COURSE SYLLABUS

Course Title: **Computational Abstract Algebra**

Abbreviated Title As Appears on Transcript: `Comp Abstract Algebra`

Course Number: DMAT 431

Credit Hours: 4 credits [semester credit hours]

Course Description: A first course in abstract algebra with emphasis on a computational approach to the subject. Topics include congruence, permutations, groups, homomorphisms, rings, fields, representations with matrices over finite fields, the Fundamental Theorem of Algebra, and solvability questions about polynomial equations, with dual emphases on traditional symbolic proofs and computational investigations.

Prerequisite: Successful completion (C- or higher) of Linear Algebra and Multivariable Calculus or equivalent, or consent of instructor.

Course Workload: 4 semester credit hours • 3 student work hours per credit hour • 14 week Carnegie semester = 168 hours student course workload average

Examination Requirements: Proctored written final examination must be passed at 60% or higher to earn passing grade in course. "B" and "A" grade paths have additional examinations.
See https://www.distancecalculus.com/grades/ for more information.

Course Professor: Robert R. Curtis, Ph.D.<rcurtis@rwu.edu>, <robert@distancecalculus.com>

University Information: Roger Williams University, University College, 1 Empire Plaza, Providence, RI, USA 02903. Roger Williams University, 1 Old Ferry Road, Bristol, RI 02809.
Accredited by New England Commission of Higher Education (NECHE).
See https://www.rwu.edu/academics/accreditation/ for more information.

E-Textbook: *Algebra - A Computational Approach* by John Scherk

Mathematical Software: Mathematica™ Computer Algebra & Graphing System

ADA ACCOMMODATIONS

Roger Williams University has a continuing commitment to providing reasonable accommodations for students with documented disabilities. Students with disabilities who need accommodations in order to fully participate in this class are urged to contact Student Accessibility Services, as soon as possible, to explore the arrangements needed to be made to assure access. Student Accessibility Services is open Monday

through Friday from 8:00AM to 5:00PM Eastern Time; Email: sas@rwu.edu or Voice: 401-254-3841. For more information about SAS, visit https://www.rwu.edu/undergraduate/academics/student-academic-success/student-accessibility-services-sas

Learning Outcomes for DMAT 431 - Computational Abstract Algebra

1. To understand and compute congruences and modulo arithmetic
2. To understand and compute permutations
3. To understand axiomatic definition of Groups
4. To understand and compute examples and constructions of Groups, including representations using matrices
5. To understand mappings, homomorphisms, isomorphisms, and kernels
6. To understand and compute cyclic, symmetric, and alternating Groups
7. To understand and compute initial examples of Rings and Fields, both finite and infinite
8. To be introduced to an initial goal of group and ring theory - the insolvability of polynomial equations by roots of degree > 4 (lack of generalization of Quadratic Formula for degree 5 and higher polynomial equations)
9. To understand the goal of the Fundamental Theorem of Algebra

Syllabus Topics Outline for DMAT 431 - Computational Abstract Algebra

1.	Getting Started
1.1	Email and Chat
1.2	Learning About the Course
1.3	Required Hardware
1.4	Software Fundamentals: Mathematica
2.	Initial Questions About Polynomial Equations
2.1	Quadratic, Cubic, Quartic Formulas
2.2	Historical Lack of Quintic Formula
2.3	Closer Look at Polynomial Factorizations
2.4	The Question of Coefficients
2.5	The Fundamental Theorem of Algebra
3.	Congruences
3.1	Basic Properties
3.2	Divisibility
3.3	Modulo Arithmetic
3.4	Solving Congruences
3.5	The Role of Prime Numbers
4.	Permutations
4.1	Mappings
4.2	Cycles
4.3	Signs of Permutations