

Faculty of Science Course Syllabus

Department of Mathematics and Statistics

Math 4055/5055

Advanced Algebra II

Fall 2018

Instructors

Instructor	E-mail Address	Office Location
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Lectures

Days	Time	Location
TRF	11:35 PM – 12:25 PM	LSC-COMMON AREA C210

Course Description

This course covers field theory, field extensions, Galois theory and applications.

Course Prerequisites

MATH 3032

Course Objectives/Learning Outcomes

- Know the difference between algebraic and transcendental extensions; be able to find the minimal polynomial for algebraic elements over a field and be able to prove whether a polynomial is irreducible over a given field.
- Be able to determine the automorphism group of an algebraic extension and the fixed field of a subgroup of the automorphism group of a field extension.
- Be able to determine the degree of a field extension.
- Know the concept of Galois extension and be able to prove the correspondence between intermediate fields and subgroups of the Galois group of a finite dimensional Galois extension.
- Be able to determine the splitting field of a polynomial.
- Know the relationships between Galois extensions, splitting fields of polynomials, algebraic closures, normal and separable extensions, and be able to prove results about these types of extensions.
- Be able to find the Galois group of certain polynomials, in particular those of degree at most 3 and for higher degree polynomials with special properties.
- Be able to characterize splitting fields and Galois extensions of finite fields.
- Be able to find the subfields of the cyclotomic extensions of the rationals and give primitive elements for these extensions.

- Be able to reason about cyclic extensions and in particular be able to determine their degrees.
- Know how to use radical extensions to show that the general quintic is not solvable by radicals.

Course Materials

- Textbook: Thomas W. Hungerford, Algebra, Springer Verlag, New York, 2000. We will cover chapter 5 of this book and possibly the first two sections of chapter 6. This is the required text for the course.

Course Assessment

The Final Grade will be computed as the maximum of the grades obtained from the following two schemes:

Scheme I:

Component	Weight (% of final grade)	Date
Midterm Exam	20%	Thursday, October 25, 2018
Final Exam	40%	To be determined by the class
Assignments	40%	Weekly

Scheme II:

Component	Weight (% of final grade)	Date
Final Exam	60%	(Scheduled by Registrar)
Assignments	40%	Weekly

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

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

Course Policies

- You are allowed to discuss your work with your classmates when solving the assignment problems, but you are required to do your final write-up by yourself.
- Missed quizzes, midterms or final exams can be made up for documented illness or upon receipt of equivalent proof of inability to write at the scheduled time.
- Information about the course may be given during class. It is the responsibility of the students to ensure that they are made aware of what occurs during classes.

Course Content

Week	Topic
Week 1:	Field extensions: algebraic, transcendental, finite, infinite; minimal polynomials
Week 2:	Galois groups, intermediate fields and subgroups, Galois extensions and the fundamental theorem of Galois theory
Week 3:	Degrees of extensions and indices of subgroups, stable intermediate fields, extendible automorphisms and the proof of the fundamental theorem
Week 4:	Symmetric rational functions, splitting fields, algebraic closure
Week 5:	Separable extensions, the generalized fundamental theorem
Week 6:	Normal closures and the fundamental theorem of algebra
Week 7:	The Galois group of a polynomial and finite fields
Week 8:	Finite fields
Week 9:	Separable and cyclic extensions
Week 10:	Cyclic and cyclotomic extensions
Week 11:	Radical extensions and the insolvability of the general equation of degree n with $n \geq 5$
Week 12:	Transcendence bases
Week 13:	Separability for non-algebraic field extensions and review

*Note that there is no class on Tuesday, December 4 since that day will follow a Monday schedule.

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate.

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of 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.

Information:

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

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

Information:

https://www.dal.ca/campus_life/academic-support/accessibility.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.

Code:

https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

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.

Statement:

<http://www.dal.ca/cultureofrespect.html>

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 (1321 Edward St) (elders@dal.ca).

Information:

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

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

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

University Grading Practices

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

Missed or Late Academic Requirements due to Student Absence (policy)

https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html

Student Resources and Support

Advising

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

Science Program Advisors: <https://www.dal.ca/faculty/science/current-students/academic-advising.html>

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

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

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

Academic supports

Library: <https://libraries.dal.ca/>

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

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

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

Fair Dealing Guidelines <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

Other supports and services

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

Student Advocacy: <https://dsu.ca/dsas>

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

Safety

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

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

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

Scent-Free Program

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