

Algebra I: Rings and Modules

Fall 2021, MATH 5107 (MAT 5141)

School of Mathematics and Statistics, Carleton University

Instructor: Colin Ingalls

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Office hours: By appointment on Zoom or Brightspace. Please write to me at cingalls@math.carleton.ca to schedule an appointment.

Description: Noetherian and artinian modules and rings. Varieties, Hilbert Basis Theorem, radical ideals, Hilbert Nullstellensatz. Localization and tensor products of modules and algebras. Semisimple rings and modules, Schur's Lemma, Jacobson Density Theorem, Artin-Wedderburn Theorem. Short exact sequences. Free, projective, injective and flat modules.

Prerequisite: There are no formal prerequisites for this course, but you are expected to be familiar with the content of courses in linear algebra and ring theory such as Math 2107 and Math 3158 at Carleton or MAT 2141 and MAT 3143 at the University of Ottawa, or equivalent courses given at other universities. This necessary background material is also covered in Chapters 0 and 2 of the textbook.

Textbook: "Abstract Algebra: The Basic Graduate Year", by Robert Ash. Freely available online at <https://faculty.math.illinois.edu/~r-ash/Algebra.html>. Also available for purchase as "Basic Abstract Algebra: For Graduate Students and Advanced Undergraduates" Dover, 2007.

Lectures: The lectures for this course will be in person Tue Thu 8:35 - 9:55 in Richcraft Hall 3202. The lectures will be streamed live and recordings of the lectures will be made available. There are two sections of this course:

5107F in person

5107O on line

If you do not plan on attending the lectures in person you should be in the on line section 5107O. There is limited capacity for 5107F. If you would like to attend the lectures in person you need to be registered for 5107F, not 5107O.

Topics to be Covered:

Chapter 4 Module Fundamentals

Chapter 8 Introducing Algebraic Geometry

Chapter 9 Introducing Noncommutative Algebra

Chapter 10 Introducing Homological Algebra

Classes begin: September 9, 2021.

Classes end: December 9, 2021.

Fall break: October 25-29.

Evaluation: Term mark is 60%; final exam is 40%.

There will be a timed final exam that will be scheduled by the university. This exam will also be the comprehensive exam. There will be approximately 6 assignments that will make up the term mark of 60%. 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, online, or that you discussed with someone else.

Other books:

Algebra:

Algebra M. Artin, Pearson 2011.

Abstract Algebra Dummit and Foote, Wiley, 2003.

Algebra: Chapter 0 Aluffi, AMS 2009.

Algebra Hungerford, Springer, 1980.

Algebra Lang, Springer, 2002.

Algebra MacLane and Birkhoff, AMS, 1999.

Noncommutative Algebra:

Noncommutative Algebra Farb and Dennis, Springer, 1993.

Noncommutative Rings Herstein, MAA, 2005.

First Course in Noncommutative Rings Lam, Springer, 2001.

Commutative Algebra, Algebraic Geometry:

Introduction to Commutative Algebra , Atiyah and MacDonald, Westview Press, 1969.

Steps in Commutative Algebra R.Y. Sharp, LMS Texts **19**, Cambridge University Press, 1990.

Ideals, Varieties, and Algorithms Cox, Little, and O’Shea, Springer-Verlag, 2007.

Undergraduate Commutative Algebra Miles Reid, LMS Texts **29**. Cambridge University Press, 1995.

Commutative Ring Theory Matsumura, Cambridge University Press, 1986.

An invitation to Algebraic Geometry, Smith, Lauri Kahanpää, Pekka Kekäläinen, Traves, 2004.

Academic Accommodation:

Pregnancy obligation: Contact me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: <https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>.

Religious obligation: Contact me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: <https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>.

Academic accommodations for students with disabilities: If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. PMC website: <https://carleton.ca/pmc>.