Syllabus - CAS MA 741 Fall 2025

Modern Algebra I

Professor: Juanita Duque-Rosero – juanita@bu.edu.
Course hours: TR 3:30 - 4:45 PM (685-725 Comm Ave CAS 314).
Office hours: T 10:30 - 11:30 AM and R 11:00 - 12:00, or by appointment (at CDS 311).
Text: Algebra: Chapter 0, by Paolo Aluffi.
Course website: Blackboard via learn.bu.edu.

Material

This course will cover properties of groups, rings, fields, and modules. We will study all these topics from a category theory perspective.

Teaching methods and philosophy

I firmly believe in Federico Ardila's axioms and I encourage you to think about them at every step of your learning process:

Axiom 1 Mathematical potential is equally present in different groups, irrespective of geographic, demographic, and economic boundaries.

Axiom 2 Everyone can have joyful, meaningful, and empowering mathematical experiences.

Axiom 3 Mathematics is a powerful, malleable tool that can be shaped and used differently by various communities to serve their needs.

Axiom 4 Every student deserves to be treated with dignity and respect.

Expectations. These are my expectations for you: treat me, your classmates, and yourself with respect; come to class on time and prepared to learn; actively work and participate in class; and follow BU's academic conduct code. This is what you can expect from me: treat everyone with respect; come to class on time and prepared; do my best to support your class interactions and to help you succeed; and have open channels of communication during class, office hours, or by email.

Grading

The course grade will be based upon the scores on weekly homework, two quizzes, and a midterm as follows:

- Homework: 40%
- Quizzes: $2 \times 15\%$
- Midterm: 30%

This grading policy is subject to change, but grades will not decrease as a result of changes.

Letter grades will be based on the following percentages:
A 93%, A- 90%, B+ 87%, B 83%, B- 80%, C+ 77%, C 73%, C- 70%, D 60%

Homework. Homework will be due one week after it is assigned. You are welcome to work with others, but the assignment **must be written up on your own** and you must acknowledge your collaborators on the first page of your write-up. Please try to solve the problems unaided before you seek online forums. If you learned how to solve a problem this way, that's fine and you will still receive credit, but please cite where you found the solution, and write the solution in your own words. Representing another person's work as your own is academic dishonesty, and will be reported as such. This includes using AI, as AI is based on the writing of people.
Your lowest homework score will be dropped.

Academic honesty

All Boston University students are expected to maintain high standards of academic honesty and integrity. It is your responsibility to be familiar with the Academic Conduct Code (for CAS, for GRS), which describes the ethical standards to which BU students are expected to adhere and students' rights and responsibilities as members of BU's learning community. All instances of cheating, plagiarism, and other forms of academic misconduct will be addressed in accordance with this policy. Penalties for academic misconduct can range from failing an assignment or course to suspension or expulsion from the university.

Representing another person's work as your own is academic dishonesty, and will be reported as such. This includes using AI, as AI is based on the writing of people.

Attendance policy

You are expected to attend each class session unless you have a valid reason for being absent. The BU attendance policy is here. If you have a good reason to miss multiple classes, please contact me as soon as possible so that we can make the appropriate accommodations.

Resources

Mental health and wellness. The academic environment is challenging, and classes are not the only demanding part of your life. There are a number of resources available to you on campus to support your wellness, including: mental health services at SHS (`https://www.bu.edu/shs/behavioral-medicine`), which allows you to book initial evaluation appointments online (`http://patientconnect.bu.edu/`); and Student Wellbeing (`https://www.bu.edu/studentwellbeing/`). Please make me aware of anything that will hinder your success in this course.

Accommodations

Students with documented disabilities, including learning disabilities, may be entitled to accommodations intended to ensure that they have integrated and equal access to the academic, social, cultural, and recreational programs the university offers. Accommodations may include, but are not limited to, additional time on tests, staggered homework assignments, note-taking assistance. If you believe you should receive accommodations, please contact the Office of Disability & Access Services to discuss your situation. This office can give you a letter that you can share with me outlining the accommodations you should receive. The letter will not contain any information about the reason for the accommodations.

Religious Observances

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me before the end of the second week of the term to discuss appropriate accommodations.

Tentative course outline

The following is a tentative outline for the course. **This page will be updated irregularly**. Please refer to the Blackboard page for updates.

Week	**Lecture**	**Section**	**Brief Description**
1	9/2	I.3,4,5	Categories, morphisms, and universal properties
	9/4	II.1, II.2	Groups and examples
2	9/9	II.2, IV.4	Examples: symmetries and cyclic groups
	9/11	II.3,4,5	Morphisms and homomorphisms, free groups
3	9/16	II.6,7	Subgroups and quotients
	9/18	II.8	Isomorphism theorems and Lagrange's theorem
4	9/23	II.9, IV.1	Group actions and the Class Formula
	9/25	IV.2	Sylow Theorems
5	09/30	IV.3	Composition series and solvability
	10/2	IV.5,6	Products and finite Abelian groups
6	10/7	III.1,2	Rings and fields and **Quiz 1** (on group theory)
	10/9	III.3	Ideals and quotients
7	10/14		No class - substitute a Monday
	10/16	III.4	Ideals and quotients
8	10/21	V.1	Factorizations
	10/23	V.2	UFDs, PIDs, Euclidean Domains
9	10/28	V.4	Unique factorization in polynomial rings
	10/30	V.5,6	Irreducibility, CRT
10	11/4	III.5	Modules
	11/6		**Midterm 1**
11	11/11	III.6	$R-$Mod
	11/13	VI.5	Classification of Finitely generated modules over PIDs
12	11/18	VII.1	Fields
	11/20	VII.4	Field extensions
13	11/25	VII.5	Field extensions
14	12/2	VII.6	Galois Theory
	12/4	VII.7	Galois Theory
15	12/9		**Quiz 2** (field extensions and Galois theory)