Syllabus for MATH 351 - 01, Modern Algebra

College of the Holy Cross, Spring 2022

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Office hours: Wednesdays 9:30am – 11am, Thursdays 1pm – 2:30pm, or by appointment.

Meeting times and location: MWF 12:00 - 12:50 pm, Swords 328

Textbook: Contemporary Abstract Algebra (ninth edition), Joseph A. Gallian, Cengage Learning,
eBook ISBN: 9781337249560

Topics: The course introduces the basic ideas of group theory, including symmetry groups, abelian, cyclic, and permutation groups. Also subgroups, normal subgroups, group homomorphisms, quotient groups, direct products, group actions on a set, and the Sylow theorems.

Goals:

- Students will understand the basic ideas and some applications of groups. Students will be able to explain groups and factor groups and their relation to symmetry. Students will recognize mathematical objects that are groups, and be able to classify them as abelian, cyclic, direct products, etc. Students will understand homomorphisms and quotients of groups, as well as group actions on a set, orbits and stabilizers, conjugacy, and be able to determine when a group has a normal subgroup.

- Students will be able to reason mathematically, to write simple proofs, and are able to judge when an attempted proof in group theory is correct/complete or is not.

- You will have a chance to reflect on doing mathematics, solving problems and on our role and progress as mathematicians**.**

Web materials: All class announcements, materials and grades will be posted on Canvas.

Homework is due at the beginning of class. If you do not hand them in at the beginning of class, 10 points will be deducted. No homework grade will be dropped.

Here are the due dates of homework:

Homework 1 (February 4), Homework 2 (February 11), Homework 3 (February 18), Homework 4 (February 25), Homework 5 (March 18), Homework 6 (March 25), Homework 7 (April 1), Homework 8 (April 8), Homework 9 (April 22), Homework 10 (April 29).

You should only submit homework problems with an asterisk, but It is strongly advised that you do all of assigned homework since the midterm exams will closely resemble the homework problems. No help from any Internet sources is allowed. Plagiarism will not be tolerated and will be treated as a violation of the Departmental Policy on Academic Integrity.

By doing mathematics you learn mathematics. You learn math best when you approach the subject as something you enjoy. Learn to explain mathematics to your classmates. Mathematics can be fun and rewarding when there are people around you who enjoy figuring out problems as much as you do. Take advantage of this opportunity and organize study groups. I will not consider working on homework problems with your classmates as a violation of the academic honesty policy in the department. However, you must prepare and submit your own solutions.

Please follow these guidelines when you submit homework assignments:

- Put your name, the date, and the homework assignment number at the top of the first page.
- Staple multi-page assignments. No paperclips or folded corners.
- Write neatly and show all your work.
- On the last page of your assignment, please write the name(s) of your classmate(s) with whom you work on homework problems (with an asterisk).

Presentations: : Each student is expected to present the proof of a theorem or the solution to a problem assigned to him/her during the semester. Presentations will take place on May 6 and May 9.

Mid-term exams:

There will be two mid-term exams during the semester. The mid-term exams are 90-minute exams; they will be held from 6pm to 7.30pm on Thursday, March 3 and Tuesday, April 12. The location of the mid-term exams is to be determined. We will typically review for each midterm during class the day before the midterm exam. No mid-term exam grade will be dropped.

Final exam: There will be a cumulative final exam in this course. Location and time of the final exam are to be determined. **Check for final exam schedule conflicts as soon as possible**.

Snow days: If classes are cancelled due to snow, or for other official reasons, any scheduled midterm exam will occur during next class meeting.

Grading: The course grade will be determined as follows:
Final exam: 25%
Mid-term exams: 40% (20% each)
Homework: 25%
Presentation: 10%

An incomplete grade is given at the discretion of the instructor.

Calculators: Calculators are NOT permitted on mid-term exams and the final exam.

Issues with the course/instructor: If you have issues with this course and/or instructor which you are not comfortable discussing with your instructor, you should contact the Chair of the Department of Mathematics and Computer Science, Professor Gareth Roberts, at groberts@holycross.edu.

Academic Honesty: Collaboration on mid-term exams and final exam is NOT allowed.

A necessary prerequisite to the attainment of the goals of the College is maintaining complete honesty in all academic work. Students are expected to present their own work in exams and in any material submitted for credit. Students may not assist others in presenting work that is not their own. Offenders are subject to disciplinary action. A violation of the Department Policy on Academic Integrity will result in a 0 for that quiz or exam, and a letter describing the occurrence of academic dishonesty will be sent to the Chair of the Department of Mathematics and Computer Science and your Class Dean.

For more on Academic Integrity see: https://www.holycross.edu/academics/programs/mathematics-and-computer-science/node/211581/academic-integrity

COVID-19:

- We are in the middle of a pandemic. Please wear a mask during class time, quizzes, mid-term exams, final exam and office hours.
- If you have any symptoms of illness, please do not attend the class. If you test positive for COVID-19, please do not attend the class even if you do not have symptoms, and please let me know immediately so I can send you a Zoom link to join the class.
- If I test positive for COVID-19, I will teach and hold office hours via Zoom until I am allowed to be back on campus.
- If classes are switched to remote learning due to COVID-19, I will teach and hold office hours via Zoom until restrictions are lifted.
- If I switch to teaching and holding office hours via Zoom due to an aforementioned situation, I will post all the Zoom links and passwords on Canvas.
- In order to facilitate contact tracing (if needed), I kindly ask that you sit in the same seat for the entire semester.

It is very important to follow the College's guidelines on COVID-19. For College's guidelines on COVID-19 see:

https://www.holycross.edu/2019-novel-coronavirus-covid-19-information/student-resources

Diversity and Inclusion: It is my intent that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength, and benefit. Any suggestions you have pertaining to diversity and inclusion are encouraged and appreciated.

Important:

1. Any student with special needs is encouraged to meet with me during the first week of classes to discuss accommodations. The student must bring a current Memorandum of Accommodations from the Office of Accessibility Services.

The following is the **link to the Office of Accessibility Services**:

https://www.holycross.edu/health-wellness-and-access/office-accessibility-services

2. Please note that, consistent with applicable federal and state law, this course may be video/audio recorded as an accommodation only with permission from the Office of Accessibility Services. Students are not permitted to record the contents of this class under any other circumstances.

3. If you are an athlete and have conflicts with an important class activity (homework, mid-term, presentation, or final), please let me know in advance.

4. For College's Excused Absence Policy see: https://catalog.holycross.edu/requirements-policies/academic-policies/#coursepoliciestext

5. All electronic devices (mobile phones, laptops etc.) must be turned off during class time, mid-term exams, presentations and final exam.

Syllabus: Syllabus is subject to change**.** It is your responsibility to be aware of any changes I may make to the syllabus as they are announced in class. Students are responsible for all information given when they are absent.

Some Additional Notes:

1. I will hold a 2-hour final exam review session the day before (or two days before) the final exam. We will discuss and find a time that works for all of us. I will let you know the location after the final exam date is announced.

2. I have given 3+ hours of office hours every week. Please bring all your questions regarding anything discussed in class, lectures notes, homework problems or anything posted on Canvas to my office hours. It is your responsibility to attend my office hours if you have any questions.

Important Dates:

March 7 -11 (Monday - Friday)	**Spring Break: no classes**
April 13, 15 and 18 (Wednesday, Friday and Monday)	**Easter break: no classes**
May 3 (Tuesday)	**Last day to withdraw with a W**

Wishing you all a safe, healthy, happy and successful semester.

Schedule of Topics and Suggested Homework Exercises

Here are the topics I plan on covering:

1. Divisors
2. Primes
3. Congruences
4. Integers mod p
5. Functions
6. Equivalence Relations
7. Permutations
8. Definition of a Group
9. Subgroups
10. Isomorphisms
11. Cyclic Groups
12. Permutation Groups
13. Homomorphisms
14. Cosets, Normal Subgroups, Factor Groups
15. Isomorphism Theorems, Automorphisms
16. Conjugacy
17. Groups Acting on Sets
18. Sylow Theorems
19. Finite Abelian Groups
20. Solvable Groups
21. Simple Groups

Advanced Topics (if time permits)

1. Nilpotent Groups
2. Semidirect Products
3. Groups of Small Order

May 9, Monday, Last day of classes
May 12, Thursday – May 18, Wednesday, Final Exams
Final Exam is based on all sections covered in class.

The mind is not a vessel to be filled but a fire to be kindled.

— Plutarch