

MATH 4123A/9023A Rings and Modules

Course Outline — Fall 2023

1. Course Information

Course Information

- **Course code and title:** MATH 4123A/9023A Rings and Modules
- **Lectures:** Tuesdays 2:30–4:30 and Thursdays 2:30–3:30 in Middlesex College 107
- **Office hours:** Thursdays 3:30–4:30 in MC 255C or by appointment

List of Prerequisites

Math 3020A/B or equivalent.

Unless you have either the requisites for this course or written special permission from your Dean's Designate (Department/Program Counsellors and Science Academic Counselling) to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor Information

- **Instructor:** Chris Kapulkin
- **Office:** Middlesex College 255C
- **Office hours:** Thursdays 3:30–4:30
- **Email:** kkapulki@uwo.ca
- **Phone:** 519.661.2111, ext. 86534
- **Fax:** 519.661.3610. This is the fax number of the Department of Mathematics, so students should specify the addressee.

Students must use their Western (@uwo.ca or @ivey.uwo.ca) email addresses when contacting their instructors.

3. Course Syllabus, Schedule, and Delivery Mode

Course Content

- Rings theory:
 - rings with examples, homomorphisms, quotients, and ideals;
 - localization and the field of fractions;
 - Chinese Remainder Theorem;
 - factorization in commutative rings, including principal ideal domains, unique factorization domains, Euclidean domains;
 - algebraic integers;
 - polynomials and formal power series, including factorization and irreducibility criteria;
- Module theory

- modules with examples, homomorphisms, quotients, and submodules;
- generation of modules, direct sums and products, free modules, tensor product;
- exact sequences, injective, projective, and flat modules;
- Noetherian rings.

Course Learning Outcomes

- Students will be able to prove abstract ring-theoretic and module-theoretic statements.
- Students will be able to identify the field of fractions of an integral domain.
- Students will be able to check if a sequence of modules is exact.
- Students will be able to verify if a module is free, injective, projective, or flat.
- Students will be able to check if a ring element is prime/irreducible.
- Students will be able to provide examples and counter-examples of common properties of rings, e.g., being a Euclidean domain.

Key Sessional Dates

Classes begin:	September 7, 2023
Last day to add:	September 15, 2023
No classes:	September 29, 2023
Holiday:	October 9, 2023
Reading Week:	October 30 to November 5, 2023
Last day to drop:	November 13, 2023
Classes end:	December 8, 2023
Exam period:	December 10 to 22, 2023

Although the intent is for this course to be delivered in person, should any university-declared emergency require some or all of the course to be delivered online, either synchronously or asynchronously, the course will adapt accordingly. The grading scheme will not change. Any assessments affected will be conducted online as determined by the course instructor.

Course Materials

Required

- D.S. Dummit, R.M. Foote, *Abstract Algebra*, Third Edition, 2003.

Recommended

- P. Aluffi, *Algebra: Chapter 0*, Graduate Studies in Mathematics 104, 2009.

Learning Management System (OWL)

Course announcements, including the recommended homework problems, and grades will be posted on the course OWL site.

If students need assistance with the course OWL site, they can seek support on the OWL Help page.

Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

4. Methods of Evaluation

Course Grade

The final course grade will be determined by student performance on:

- weekly quizzes: 25%
- two midterm tests: each worth 25%
- final exam: 25%

Although graduate and undergraduate students will be evaluated based on the same components, the specific questions asked on the assessments might be different.

Quizzes [25%]: There will be nine quizzes, held weekly on Tuesdays during the last 15 minutes of class. No quiz grades will be dropped; the best quiz grade will be counted twice.

The quiz dates are as follows: (1) September 19, (2) September 26, (3) October 3, (4) October 17, (5) October 24, (6) November 7, (7) November 21, (8) November 28, and (9) December 5.

Two Midterm Tests [25% each]: There will be two non-cumulative one-hour midterm tests, each worth 25% of the final grade.

- Midterm Test 1: October 12, 2023, 2:30–3:30 AM.
- Midterm Test 2: November 16, 2023, 2:30–3:30 AM.

Final Exam [25%] The non-cumulative one-hour Final Exam will be scheduled by the Office of Registrar during the Exam Period.

Make-up Dates

There will be no make-ups for quizzes, instead the grade will be re-weighted to the remaining quizzes. The make-up dates for midterms will be arranged with the students who have received an accommodation. The make-up date for the final exam will be in early January 2024.

5. Student Absences

If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below.

1. Contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to obtain an accommodation.
2. Subsequently, contact the instructor to arrange for an accommodation.

Quizzes

If a quiz is missed and an accommodation is approved by the Academic Counselling, the grade will be re-weighted to the remaining quizzes.

Midterms

If a midterm is missed and an accommodation is approved the Academic Counselling, a makeup exam will be offered.

For work totalling 10% or more of the final course grade, you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the [University's medical illness policy \(click here\)](#) and review the [Student Medical Certificate \(click here\)](#). In the event that the links do not work, type either

- https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration.pdf (for policy)
- https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf (for certificate)

into your browser.

Absences From Final Examinations

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., 3 or more exams in 23-hour period, 4 or more exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under Special Examinations).

Accommodation and Accessibility

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult [the University's list of recognized religious holidays \(click here\)](#), which is updated annually. Alternatively, you may wish to enter

- <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>

directly into your browser.

Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. Students can consult [the policy on Academic Accommodation for Students with Disabilities \(click here\)](#). Alternatively, type

- [www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf)

into a browser.

6. Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca> (click here).

In accordance with [policy \(click here\)](#), the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner. The policy referenced above can also be accessed by typing

- https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf

into your browser.

Scholastic offences are taken seriously and students are directed to read the appropriate [policy \(click here\)](#), specifically, the definition of what constitutes a Scholastic Offence. This policy can also be accessed by typing

- http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

into your browser.

In the event of a health lock-down, tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide personal information (including some biometric data) and the session will be recorded. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at <https://remoteproctoring.uwo.ca> (click here).

7. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/> (click here).

Students who are in emotional/mental distress should refer to Mental Health@Western by visiting their website <https://uwo.ca/health/> (click here) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for

survivors, including emergency contacts [is available \(click here\)](#). If you cannot access the link you can type

- https://www.uwo.ca/health/student_support/survivor_support/get-help.html

into your browser. To connect with a case manager or set up an appointment, please email support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact [Accessible Education \(click here\)](#) if you have any questions regarding accommodations. If the link provided does not work, type

- http://academicsupport.uwo.ca/accessible_education/index.html

into your browser.

Learning-skills counsellors at the [Student Development Centre \(click here\)](#) are ready to help you improve your learning skills (alternatively, type <https://learning.uwo.ca> into your browser). They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Additional student-run support services are offered by the USC, <https://westernusc.ca/services/> ([click here](#)).