# MTH 523: Modern Algebra I
# Course Information Sheet and Syllabus[1]
# Spring 2014

**Instructor:** Dr. Susan Cooper

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*Office Hours:* Tuesdays 11:00 a.m. – 12:00 p.m.; Wednesdays 2:45 p.m. – 3:45 p.m.;
or by appointment
*Correspondence:* The most reliable way to contact me is via email.

**Class Times and Location:** TR 9:30 a.m. – 10:45 a.m., Pearce Hall – Room 203

**Course Web-Page:** We will use *Blackboard* which can be found at http://blackboard.cmich.edu/.

**Text:** *Contemporary Abstract Algebra* by Joseph Gallian (8th Edition)

**Course Prerequisites:** MTH 332 or graduate status

**Course Description and Objectives:**

*"Symmetry is a vast subject, significant in art and nature. Mathematics lies at its root, and it would be hard to find a better one on which to demonstrate the working of the mathematical intellect."*
*Hermann Weyl*

The basic idea of Abstract Algebra is to study a set endowed with an *algebraic structure*, i.e., a method for combining elements. Why study Abstract Algebra? One of the great advantages of studying mathematics is that it helps one develop the ability to handle abstract ideas, and no subject is better suited to cultivate this ability than algebra. Further, there are many applications of Abstract Algebra.

In this course, we will concentrate mainly on *groups*. Groups allow us to formalize the symmetries of an object, and applications of this idea range from the physics of boiling water in a microwave oven to the insolvability of a general polynomial of degree 5 or greater. If time allows, we will also consider rings. There are fewer axioms for groups than there are for rings (and only one operation instead of two). Fewer rules allow for a greater diversity of behavior, and the absence of a second operation (with the accompanying distributive law) can make things less intuitive. By considering concrete examples, you will make conjectures and then try to verify or disprove them. You will gain facility and become confident that you can *do* mathematics and you will experience the joy of discovering hidden patterns and mathematical truths.

We will cover Sections 1 through 12 of the textbook and other selected topics, as time allows.

**Problem Sets, Quizzes, and Daily Homework:** Mathematics is not a spectator sport. The best way to learn mathematics is by doing mathematics. A collection of exercises, namely *Problem Sets* and *Quiz Sets*, will be assigned regularly. Solutions to Problem Sets will be submitted and a subset of the problems will be graded based on correctness, clarity, and style/creativity. Quizzes will be given based on the Quiz Set exercises and definitions from class. The quizzes are intended to gauge your understanding of the material while presenting opportunities for you to practice writing proofs in a timed-setting. All feedback is meant to *improve* your mathematical abilities and communication. In addition, *Daily Homework* consisting of readings and problems will also be assigned (but not collected).

**GAP Exercises:** Some of the Problem Sets will include "extra credit" exercises that require the use of *GAP*, a computer system designed for computational group theory. You can use GAP in Pearce Hall–Room 403, Stations 2–12, or you can download it for free from http://www.gap-system.org. Many of the exercises will be taken from the lab manual *Abstract Algebra with GAP* by J. Rainbolt and J. Gallian. The manual is available on-line for free at http://math.slu.edu/~rainbolt/FullManual8th.pdf.

**Dictionary Project:** The mastery of mathematics requires knowing and understanding many definitions. You will be required to construct and maintain a working dictionary. The deadline for the dictionary submission will be announced near the end of the semester.

**Discussions:** It is crucial to be able to communicate mathematics with peers. Volunteers may be asked to present solutions and ideas to the class. Please take your turn in this activity.

[1] *The details stated in this course syllabus are subject to change at the discretion of the instructor. Announcements concerning all (if any) changes will be made in a timely fashion.*

**Exams:** There will be two exams and one cumulative final examination. The schedule is:

| *Exam* | *Date* | *Time and Location* |
|---|---|---|
| Exam 1 | Tuesday, February 18 | In Class |
| Exam 2 | Tuesday, April 15 | In Class |
| Final Exam | Tuesday, May 6 | 10:00 a.m. – 11:50 a.m., Pearce Hall – Room 203 |

**Missed/Late Work Policies:** The following policies will be followed:

(1) Problem Sets must be turned in *by the beginning of class* on the day that they are due. Late work will receive no credit.
(2) No make-up quizzes will be granted.
(3) Make-up exams will only be given if arrangements are made with *prior* notification and you have a reasonable excuse for missing the scheduled exam. If you must miss an exam for an unforeseen, excusable absence, you must provide proper documentation for that absence. Make-up exams may be administered for exceptional circumstances and only by the discretion of the instructor. No make-up exams will be granted for the final examination.

**Course Grades:** Final grades will be determined as follows:

| Task | Percentage of Grade |
|---|---|
| Problem Sets | 20% |
| Quizzes | 15% |
| Dictionary Project | 5% |
| Exams | 20% each |
| Final Exam | 20% |

| Percentage Grade | Lowest Letter Grade Earned |
|---|---|
| $\geq 90\%$ | A− |
| $\geq 80\%$ | B− |
| $\geq 70\%$ | C− |
| $\geq 60\%$ | D− |

**Classroom Atmosphere:** A part of learning is making mistakes. We want to establish a classroom atmosphere where the inevitable false starts and mistakes become an opportunity to improve – not an opportunity for embarrassment. Please be constructive and polite in questioning your colleagues in class.

**Expectations and Tips for Success:** I ask that you have a well-defined sense of professionalism, that you always put forth your best effort, and that you develop a sense of responsibility to your educational community. I ask that you exhibit a persistent desire to learn. In return I will provide you with significant support. Also:

- Be positive, open, and responsive to feedback.
- Be an active participant - this includes being responsible for material when a class is missed, participating fully in classroom activities (please, turn your cell phones off during class), and critically thinking about the mathematics during and outside of class. *In order for this class to be successful, it is imperative that you commit to coming to class regularly, that you arrive to class on-time, that you commit to coming to class prepared, and that you commit to participating in class!*
- Be committed, take pride in your work, and take your work seriously.
- Be patient with yourself - it takes time to master newly learned things. Ask for assistance when it is needed. Constantly try to improve yourself as a mathematician.
- Starting with the first class, study in-depth and regularly.
- Get help as soon as you need it: ask questions in class and office hours; form a study group with your classmates; consider getting a tutor, etc.
- For exam preparation, practice exercises that have not been assigned.
- It is tempting to just copy available solutions. However, struggling through the exercises on your own is an important phase of the learning process.
- Be academically honest. You will be expected to submit only work that is your own. This will help us gauge your understanding, progress, and abilities for the material. Although you are encouraged to work together as you study, you should not submit anything that you do not understand or is not written in your own words. You are obligated to adhere to the CMU Policy on Academic Integrity.
- Everyone wants you to succeed. Please speak with me regarding any concerns you may have.
- Relax and have fun with the course!

**Special Needs:** CMU provides students with disabilities reasonable accommodation to participate in educational programs, activities, or services. Students with disabilities requiring accommodation to participate in class activities or meet course requirements should first register with the office of Student Disability Services (Park Library, Suite 120, telephone: 989-774-3018, TDD 989-774-2568), and then contact me as soon as possible.