GOSHEN COLLEGE
MATHEMATICS DEPARTMENT
MATH 302 ABSTRACT ALGEBRA – SPRING 2018

Content	An introduction to algebraic structures such as groups, rings and fields. The planned focus will be on rings, although this could change based upon student interest.

Learning Objectives

The student will

1. Understand and be able to use arithmetic, axioms and important theorems related to the integers, including the division algorithm, Euclid's lemma, and Bezout's identity.

2. Understand and be able to find equivalence classes for given equivalence relations and be able to identify when a relation is an equivalence relation.

3. Be able to give the definition of the algebraic structure of a ring and use ring axioms to perform calculations and prove results including proving when a subset is a subring.

4. Be able to use isomorphism definitions and theorems to prove or disprove that structures are isomorphic and use invariants to prove that structures are not isomorphic.

5. Know and be able to give examples of rings satisfying various properties (commutative, with identity, etc.).

6. Understand the structure and theory of polynomial rings, including irreducible polynomials, functions induced by polynomials, roots and irreducibility.

7. Know and be able to apply the Division algorithm and the Unique Factorization theorem for polynomials over a field.

8. Be able to illustrate properties of polynomial rings with examples over the rational, real, and complex numbers.

9. Learn mathematics by reading, listening, exploring, and conversing in an effective manner;

10. Explain mathematical reasoning through writing in a precise and articulate manner in both informal and formal settings; and

11. Exhibit curiosity, playfulness, creativity, confidence, perseverance, interest in multiple perspectives, and a collaborative spirit.

Prerequisites	A grade of C or higher in Math 211 Calculus I and either Math 205 Discrete Mathematics or Math 212 Calculus II.
Activities	We will learn mathematics by reading, solving problems, and communicating our solutions and questions with each other orally and in writing. A majority of each class will be devoted to students presenting solutions to problems. Thus, you must attend, come prepared, and participate fully in every class.
	An average student can obtain an average grade with an average of nine hours each week devoted to this course—adjust if you are not average or desire a grade that is not average.
Instructor	David Housman, SC 117, dhousman@goshen.edu, 535-7405 (office), 612-7185 (cell) See office door or Moodle for availability.
Class Time	MWF 8:00-8:50AM in SC 107.
Textbook	Hodge, Schlicker and Sundstrom. *Abstract Algebra: An Inquiry Based Approach*. CRC Press. ISBN: 978-1-4665-6706 A copy of this book is available on the Good Library reserve shelf. Investigations 1-15 will be covered.
On-line	Moodle https://moodle.goshen.edu contains all course information. Announcements posted to the forum will be emailed to all students.

Other Materials   A three-ring binder with loose-leaf lined paper is highly recommended so that you can keep a written record of problem solving attempts, questions, math discoveries, and skill assessments. An iPad or cell phone can be useful for taking pictures of board work.

Grading   Course grades will be based on performance on class participation (10%), assignments (40%), two midterm exams (30%), and a comprehensive final exam (20%). If helpful, the final exam grade will replace one of the midterm exam scores.

Class Participation   Come to class having read and engaged in the preparatory activities. Be prepared to ask questions about parts you did not fully understand and to present solutions to parts you did understand. Students who come to class having done the preparatory reading and activities, regularly present solutions, and fully engage in all other class activities will earn full credit.

Assignments   Achieve and demonstrate understanding by completing the assigned exercises. Exercises may involve computation, evaluating and writing proofs, constructing examples, or other elements of problem solving. Your solutions will be evaluated on the correctness of your mathematical descriptions and arguments, the clarity of your writing, and the quality of your presentation.

It may be helpful for you to distinguish between the process of figuring out an exercise and the process of writing up your results. Normally, what a person writes down during the process of figuring out an exercise is not sufficiently clear or complete for another person to read and understand, unless they have already done the same exercise. Imagine that your audience is a student taking a similar abstract algebra class at a different college, who does not happen to have a copy of the book in their hands, and write up the results of the exercise in a clear and readable form.

Some basics on writing clearly: Restate the question as a claim that can be understood on its own. Write in complete sentences. Define any variables that you use. Consider computations and drawings as supplemental to your verbal description of the mathematics. If you include a lengthy computation or a drawing, describe it verbally. Check for spelling, grammar, punctuation, and readability.

Some basics on presentation: Write your name and the assignment number on the front page. Staple all the pages of your homework into one neat packet. Trim the frayed edges of paper with scissors. Write neatly, and make sure that there is adequate space between exercises. If your handwriting is illegible, use a word processor. There is an expectation that at least one solution for each assignment will be typed. If a mathematical expression is longer than a long word, put it on a line by itself. If you include a drawing or a graph, make sure it is clearly labeled.

Unless otherwise announced, assignments are due at the *start* of the class after it is assigned. Resubmissions and late submissions of individual exercises are due at the start of the next class after the original submissions were graded. Most exercises will be graded on a 10 point scale in accordance with the following rubric (points for on-time submission and resubmission or late submission are given in parentheses):

- (10, 7): correct mathematics, clear writing, and good presentation

- (8, 5): contains only one or two small and easily correctiblel mathematical gaps, lack of clarity in writing, and/or poor presentation style

- (5, 2): contains one clearly identifiable major mathematical gap, lack of clarity in writing, or poor presentation style

- (2, 0): attempted (not just restated), but the approach was inappropriate, the reasoning faulty, or the writing was unclear

- (0, 0): not attempted

You are encouraged to collaborate and seek assistance when having difficulties. You will have achieved the expected level of understanding when you are able to obtain your own solutions, independently reproduce solutions developed in collaboration or with assistance, and/or explain a solution to others.

Exams   Demonstrate a basic understanding of the course content by stating major definitions, axioms, theorems, and proofs from memory during in-class portions of exams. Demonstrate mastery of solving problems, discerning the truth of conjectures, and writing proofs during take-home portions of exams. In-class portions of exams are to be completed without any resources. Take-home portions of exams are to be

completed using only the text, your notes, and notes provided on Moodle.

Extra Credit Receive extra credit toward your assignment grade by doing one or more of the following: (1) find errors in the text or posted course materials and describe the error; (2) attend a quantitative presentation (e.g., Science Speakers) or participate in a quantitatively based activity and describe in writing some interesting mathematical aspect of the presentation or activity; or (3) participate in a Career Networks event and describe your most important discovery. Turn in to the instructor a single piece of paper containing your description.

Tutoring If you would like to be part of a small study group led by a peer tutor, fill out the request form at http://tiny.cc/GCtutoring or drop by the Academic Success Center.

Disability Accommo-dation Goshen College offers all students equal access to classes and programs. If you have a disability and wish to request accommodations, please contact Judy Weaver in the Academic Success Center (Good Library 113). You will be asked to provide documentation of your disability. All information will be held in the strictest confidence. Phone: 574-535-7560; Email: jweaver@goshen.edu. More information at: www.goshen.edu/campuslife/asc/disabilities-services/

Collaboration and Academic Integrity You are encouraged to use all available resources in order to learn the concepts and techniques discussed in this course. In particular, conversations with other students and the instructor can be an effective learning method. Reading other books and web pages can be another effective learning method. However, copying someone else's work subverts the learning process.

For homework and labs, you may look at and discuss another student's work, but any written work developed during collaboration with another student should be destroyed before writing your own solutions. You should give written acknowledgement to people with whom you have had discussions and to any written materials (other than the text) that were helpful.

For exams, you may *not* use any resources unless a specific exception is stated by the instructor.

Failure to observe the above rules will result in a zero on the assignment or exam. Any violation of academic integrity will be reported to the Academic Dean. Observation of the above rules will help you learn the material well and give you the satisfaction of knowing that you have earned your grade.

Due Date Policy Class participation, assignments, labs, and exams can only be excused, rescheduled, or made up if (1) there is a serious medical problem, a death in the immediate family, or an irreconcilable conflict with another official Goshen College activity; (2) there is written documentation signed by proper authorities; and (3) the instructor is notified prior to the due date or as soon as possible afterwards.