



COURSE SYLLABUS

MATH 320 Abstract Algebra for Educators

Self-Paced Course - Web Based Format Option

Session begins on the 1st day of enrollment month and ends on the last day of the 6th month

Instructor Information

Instructor Name: [faculty member]

Contact Information: For questions, comments, or concerns please contact the Self-Paced Degree Program office:

Telephone: 563-425-5200 or 1-800-553-4150

E-mail: selfpaced@uiu.edu

Address: Upper Iowa University, PO Box 1857, Fayette, IA 52142

Course Description

Semester Credits: 3

Catalog Course Description: This course introduces abstract algebra for future mathematics educators, emphasizing connections between advanced algebraic structures and secondary mathematics. Topics include number theory, modular arithmetic and its applications (including cryptography and check digits), groups, rings, fields, polynomial structures, cyclic and permutation groups, symmetry groups, and the real and complex number systems as algebraic structures. Students verify algebraic properties, construct proofs, and analyze how abstract structures justify K–12 procedures involving operations, factoring, equation solving, divisibility, and patterns. The course culminates in a capstone project in which students design secondary-level instructional materials that surface the abstract structure underlying a school

mathematics topic. Emphasis is placed on pedagogical applications and mathematical communication.

Prerequisites: MATH 240

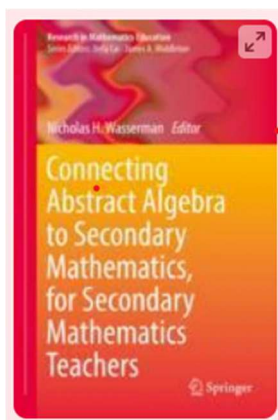
Credit Hours: As a requirement of HLC Accreditation, all UIU courses, regardless of meeting schedule or instructional mode, follow the Federal Credit Hour Definition. As such, each credit hour earned at UIU is equivalent to a minimum of 45 hours of student engagement.

For more information on how specific instructional modes meet this requirement, please see *UIU's Policy Guidelines for Instructional Time Expectations*: [UIU Policies](#).

Course Materials

It is the student's responsibility to make sure she/he has access to all required course materials by the start of the session.

Required Textbooks



Connecting Abstract Algebra to Secondary Mathematics, for Secondary Mathematics Teachers

Nicholas H. Wasserman, Editor
Springer 2018

AND:

Abstract Algebra: Theory and Applications by Thomas W. Judson
Stephen F. Austin State University
SFA ScholarWorks eBooks Fall 2020

Recommended Resources

UIU Tutor Center

- Email: tutorcenter@uiu.edu
- Phone: (563) 425-5272

UIU Academic Success

- Email: academicsuccess@uiu.edu
- Phone: (563) 425-5264

Course Outcomes

Students will be able to:

1. Describe and analyze the structure of the real and complex number systems as algebraic fields, identifying the field axioms and explaining how these properties underpin operations taught in K–12 mathematics.
2. Describe and analyze properties of subsets of the real numbers (rational, irrational, algebraic, transcendental) and the complex numbers (real, imaginary), and explain their relevance to secondary mathematics content.
3. Apply fundamental number theory concepts—including divisibility, prime factorization, the Fundamental Theorem of Arithmetic, GCD, LCM, and the Euclidean algorithm—to solve problems in a variety of mathematical and pedagogical contexts.
4. Investigate and apply congruence classes and modular arithmetic, including modular addition and multiplication, properties of the integers mod n , and applications such as check digits, cryptography, and clock arithmetic.
5. Define and identify the algebraic structures of groups, rings, and fields; verify whether given sets with operations satisfy group, ring, or field axioms; and provide both mathematical and K–12-accessible examples of each structure.
6. Analyze the structure of cyclic groups, permutation groups, and symmetry groups (e.g., dihedral groups), and connect these concepts to geometric transformations and patterns taught in secondary mathematics.
7. Investigate ring structures including polynomial rings and integer rings, and explain how ring properties relate to factoring, divisibility, and algebraic manipulation in secondary algebra courses.
8. Apply properties of algebraic structures to explain and justify standard algebraic algorithms and procedures used in K–12 mathematics, such as the distributive property, factoring techniques, and solving equations.
9. Construct and evaluate mathematical proofs using direct proof, proof by contradiction, and mathematical induction within algebraic contexts.

10. Explain the relationship between abstract algebraic structures and their concrete applications in secondary mathematics, including how groups relate to symmetry, fields relate to equation solving, and number theory relates to divisibility rules and patterns.

Course Requirements and Grading Criteria

Course Requirements

1. Review the **entire** course syllabus before beginning the course. Be sure you understand the course procedures and objectives. Procedures do change, so please review **ALL** requirements and policies even if this is not your first course including, but not limited to, administrative withdrawal. Your course status will be affected if policies are not followed.
2. Students who develop a regular time schedule and set goals for unit completion are most successful in completing courses within a specific timeframe.
3. The feedback you receive from the instructor of your work is **critical** to your success on subsequent lessons. These comments allow you to improve and modify the next units if necessary.
4. Assignments are submitted using uiuLearn. Please complete all assignments and modules in order.
5. If the information in your syllabus is not clear or if units are not graded within a reasonable period of time, please contact your instructor using uiuLearn's email tool, if that doesn't work contact the Self-Paced Program office. We would like the opportunity to address concerns, however, we may not know unless we hear from YOU!
6. ALWAYS keep a copy of your completed work when submitting it for grading.

Grading Criteria

Activity	Points
Unit Practice Sets	32
Unit Quizzes	21
Applied Assignment	7
Final Project	15
Final Exam	25

Activity	Points
Total	100

Grading Scale

Letter Grade	Percent	Letter Grade	Percent	Letter Grade	Percent
A	100-93	B-	81-80	D+	68-69
A-	92-90	C+	79-78	D	64-67
B+	89-88	C	77-72	D-	60-63
B	87-82	C-	71-70	F	59-0

Grades and Feedback

This syllabus contains all assignments necessary for completing your self-paced course.

Submit your completed assignments via uiuLearn.

If you need academic assistance with the course, please feel free to contact the Self-Paced Degree Program office.

To protect the integrity of the final assessment/exam, you only receive your final grade on the exam; you do not receive any feedback on the answers to the exam questions. The answers to the questions on the exam are not shared with students. Please remember to stay academically honest.

Turnitin

Turnitin is a tool for both teachers and students to ensure academic integrity by checking the originality of submitted papers to avoid issues of plagiarism and academic dishonesty.

Students should be aware that Turnitin scans submitted work and compares it to ALL other sources on file.

Extension Policy

Students will be allowed to request an extension and receive an 'X' (extension grade) at the end of their original six-month enrollment period if:

- A minimum of one assignment has been received for grading per guidelines **AND**
- All course units and exams are not completed and submitted **OR**

- A course withdrawal has not been initiated.

Note: There is a one-time fee for a self-paced extension per course. Refer to the Prereqcourses.com website for current fees. The request for an extension must be submitted no earlier than one month before the end of the course and no later than a week before the end of the course.

Extension grade details

- When the extension is granted and an “X” grade is issued, the student will receive a four-month enrollment period to complete the course.
- Students do not have the option to withdraw from a course after the initial six-month enrollment period.
- An ‘X’ grade posted to the student’s official record will be replaced with a final letter grade; however, the extension will remain on the official transcript as a notation.
- If the course is not completed by the end of the extension period, the instructor will assign a final grade (A-F) based on work completed in relation to the total course requirements.
- If credit is not earned by the end of the extension period, students can re-enroll and repeat the entire course for credit.

Note: Students are not reported as enrolled during the extension period and are not eligible for student loan deferment. No more than one extension will be granted.

Course Schedule

Unit 1 — Proof Foundations & Mathematical Reasoning

Activities	Read Judson Ch. 1.1 (A Short Note on Proofs)
	Read Judson Ch. 2.1 (Mathematical Induction)
	Review supplement on direct proof and proof by contradiction
	Complete practice exercises on constructing inductive proofs
Assignments	Unit 1 Practice
Assessment	Unit 1 Quiz

Unit 2 — Number Theory & Divisibility

Activities	Read Judson Ch. 2 (Division Algorithm, GCD, Euclidean Algorithm, Fundamental Theorem of Arithmetic)
Assignments	Unit 2 Practice
Assessment	Unit 2 Quiz

Unit 3 — Modular Arithmetic, Congruences & Applications

Activities	Read Judson Ch. 2–3 (congruence classes, integers mod n)
	Read Judson Ch. 7.1 (error-detecting codes and the RSA example, assigned as illustrative excerpt)
Assignments	Unit 3 Practice
Assessment	Unit 3 Quiz

Unit 4 — Groups

Activities	Read Judson Ch. 3 (Groups) and Ch. 4 (Cyclic Groups)
Assignments	Unit 4 Practice
Assessment	Unit 4 Quiz

Unit 5 — Symmetry, Permutation & Dihedral Groups

Activities	Read Judson Ch. 5 (Permutation Groups)
	Read Judson Ch. 12 (Matrix Groups and Symmetry)
Assignments	Unit 5 Practice
Assessment	Unit 5 Quiz

Unit 6 — Rings and Fields

Activities	Read Judson Ch. 16 (Rings)
	Read Judson Ch. 17 (Polynomials)
	Read Judson Ch. 18 (Integral Domains)
	Read Judson 21.1 and 21.3 (Fields, Extension Fields, Geometric Constructions)
Assignments	Unit 6 Practice
Assessment	Unit 6 Quiz

Unit 7 — Structures That Justify Secondary Algorithms

Activities	Read Wasserman Ch. 14 (Lee & Heid, "Developing a Structural Perspective...A Factorization Example")
	Optional: Wasserman Ch. 5 (McCallum) and/or Ch. 6 (Smith)
Assignments	Applied Assignment 7

Activities	Read Wasserman Ch. 14 (Lee & Heid, "Developing a Structural Perspective...A Factorization Example")
	Optional: Wasserman Ch. 5 (McCallum) and/or Ch. 6 (Smith)
Assessment	-

Unit 8 — Structures in the Secondary Classroom

Activities	Read Wasserman Ch. 12 (Shamash, Barabash & Even, required)
	Read one additional Wasserman chapter matched to final project topic (Ch. 10 Zbiek & Heid; Ch. 11 Baldinger; or Ch. 13 Lai & Donsig)
Assignments	Lesson/mini-unit
Assessment	Video-Explanation of Lesson/Mini-unit
	Written Reflection Narrative

Course Expectations

Artificial Intelligence

For the duration of this course, the use of generative artificial intelligence (such as ChatGPT) in assignments is strictly prohibited. Assignments are opportunities for personal growth, critical thinking, and applying your acquired knowledge. Your individual effort and creativity are essential in demonstrating your understanding of the course material. Dependence on AI undermines these objectives and compromises the integrity of the learning process. I appreciate your commitment to academic honesty and dedication to upholding this course's principles by refraining from using Generative AI in your assignments.

Late Work

Late work is not accepted without obtaining an official extension ('X' grade) from the University. See the syllabus policy on Extensions for details.

Professional Writing and Speaking Guidelines

Communications in class and online should follow the Student Conduct and Discipline, Respect for the University Environment, and Code of Student Responsibility in the [Student Handbook](#) (pg. 20 and 21). Respect the opinions of others using appropriate language and communications.

University Policies

Withdrawal (W)

Students who have registered for this course through our partnership prereqcourses.com are required to follow the withdrawal policy outlined on the partnership website. Please refer to the partnership site for official withdrawal procedures, deadlines, and associated fees.

For students enrolled through the prereqcourses.com partnership, no refund is allowed after the first two weeks.

Students who withdraw from a course prior to submitting the first assignment, or who are administratively withdrawn for non-submission of assignments, will be charged an administrative fee.

Administrative Withdrawal (AW)

A grade of AW (administrative withdrawal) is recorded for any course from which a student is administratively withdrawn. **At least one complete assignment/unit must be received and verified by the instructor within the first 60 days of the enrollment period or the student will be administratively withdrawn from the course.** Students who are administratively withdrawn for non-submission of assignments, will be charged an administrative fee. See website for current fees for re-enrollment.

Academic Accommodations

It is the policy of Upper Iowa University to ensure equal access to educational and co-curricular activities to students with disabilities as mandated by the Americans with Disabilities Act Amendments Act (ADAAA) and Section 504 of the Rehabilitation Act of 1973. A student seeking accommodations should contact the Director of Student Accessibility Services as early in the session as possible. In order to receive accommodations, students are required to disclose their disability to the Director by completing an application for services that can be found on the Student Accessibility Webpage. In addition to the application packet, the student is required to submit supporting documentation. Submit these to the Student Accessibility Services Office either in person or by email/Fax. A brief interview, in-person, by phone or virtually, with the Director will confirm or deny the accommodations requested. The Student Accessibility Services Office will email accommodation letters to the appropriate professor, the student, and the student's advisor. Additionally, students should work cooperatively with their

instructors throughout the session to make sure that their accommodations are appropriate and effective.

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Contact the Director at (563) 425-5949, accessibility@uiu.edu or stop by the office on the 2nd floor of the Student Center, Office of Student Life, Room 229.

Emergency Directives: (Fire, Natural Disaster, Threat on campus, etc.)

In accordance with Upper Iowa University's emergency management plan, any student that requires assistance in the event of an emergency (Fire, natural disaster, threat on campus) is responsible for notifying their instructor of the need for assistance. (Evacuation, and/or indoor safety protocols) This information will be held confidential and only needed in the unlikely event that there is an emergency.

Copyright Statement

In recognition of the Copyright Law of the United States (Title 17, United States Code), Upper Iowa University reminds both faculty members and learners that a willful infringement of the law may result in disciplinary action. The University library has available materials discussing the "fair use" concept, along with criteria and guidelines for reproduction and use of copyrighted materials.

This syllabus is subject to change.

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