Syllabus - MA 541 Fall 2024

Modern Algebra I

Professor: Juanita Duque-Rosero - juanita@bu.edu.
Course hours: TR 9:30 AM - 10:45 AM (685-725 Comm Ave CAS 201).
Office hours: T 1:00 - 2:00 PM and W 4:00 - 5:00 PM, or by appointment (at CDS 311).
TF: John Ivanhoe - jivanhoe@bu.edu.
TF Office hours: M 2:00 - 3:00 PM and R 3:30 - 4:30 PM.
Text: Contemporary Abstract Algebra, Joseph A. Gallian *(10th edition)*.
Course website: Blackboard via learn.bu.edu.

Material

This course will serve as an introduction to the theory of groups and rings in abstract algebra. We will study basic properties of groups, permutation groups, Lagrange's theorem, homomorphisms, the isomorphism theorems, the Sylow theorems, and basic properties of rings and ideals.

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.

Course objectives

The two main goals of this class are to develop your ability to read and write proofs, and to cover the basic topics in Group Theory. This course is intended for Mathematics majors in the pure math track but anyone with an interest in higher level mathematics and a working knowledge of Linear Algebra is welcome.

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.

Grading

The course grade will be based upon the scores on weekly discussion participation (10%), written homework (30%), two midterms ($2 \times 20\%$), and a final exam (20%). This grading policy is subject to change, but grades will not decrease as a result of changes.

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.

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.

Absence due to religious observance

If you must miss class due to religious observance, you will not be penalized for that absence and you will receive a reasonable opportunity to make up any work or examinations that you may miss. Please notify me of absences for religious observance as soon as possible and **before the absence**.

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.

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	9/3	1	Symmetries of a square. Why abstract algebra?
	9/5	0	The integers modulo n and introduction to proofs
2	9/10	2	Groups: basic definitions
	9/12	3	Subgroups
3	9/17	4	Cyclic groups
	9/19	4	Cyclic groups
4	9/24	0	Functions
	9/26	5	Permutation groups
5	10/1	6	Isomorphisms and Cayley's Theorem
	10/3		**Midterm 1** (Covers topics 9/3 – 9/26)
6	10/8	0, 7	Equivalence relations and Cosets
	10/10	7	Lagrange's Theorem
7	10/15		No class - substitute a Monday
	10/17	8, 9	Direct products
8	10/22	11	The Fundamental Theorem of Finitely Generated Abelian Groups
	10/24	9	Normal subgroups and Quotient groups
9	10/29	10	Homomorphisms and the first isomorphism theorem
	10/31	23	The Class Equation and Sylow theorems
10	11/5	12	Rings: basic definitions and examples
	11/7		**Midterm 2**
11	11/12	12	Polynomial rings, matrix rings, and group rings
	11/14	13	Integral domains
12	11/19	14	Ideals
	11/21	15	Ring homomorphisms
13	11/26	16, 17	Polynomial rings and factorization
14	12/3	18	Unique factorization domains
	12/5	18	Euclidean domains
15	12/10	24	Finite simple groups
	12/16-12/20		**Final exam - No early exams allowed**