Abstract Algebra
Fall 2018

Course no. 4301.010
Instructor Trey Smith
Time TR 9:30
Location MCS 215
Office MCS 219A
Office Hours MWF 9:00-10:00, 2:00-3:00: TR 11:00-12:00, 2:00-3:00
Others by Appointment
Phone (325) 486-5441
Email trey.smith@angelo.edu
Fax (325) 942.2503

Grading Your grade will be determined using your homework/quiz grade, two tests and a comprehensive final exam. The homework/quiz grade will count as 30% of your final grade while the two regular tests will count as 35% each (subject to the impact of the final exam). The final exam will serve to determine your final grade in the following way; if your final exam is a 90 or better, you will gain a letter grade, if the final exam is 60 or less, you will drop a letter grade.

Homework You will be assigned homework every class period. The next class, the homework will either be collected, or you will be given a quiz based on the homework material. Additionally, regular student presentations will be assigned and assessed.

Attendance Regular class attendance is expected. There will be no make-up for missed homework or quiz, so a missed day may result in a zero.

Calculators Calculators will generally not be allowed during exams.

Course Outline The following is a tentative weekly outline of the material to be covered. I reserve the right to change the material and/or sequence.

1. Functions, Binary Operations, Cayley Tables
2. Permutations, Groups
3. Groups, Equivalence Relations
4. Cyclic Groups, Group Theorems
5. Isomorphisms, Cayley’s Theorem
6. Cosets
7. Review, Test 1 (10.11)
8. Normal Groups, Homomorphisms
9. The Fundamental Theorem
10. Rings
11. Ideals
12. Integral Domains, Fields
13. Field Extensions, Finite Fields
14. Review, Test 2 (11.29)
15. Course Review
16. Final Exam (12.13, 8:00-10:00)

General University Policies

- **Student Disability Services**
  ASU is committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs or activities of the university, or be subjected to discrimination by the university, as provided by the Americans with Disabilities Act of 1990 (ADA), the Americans with Disabilities Act Amendments of 2008 (ADAAA), and subsequent legislation.

  The Office of Student Affairs is the designated campus department charged with the responsibility of reviewing and authorizing requests for reasonable accommodations based on a disability, and it is the student’s responsibility to initiate such a request by contacting:

  Dallas Swafford  
  Director of Student Disability Services  
  Office of Student Affairs  
  325-942-2047  
  dallas.swafford@angelo.edu

- **Title IX**
  Angelo State University is committed to the safety and security of all students. If you or someone you know experience sexual harassment, sexual assault, domestic or dating violence, stalking, or discrimination, you may contact ASU’s Title IX Coordinator:

  Michelle Boone  
  Director of Title IX Compliance  
  325-486-6357  
  michelle.boone@angelo.edu

- **Student Absence for Observance of Religious Holy Days:** A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. ([http://www.angelo.edu/opmanual/](http://www.angelo.edu/opmanual/) -- OP 10.19)
• **Incomplete Grade Policy:** It is policy that incomplete grades be reserved for student illness or personal misfortune. Please contact faculty if you have serious illness or a personal misfortune that would keep you from completing course work. Documentation may be required. See ASU Operating Policy 10.11 [Grading Procedures](#) for more information.

• **Student Absence for Observance of Religious Holy Days:** A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. ([http://www.angelo.edu/opmanual/](http://www.angelo.edu/opmanual/)-- OP 10.19)

• **Student Conduct Policies**

  **Academic Integrity**

  Students are expected to maintain complete honesty and integrity in all work. Any student found guilty of any form of dishonesty in academic work is subject of disciplinary action and possible expulsion from ASU.

  The College of Science and Engineering adheres to the Statement of [Academic Integrity](#).

  **Plagiarism**

  Plagiarism is a serious topic covered in ASU’s [Academic Integrity policy](#) in the Student Handbook. Plagiarism is the action or practice of taking someone else’s work, idea, etc., and passing it off as one’s own. Plagiarism is literary theft.

  In your discussions and/or your papers, it is unacceptable to copy word-for-word without quotation marks and the source of the quotation. It is expected that you will summarize or paraphrase ideas giving appropriate credit to the source both in the body of your paper and the reference list.

  Papers are subject to be evaluated for originality via Turnitin. Resources to help you understand this policy better are available at the [ASU Writing Center](#).

  **Copyright Policy**

  Students officially enrolled in this course should make only one printed copy of the given articles and/or chapters. You are expressly prohibited from distributing or reproducing any portion of course readings in printed or electronic form without written permission from the copyright holders or publishers.
• **General Policies Related to this Course:** All students are required to follow the policies and procedures presented in these documents:
  - Angelo State University Student Handbook
  - Angelo State University Catalog

**Student Learning Outcomes**

1. **The students will demonstrate factual knowledge including the mathematical notation and terminology used in this course.** Students will read, interpret, and use the vocabulary, symbolism, and basic definitions used in abstract algebra, including binary operations, relations, groups, subgroups, homomorphisms, rings, and ideals.

2. **The students will describe the fundamental principles including the laws and theorems arising from the concepts covered in this course.** Students will develop and apply the fundamental properties of abstract algebraic structures, their substructures, their quotient structure, and their mappings. Students will also prove basic theorems such as Lagrange’s theorem, Cayley’s theorem, and the fundamental theorems for groups and rings.

3. **The students will apply course material along with techniques and procedures covered in this course to solve problems.** Students will use the facts, formulas, and techniques learned in this course to prove theorems about the structure, size, and nature of groups, subgroups, quotient groups, rings, subrings, ideals, quotient rings, and the associated mappings. Students will also solve problems about the size and composition of subgroups and quotient groups; the orders of elements; isomorphic groups and rings; and the composition of ideals.

4. **The students will apply course material along with techniques and procedures covered in this course to solve problems.** Students will use the facts, formulas, and techniques learned in this course to prove theorems about the structure, size, and nature of groups, subgroups, quotient groups, rings, subrings, ideals, quotient rings, and the associated mappings. Students will also solve problems about the size and composition of subgroups and quotient groups; the orders of elements; isomorphic groups and rings; and the composition of ideals.

**Course Content**

**Textbook:** *An Introduction to Abstract Algebra* by Malik, Mordeson, and Sen. Available for free download from

[https://www.researchgate.net/publication/238669835_MTH_581-582_Introduction_to_Abstract_Algebra](https://www.researchgate.net/publication/238669835_MTH_581-582_Introduction_to_Abstract_Algebra)

1. **Binary Operations:** Definition and examples, properties.

2. **Groups:** Definition, examples, finite and infinite groups, abelian groups, properties.

3. **Subgroups:** Definition, generators and defining relations.

5. Permutations: Symmetric groups, dihedral groups, cycles and transpositions, even and odd permutations, alternating groups.

6. Isomorphisms and Homomorphisms: Definitions and properties, normal subgroups, kernel and range, Cayley’s Theorem.

7. Cyclic Groups: Finite and infinite cyclic groups, subgroups.

8. Partitions and Equivalence Relations

9. Quotient Groups: Lagrange’s Theorem, examples and applications.

10. Rings, Fields, and Integral Domains: Commutative rings, rings with unity, invertible elements, zero divisors.

Additional topics to be covered as time permits: The Fundamental Homomorphism Theorem, the Correspondence Theorem, Cauchy’s Theorem.