
Professor:	Dr. L. Carpenter, llcarpen@bju.edu
Office:	A1 46
Office Hours:	Daily by appointment, https://calendly.com/llcarpen
Preferred Contact:	MS Teams or email
Textbooks:	<i>Contemporary Abstract Algebra</i> (10e) by Joseph Gallian, CRC Press, 2021.
Technology:	TI-NSpire CAS or other graphing calculator
Course Website:	https://math.bju.edu/ma411/

Course Description

The theory of mathematical structures with an emphasis on group theory. Examples are taken from the real number system, linear algebra and calculus. Elements of number and set theory are used extensively. The study of homomorphisms, isomorphisms and related theory is included. (3 credits)

Prerequisite: TI 89 or Nspire CAS.

Course Context

This course is an abstract mathematics course required of upper-level mathematics and mathematics education majors. It is also appropriate for other mathematics related majors who desire a strong grounding in pure mathematical theory. Studying abstract algebra gives insight into the structure of the mathematics we use every day. One of the major goals of the course is to further develop the students ability in proof construction.

This course supports the following objectives of the mathematics and mathematics education programs:

- MM1: Progress logically from premises to valid conclusions in a variety of mathematical contexts.
- MM2: Apply mathematics to model real-life situations.
- MM3: Select and use technology for understanding, as well as a labor-saving or problem-solving tool.
- ME1: Solve problems in theoretical . . . settings in a variety of mathematical contexts.
- ME2: Progress logically from premises to valid conclusions in a variety of mathematical contexts.

Course Goals

The student will learn to . . .

- CG1: Recognize patterns in mathematical structures.
- CG2: Use a variety of proof techniques.
- CG3: Recognize and implement structure in mathematical theory.
- CG4: Develop mathematical theory using definitions.

- CG5: Understand the foundational theory of groups.
- CG6: Develop group-theoretic models for a variety of mathematical structures.
- CG7: Appreciate the beauty of pure mathematical structure.
- CG8: Formulate questions which lead to a deeper understanding of mathematics.

Course Objectives

The student will be able to ...

1. Define from memory the foundational terms from group theory.
2. Explain the concepts from group theory discussed in this course.
3. Construct examples illustrating terms and concepts that have been discussed. (NCTM 1.5.1)
4. Formulate questions which lead to a deeper understanding of the subject.
5. Develop mathematical theory using definitions.
6. Recognize valid proofs.
7. Prove from memory theorems that have either been proved in class or assigned as proofs to know.
8. Prove independently theorems from the assigned exercises, thereby demonstrating ...
 - an understanding of the relevant concepts, and
 - an ability to reason and to express that reasoning process in a manner that cannot be misinterpreted. (NCTM 1.5.1, 1.5.8, 1.5.9, 1.5.14)
9. Solve computational problems relating to examples modeling group theory. (NCTM 1.5.2, 1.5.11)

Course Requirements

The course grade will consist of ...

- Unit Tests: Four unit tests as announced in class will be worth approximately 100 points each.**
Tentative Test Dates: Dates may shift depending on when material is finished in class. To better anticipate test dates, note the number of sections remaining in the chapters. See Canvas for current schedule.
Chps 0-3 Sept 14, Chps 4-7 Oct 12, Chps 8-10 Nov 9, Chps 11 and 23 Dec 7
- Final Exam: A cumulative final exam worth 200 points will be given at the time assigned by the University.**
- Problems and Projects: Regular Problem Sets worth 10 points each will be due on the class day following the last lecture of each chapter. Special Problem Sets worth 100 pts each will be due at the same time as the Chap 7 and Chap 23 tests. The Theory Project worth 100 points will be due on the final class day of the semester.**

** Point assignments are subject to change.

Course Evaluation

All course/assignment grades are based on the evaluation of the work communicated by the student. Unclear or incomplete communication of the solutions, which includes the process, may result in a penalty at the professor's discretion.

Letter grades will be based on a standard 10-point scale.

Office Hours

Office appointments can be made using the Calendly site (appointments may be made up to two weeks in advance), <https://calendly.com/llcarpen>. If there are no available times at which you are able to meet, send your professor a message including some days/times between 7:30am and 3pm when you are available.

General Policies

DEPARTMENT

Compliance with student handbook policies is expected during class. The classroom is to be a professional environment. That means you are to come to class prepared for the day's discussion, your attention is expected to be on course related material, and you are expected to positively contribute to the class.

EMERGENCIES DURING CLASS

In case of emergency requiring evacuation, students will go down the stairs on the Student Center side and exit the door facing Wade Hampton underneath the stairs. Students will immediately cross the street and gather by the fence with their class. If we are unable to exit the building, the professor will instruct the students on the best course of action. To be able to respond quickly to external threats, professors may keep classroom doors locked. If you are late arriving to class, you may need to knock on the door and be let in.

ABSENCES

BJU attendance policy is in effect (see <https://home.bju.edu/bju-policies/> for details).

- Scheduled tests/quizzes should be taken before your planned absence; please contact your professor to make arrangements for doing so. You are personally responsible for getting notes from your classmates and discussing the missed material with them. You should not expect your professor to privately re-teach you the material you missed. Your professor is always available to help you with specific questions. If an unannounced quiz/assessment is taken during the class that you miss, you will NOT be allowed to make it up, and you WILL receive a zero on the assignment. Work may always be completed early (see your professor if you wish to take a test early).

- Missing an in-class test because you feel you are not prepared to take it is not acceptable. Work missed for this reason will not be made up and you will receive a zero on the assignment.
- For absences due to incapacitating illness or emergency, you should contact the instructor as soon as you realize you will not be in class to make arrangements to make up any missed work. See late policy for details on missed assignments.
- Students who must be reinstated due to excessive absences/lates may earn at most a *B+* in the course.

PRESENTATION OF WORK

The goal is professional, fluent, and clear communication of what you know.

- PW 1: Proper use of mathematical notation is expected. The structure of notation conveys specific meaning and should be used appropriately.
- PW 2: Mathematical presentation is like grammar. There are subjects, verbs ($=, \leq, >$, etc.), and objects. Always write in “complete sentences.”
- PW 3: Tests/presentations/projects are not about what you know, but about what you can communicate about what you know – so the presentation of your work/logic should always be neat, orderly, clearly defined, and with the appropriate amount of supporting detail. (Excessive steps are not required; however, answers alone are not (usually) acceptable.)
- PW 4: Always work down the page. (Working in multiple columns is generally not acceptable.) There should be one problem worked in each “row” because this contributes to clarity and the development of your logical argument.
- PW 5: Skip lines between problems (and within problems as necessary for clear communication). If you have dense handwriting, skip every other line and skip 2-3 lines between problems.
- PW 6: Clearly label/number problems/sub-problems. Problems do not necessarily have to be worked in order but must be clearly labeled either way. Your professor will communicate their expectation on presenting problems out of order.
- PW 7: Answers are to be presented as the logical conclusion of your work, not as the only important thing (e.g. at the start of the problem and/or unconnected with any justifying work).
- PW 8: Work should be submitted on clean 8.5×11 inch (standard-size) paper and should not be submitted with “spiral”/ripped edges.
- PW 9: Take-home tests (when time is not limited) should be neatly presented (rewritten, organized, no scratchwork, etc.) as a final polished piece.
- PW 10: Follow any additional instructions given.

Your professor may refuse to accept work that does not meet the minimum presentation requirements above, or they may choose to deduct up to 10% from the assignment.

PROBLEMS EXPECTATIONS

The goal is to prove your mastery (not your just barely comprehending). Failure to meet these expectations will be reflected in lower test scores.

- PE 1: Read all words carefully in a question. Everything is important, so know what the meanings of all words are and how those words tell you to respond.
- PE 2: Theory is a precise expression of important ideas. While it is not graded word for word, jot for jot, the precise ideas must be maintained. Embrace thorough, smooth learning and presentation. Can you recite the theory from the last class period quickly, comfortably, and conversationally?
- PE 3: Theory tells us how to solve problems. Know exactly what problems connected to each theorem or definition look like, and know how to solve them.
- PE 4: Know what the key steps of each problem are. Present only the key steps (or the minimum needed to get the answer right and show all your logic).
- PE 5: Do enough practice for each type of problem so that you are smooth.

LATE POLICY

Assignments not submitted as directed by the due date will incur the following late penalty.

- Homework is due by the start of the class period. No late homework/in-class assignments are accepted.
- Written assignments/projects/take-home tests are penalized at 15% if submitted within 3 calendar days of the due date and are a 0 after that. Oral presentations are a 0% if not presented on the day assigned.

Late paper submissions must include the date and time the paper is submitted.

- In-class tests must be taken by the date given in class (or selected time in the case of an oral exam) unless there is incapacitating illness (see attendance policy). Missing a test/taking the test late (including an oral exam) may result in a penalty unless excused by the professor.

In-class tests will be made up without penalty for the first occurrence. Each subsequent time a test is missed, the penalty for taking the test late will increase by 10% with each occurrence.

Tests should be made up prior to the next class period unless other arrangements have been made with the professor.

- Work may always be completed early (contact your professor if you wish to take a test early).

Academic Integrity Policies

The university's Academic Integrity Policy is in effect (see <https://home.bju.edu/bju-policies/> for additional details).

DEFINITIONS OF INTEGRITY VIOLATIONS

Integrity is the reflection of the character and nature of God in our actions; therefore, students will be expected to work with integrity. In academia, violations of integrity generally fall into one or more of the following categories:

- Cheating: unauthorized use or attempted use of assistance, information, or aids in any academic assignment
- Falsification: submitting work done by others, changing work after submitting an assignment, reporting false information about the completion of an assignment
- Unacceptable collaboration: working with others when not permitted, using AI to generate ideas, thoughts, or content without the explicit permission of the professor
- Facilitation of Cheating: helping another student violate academic integrity, communicating quiz/test questions to other students
- Plagiarism: the intentional or unintentional use to any degree of the ideas or words of one's source material without proper acknowledgement

All work done for this class must represent your own effort, your own understanding, and your own communication of the material.

COURSE INTEGRITY POLICIES

If information is taken from other sources (which is at times appropriate), it always needs to be referenced and credit given where it is due. Use standard referencing techniques as taught in En 102. Solutions found on the internet are not to be copied.

- Homework: While you are encouraged to work together on the homework assignments, simply copying someone else's solution is neither useful nor acceptable. Your homework should represent your work and your understanding of the work.
- Tests (In-Class and Take-Home): No resources may be used while taking the test unless permitted by the professor. The presence of any unauthorized material on your desk, in your calculator, on your laptop, etc. while taking a test will be construed as cheating and will be dealt with as such. Internet/AI enabled devices or any communication devices (including but not limited to smart glasses, watches, earbuds, etc.) are not permitted to be used and should be stored out of sight during the testing period. Access these type of devices during the test will be construed as cheating and will be dealt with as such. Cheating on a test will likely result in a zero on the test and will be submitted to the Academic Integrity Committee.
- Projects: You are encouraged to discuss the general ideas needed to complete the project as discussed in this course with your classmates but are not permitted to "work together" on your project (outside of your own team and any faculty appointed advisors). Your projects must represent your own ideas, your own work, and your own communication of your work.

Assignment submissions will be evaluated for plagiarism and AI usage at the discretion of the professor. If you have a question about any source you are considering using, it is wise to gain your professor's approval before using it. You are always permitted to ask your professor for help. Any help they choose to provide is acceptable.

AI USAGE POLICY

The goal of the assignments in this course is to learn to develop the skills covered, NOT to complete the tasks assigned. The use of AI to complete or jumpstart tasks defeats the goal of the assignments. Therefore, you may not use generative AI tools in this course for any assignment without the professor's express permission. AI tools include, but are not limited to, CoPilot, Apple Intelligence, Chat GPT, Bing Chat, Google Bard, Grok, Deepseek, Grammarly, and language translators.

Use of generative AI to develop code (such as Python or R) may be helpful during the project (each student has permission to use AI for only this purpose, other purposes require express permission). It would be wise to consult with your professor before incorporating it into your work. Reliance on AI to generate code has not yet resulted in an acceptable paper. If you do use it, you must document it as indicated above. You may NOT use AI to generate the text/discussion in your project.

DOCUMENTATION OF PERMITTED AI USE

Should an AI tool be used with permission, its use must be documented according to the expectations of the professor. Expectations may include the tool used, a summary of the prompts provided and the portions of the assignment that were based on AI generated work.

See <https://style.mla.org/citing-generative-ai/> and <https://guides.lib.purdue.edu/c.php?g=1371380&p=1013507> for details on citing the use of AI.