Math 567 - Abstract Algebra II
Spring 2022

Basic Information

Instructor: Maria Gillespie, Maria.Gillespie@colostate.edu
Office: Weber 125

Course web page: http://mathematicalgemstones.com/maria/Math567Spring22.php
See also the Canvas course page.

Class time and location: MWF 1:00 pm, E 104 (Engineering Building)

Office hours: MW 2-2:30 pm, Th 8 pm on zoom (ID: 873 0031 2375, Passcode: Symmetry), by appointment, or by knock

Final Exam: Qualifier (May 11, 7:30-9:30am)

Textbook: *Algebra* by Michael Artin, 2nd ed.

Grades and Policies

The following table summarizes how the course will be graded.

Activity	**Percent of Grade**	**Date**
Homework	70%	Due Fridays in class
Presentations	10%	Three problems per student
Final exam	20%	May 11, 7:30-9:30am

Homework: will be posted each Friday and will be due the following Friday in class. Please either (a) write your homework on paper to hand it in, (b) type it in LaTeX and print it, or (c) type it in LaTeX and email it to me. If emailing it, the timestamp on the email should be before 11:10 am on Friday, or else it is counted as one day late (see Late Policy below).

Collaboration is permitted, but as in research, you must list all coauthors on a problem's solution at the top of the page, and cite any online sources used. In addition, your writing must be your own; copying is not permitted and clearly-copied solutions (either from a fellow student or from an online resource) will result in an automatic zero on the assignment.

In-class problems and Presentations: We will start off each class by working on one of the homework questions for 5 minutes and then discussing the solution. This is intended to lessen the workload of the weekly homeworks while still keeping the total amount of problems worked on consistent. The homework problems that will be discussed in class will be marked with a (*) on each homework sheet.

Each student should sign up to present their solution to one of the indicated homework problems to be discussed at least **three times** throughout the term. If a solution attempt is incorrect or incomplete, you can try again on another homework problem later as a replacement for that grade. Each homework problem presentation will be graded out of 10 points (mostly on mathematical accuracy) and the top three scores throughout the term will be averaged to be the student's Presentations grade.

To sign up to present a homework problem, just email me in advance; if two students sign up for the same problem, the email I receive first will be given priority, unless that student has already given three fully correct presentations and the other has not. If no student signs up for a given day, I will present the solution to that homework problem.

Final Exam: The final exam also counts as the qualifying exam for this course. It will be on material from all topics covered in the course.

Late policy: You may hand in homework late, but one point will be deducted for each day it is late. In particular, if it is handed in between 11:10 am on the Friday it is due and 11:09:59 am on Saturday, it is counted as one day late. If it is handed in between 11:10 on Saturday and 11:09:59 am on Sunday, it is counted as two days late, and so on.

Note that these deductions will continue past 10 days; if you hand it in 11 days late, you can get a maximum score of -1 on that homework. If the homework is not handed in at all, it will be scored -10.

The lowest homework score will be dropped from your overall homework average.

Covid policies: We will be wearing masks during class and in the in-person office hours. Please wear a high-quality medical grade mask with a good fit. I have medical grade masks available outside my office door (Weber 125) if you need a new one. We may move class outdoors when it's nice out in order to have a masks-optional day of class now and then.

If you are knowingly exposed to COVID-19, have symptoms, or test positive, please send me an email to let me know. I will not reveal your identity to the other students or anyone else, though you should self-report to the CSU COVID Reporter system. Since we are a small class, I will move the class onto Zoom until the exposed student obtains test results. We will stay online until the student tests negative, irrespective of whether the CDC still says the student can come back with a mask after only 5 days.

In general, if you have any needs or concerns related to the ongoing COVID-19 pandemic at any time, please do not hesitate to reach out by email or come see me in my office.

Attendance: Attendance in class is important. The class will not follow the textbook closely; the textbook will more be used as a guide and as a reference for important proofs and exercises.

Goals and Topics

The goal of this class is to study the theory, uses, applications of modules and field theory. The chapters 10, 14, 15, 16 from Artin will be the primary textbook chapters used. A tentative schedule of topics is listed below.

Tentative Schedule

- Week 1: (Jan 19, 21) Review of groups, rings, vector spaces, algebras
- Week 2: (Jan 24, 26, 28) Modules; definitions, basic operations, abelian groups
- Week 3: (Jan 31, Feb 2, 4) Free modules, generators and relations
- Week 4: (Feb 7, 9, 11) Noetherian rings, Structure theorems for abelian groups and modules, Chinese remainder theorem
- Week 5: (Feb 14, 16, 18) Group rings and algebras, A-modules, connection to representations
- Week 6: (Feb 21, 23, 25) Representation theory - Maschke's theorem, Schur's lemma
- Week 7: (Feb 28, Mar 2, 4) Characters and character tables
- Week 8: (Mar 7, 9, 11) Representation theory of the symmetric group
- (SPRING BREAK)
- Week 9: (Mar 21, 23, 25) Fields - examples, algebraic vs transcendental extension
- Week 10: (Mar 28, 30, Apr 1) Degree of an extension, irreducible polynomial

- Week 11: (Apr 4, 6, 8) Constructibility, splitting, finite fields
- Week 12: (Apr 11, 13, 15) Primitive elements, FTA, symmetric polynomials, discriminant
- Week 13: (Apr 18, 20, 22) Splitting fields, fixed fields, Galois extensions, Galois theory
- Week 14: (Apr 25, 27, 29) Constructing a 17-gon and solving quintics
- Week 15: (May 2, 4, 6) Bonus topics: Finite field geometry and the game of SET, more on symmetric polynomials

Additional COVID information from CSU administration

The following information will appear verbatim on every class syllabus this term as required by the university administration. Please also follow our specific class rules above.

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Important information for students:

Masks are required inside university buildings. You must also meet university vaccine or exemption requirements.

All students are expected and required to report to the COVID Reporter (https://covid.colostate.edu/reporter/) when:

- You suspect you have symptoms of COVID, regardless of whether or not you are vaccinated and even if your symptoms are mild
- You have tested positive for COVID through a non-CSU testing site, such as home test or test at a pharmacy
- You believe you may have been exposed to COVID go to the COVID Reporter and follow the guidance under “I believe I have been in close contact with someone who has COVID-19.” This guidance will depend upon your individual circumstances

You will not be penalized in any way for reporting symptoms or concerns.

Do not ask me as your instructor to report for you. It is your responsibility to report through the COVID Reporter promptly.

As your instructor I may not ask you about vaccination status or if you have COVID but you may freely volunteer to send me information from a public health official if you have been asked to isolate or quarantine.

When you complete the COVID Reporter, the CSU Public Health office is notified. Once notified, that office will contact you and, depending upon each situation, will conduct contact tracing, initiate any necessary public health requirements and notify you if you need to take any steps.

If you do not have internet access to fill out the online COVID-19 Reporter, please call (970) 491-4600.

For the latest information about the University’s COVID resources and information, including FAQs about the spring semester, please visit the CSU COVID-19 site https://covid.colostate.edu/. ”