in abstract algebra and mathematics.

Course Content

Readings indicate chapter numbers in Dummit and Foote.

Week	Date	Topics	Reading
1	08-12/01	Rings, definition and examples	7.1 & 7.2
2	15-19/01	Homomorphisms and quotients	7.3
3	22-26/01	Ideals	7.4
4	29/01-02/02	Rings of fractions	7.5 & 7.6
5	05-09/02	EDs	8.1
6	12-16/02	PIDs & UFDs	8.2 & 8.3
7	19-23/02	Study break	
8	26/02-01/03	Polynomial rings	9.1
9	04-08/03	Polynomial rings over fields	9.2
10	11-15/03	Factorization of polynomials	9.3
11	18-22/03	Irreducibility	9.4 & 9.5
12	25-29/03	Grobner bases	9.6
13	01-05/03	Review	
14	08-09/03	Review	

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at:

https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about-dal/internationalization.html>

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at:

https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro

(<https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html>)

Conduct in the Classroom - Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion - Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <http://www.dal.ca/cultureofrespect.html>

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at:

https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.

Faculty of Science

Student Resources and Support

University Policies and Programs

Important Dates in the Academic Year (including add/drop dates):

http://www.dal.ca/academics/important_dates.html

Classroom Recording Protocol:

https://www.dal.ca/dept/university_secretariat/policies/academic/classroom-recording-protocol.html

Dalhousie Grading Practices Policies:

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Grade Appeal Process:

https://www.dal.ca/campus_life/academic-support/grades-and-student-records/appealing-a-grade.html

Sexualized Violence Policy:

https://www.dal.ca/dept/university_secretariat/policies/health-and-safety/sexualized-violence-policy.html

Scent-Free Program:

<https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>

Learning and Support Resources

General Academic Support – Advising (Halifax):

https://www.dal.ca/campus_life/academic-support/advising.html

General Academic Support – Advising (Truro):

<https://www.dal.ca/about-dal/agricultural-campus/ssc/academic-support/advising.html>

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

On Track (helps you transition into university, and supports you through your first year at Dalhousie and beyond):

https://www.dal.ca/campus_life/academic-support/On-track.html

Indigenous Student Centre:

https://www.dal.ca/campus_life/communities/indigenous.html

Indigenous Connection: <https://www.dal.ca/about-dal/indigenous-connection.html>

Elders-in-Residence (The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit the office in the Indigenous Student Centre or contact the program at

elders@dal.ca or 902-494-6803:

<https://cdn.dal.ca/content/dam/dalhousie/pdf/academics/UG/indigenous-studies/Elder-Protocol-July2018.pdf>

Black Student Advising Centre:

https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre.html

South House Sexual and Gender Resource Centre:

<https://southhousehalifax.ca/about/>

LGBTQ2SIA+ Collaborative:

<https://www.dal.ca/dept/vpei/edia/education/community-specific-spaces/LGBTQ2SIA-collaborative.html>

Dalhousie Libraries: <http://libraries.dal.ca/>

Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>

Dalhousie Student Advocacy Services: <https://www.dsu.ca/dsas?rq=student%20advocacy>

Dalhousie Ombudsperson:

https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Human Rights and Equity Services: <https://www.dal.ca/dept/hres.html>

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Study Skills/Tutoring: http://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Faculty of Science Advising Support:

<https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

Safety

Biosafety: <http://www.dal.ca/dept/safety/programs-services/biosafety.html>

Chemical Safety:

<https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

Radiation Safety: <http://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

Laser Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety/laser-safety.html>