Clemson University
Department of Mathematical Sciences

MATH 4120-141 / 6120-141, Modern Algebra
Summer Session I, 2019

Instructor: Matthew Macauley, Martin 0-325, 656-1838 (no voicemail)

Instructor e-mail: macaule@clemson.edu

Course Description: Group theory is the study of symmetry, and is one of the most beautiful areas in all of mathematics. It arises in puzzles, visual arts, music, nature, the physical and life sciences, computer science, cryptography, and of course, all throughout mathematics. This course will cover the basic concepts of group theory, with a a special effort will be made to emphasize the intuition behind the concepts and motivate the subject matter. It will also cover basic Galois theory and ring theory, which are more advanced topics.

Many pictures and diagrams will be provided. We will analyze art freises, chemical molecules, and braids. At the end of the semester, you will truly understand groups, rings, subgroups, cosets, ideals, products and quotients, homomorphisms, group actions, conjugacy classes, centralizers, normalizers, semidirect products, theorems by Lagrange, Cayley, Cauchy, and Sylow, and what Évariste Galois stayed up until dawn writing the night before his untimely death in a duel at age 20, that remains one of the most celebrated achievements in all of mathematics.

In the end, you will leave with a new appreciation of the beauty (and difficulty) of an area of mathematics you never dreamt existed.

Prerequisite: Math 3110 (Linear Algebra) and Math 3190 (Introduction to Proof).

Office Hours & Communication Strategy:

"Office hour meetings" can happen by appointment through Adobe Connect. Please send an e-mail for an appointment time, giving me block(s) of time in which you are available. These meetings could be individual or group. To log on to a meeting, go to `https://connect.clemson.edu/math4120/`

Email is the best way to reach me. I have not set up voicemail on my phone (as a way to encourage you to use email instead!), and I will be traveling to a few conferences during the class. I strongly recommend that you put Math 4120 in the subject line of any email – I will set up a Gmail filter for this.

Students are responsible for checking their Clemson email regularly, as that address will be the one subscribed to the class email list. I am not responsible if you miss important messages because you use a different email account.

Useful websites:

Course webpage: `http://www.math.clemson.edu/~macaule/classes/m18_math4120/` (all relevant links posted here)

Canvas: `https://www.clemson.edu/canvas/` (homework will be submitted through Canvas)

Texts:

Visual Group Theory, by Nathan Carter (recommended)

Abstract Algebra: Theory and Applications, by Tom Jusdson (required; a free textbook)

An Inquiry-Based Approach to Abstract Algebra, by Dana Ernst (required; a free textbook)

Required technology:

A computer on which you can watch the YouTube lecture videos and view pdf files.

Access to Canvas at `https://www.clemson.edu/canvas/` is required.

Adobe Connect - recommended for 'office hour meetings'.

Hardware - a scanner that can scan to pdf is required. All homework MUST be submitted as pdf files with multiple pages in one document (not one document per page).

Hardware – headset microphone - recommended, not required for meeting through Abode Connect.

Calculators/Other Technology: A calculator is not required nor needed for this course.

Schedule: This course is being offered in an entirely ONLINE asynchronous format through the course website and Canvas (only for submitting HW). The course calendar can be found on the course website.

Lectures: There will be 49 lectures, ranging in length from 11 to 48 minutes, that are be available on YouTube. Students will be required to watch approximately 2 lectures each day. The lecture schedule is listed on the course calendar.

Homework: Homework assignments are posted on the course webpage. Students will be required to upload and submit each assignment on Canvas as a single pdf file with multiple pages (*not* one document per page). Students can either hand-write and scan their assignment, or typeset them using LaTeX. Homework assignments must be submitted by 11:59pm on the day they are due. Late assignments will NOT be accepted.

Course Format: This course is being offered in one summer semester so EVERYTHING GOES QUICKLY.

You should expect to spend *at least* 4 hours per day on this course:

Listening to (usually) two online lectures.

Working written homework problems.

You will prepare for two tests and a cumulative Final Exam.

Because this is an online course, our chief means of communication is through e-mail. It is important that you check your Clemson e-mail on a regular basis - at least once a day.

Attendance: Because this is an asynchronous online course, a zero on a written homework assignment that is not turned in will be counted as 2 missed class. Any student who accumulates 4 'missed classes' before Mon. May 20 (the last day to drop the course without a final grade) is subject to being dropped from the course.

Exams: There will be 2 exams (closed book and notes) during the semester and a cumulative final exam: Midterm 1 on Wed. May 29, Midterm 2 on Wed. June 12, and the Final Exam on Thu. June 20. All three exams must be taken either at Clemson or at an approved proctored test facility. Guidelines for administration of these exams are given in the separate write-up under the heading Proctored Tests Policy. These guidelines must be followed by all students.

Grading: Your final grade will be computed as follows:

Homework	25%
Midterm 1	25%
Midterm 2	25%
Cumulative Final Exam	50%

I will drop either your lowest midterm grade, OR half of the weight of the final exam; whichever is lowest. Also, if you get at least an A or B on the final exam, then you get at least that grade in the course, *assuming you have a passing grade on the homework.*

Make-Up Policy: No make-up exams will be given. I will drop your lowest midterm, which means that if you miss a midterm, then your final exam grade will replace it. The homework deadlines will not be extended for individual students, and assigned homework must be turned in by the deadline. PLAN AHEAD: If you submit assignments minutes before the deadline, you take the risk of bad luck, e.g., a power outage, computer freeze or crash, personal emergency, zombie attack, etc., that could make you miss the deadline.

Student Learning Outcomes: Upon successful completion of MATH 4120, students will be able to

Demonstrate a solid understanding of modern algebra (group theory, ring theory, and Galois theory) at the undergradate level.

Explain to a friend or family member who knows nothing about mathematics what group theory is, how it arises, and why it's beautiful.

Explain how group theory can be thought of as the study of symmetry, and how it arises in puzzles, visual arts, the sciences, and other brances of mathematics.

Use visual diagrams and pictures to demonstrate the important definitions and concepts of group theory (of course, in addition to being able to define them rigorously).

Learn to understand, read, and write rigorous mathematical proofs on topics in algebra.

Develop good mathematical writing skills. Important aspects of this are *accuracy*, *clarity*, and *conciseness*.

Key Dates

May 14 (Tue)	Classes begin; late enrollment fee applies
May 15 (Wed)	Last day to register or add a class
May 20 (Mon)	Last day to drop a class or withdrawfrom the University without a W grade
May 27 (Mon)	Memorial Day holiday
May 29 (Wed)	Midterm 1
June 7 (Thu)	Last day to drop a class or withdraw from the University without final grades
June 12 (Wed)	Midterm 2
June 18 (Tue)	Last day of class
June 20 (Thu)	Final Exam
June 26 (Wed)	Deadline to submit grades

Academic Integrity: "As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a 'high seminary of learning'. Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot

earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form."

Special Accommodations: Students with disabilities who need accommodations should make an appointment with Dr. Arlene Stewart, Director of Disability Services, to discuss specific needs within the first week of classes. Students should present a Faculty Accommodation Letter from Student Disability Services when they meet with instructors. Student Disability Services is located in Suite 239 Academic Success Building (656-6848; sds-l@clemson.edu). Please be aware that accommodations are not retroactive and new Faculty Accommodation Letters must be presented each semester.

Copyright Statement: Some of the materials in this course are possibly copyrighted. They are intended for use only by students registered and enrolled in this course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act. Refer to the Use of Copyrighted Materials and "Fair Use Guidelines" policy on the Clemson University website for additional information: http://clemson.libguides.com/copyright

Statement Included for Certification Purposes: In this online course, you will interact with the content, instructor and classmates on at least a weekly basis through course assignments, asynchronous discussions and/or synchronous sessions as indicated in this syllabus.