University of Texas at Dallas

Course Syllabus

Math 3311: Abstract Algebra 1

Fall 2016

Time and Location:	Mondays & Wednesdays 4:00pm-5:15pm	FO 2.204
Instructor:	Wieslaw Krawcewicz	Professor
Contact Information:		
• Office:	FO 2.602F	
• Phone:	972-883-6620	
• Email:	wieslaw@utdallas.edu	
• Office hours:	Tues & Mondays-Wednesdays: 12:00 pm - 1:00 pm or by appointment.	
Prerequisites:	MATH 2415/2419, MATH 2418	

Course Description:

MATH 3379 - Abstract Algebra I (3 semester credit hours) Groups, rings, fields, vector spaces modules, linear transformations, and Galois theory. Prerequisite: A grade of at least a C- in either MATH 2415 or in MATH 2419, and a grade of at least C- in MATH 2418 or equivalent. (3-0) S

References:

- **Main Textbook:** Joseph A. Gallian, *Contemporary Abstract Algebra*, Cengage Learning, **any edition**.
- **Additional Book:** david S. Dummit and Richard M. Foote, *Abstract Algebra*, John Wiley & Sons, Inc. (any edition).

Homework Assignments:

There will be about 5-6 mandatory graded assignments. Assignments will contribute 20% to your final grade. The homework assignments will be published at our website and you will be given approximately 7 days to complete your solutions. You will be required to hand your homework to your instructor in class on the due-dates.

Grading Policy:

•	Homework assignments:	20%
•	Midterm Exam 1:	25%
•	Midterm Exam 2:	25%
•	Final Exam:	30%
•	Total:	100%

Grade Scale:

A+	[95...100]	A	[86...94]	A-	[80...85]
B+	[75...79]	B	[70...74]	B-	[65...69]
C+	[60...64]	C	[55...59]	C-	[50...54]
D+	[46...49]	D	[44...45]	D-	[42...43]
F	[0...41]				

Midterm Exams:

	Date	**Time**	**Location**
Midterm Exam 1:	Oct. 3, 2016	4:00–5:15 pm	FO 2.204
Midterm Exam 2:	Nov. 2, 2016	4:00–5:15 pm	FO 2.204

Exams Rules: Textbooks, notes, mobile phones, iPhones, scientific calculators or other electronic devises won't be allowed during examination. Rules governing the proper academic conduct and student's integrity will be strictly observed. Cheating and plagiarism won't be tolerated.

Student Learning Objectives:

- Students will review: basic algebraic structures, including group, and field and vector space

- Students will review: complex numbers and their geometric properties, roots, exponents, quaternions, their properties, operations on quaternions.
- Students will learn: real, complex and quaternionic vector spaces. Linear transformation of vector spaces. Examples of groups including matrix groups ($\mathrm{GL}(m, \mathbb{R})$, $\mathrm{GL}(n, \mathbb{C})$, $\mathrm{GL}(n, \mathbb{H})$, $\mathrm{O}(n)$ and $\mathrm{SO}(n)$.
- Students will learn: elementary properties of groups, symmetries of objects, isomorphisms of groups, permutation group and properties of permutations.
- Students will learn: examples of finite groups including the classical symmetry groups D_n, A_4, S_4, A_5 related to symmetries of a regular n-gone, tetrahedron, cube and dodecahedron.
- Students will learn: notion of group homomorphism including epimorphisms, monomorphisms, isomorphisms, automorphisms and inner automorphisms, conjugacy relations, subconjugacy lattices of subgroups and their geometric interpretation (for specific classical groups).
- Students will learn: properties of left and right cosets, notion of normal subgroup, quotient subgroup, Lagrange theorem, notion of normalizer and the homomorphism theorem.
- Students will learn: the structure of subgroups in a product group with examples.
- Students will learn: group action on a set, notions of isotropy, fixed-point subsets, orbits, orbit set, orbit types.
- Students will learn: Caley's Theorem, Sylow's Theorem (and its applications)
- Students will learn: the notion of a ring, basic properties of rings, notions of an ideal, zero divisor, integral domain, prime ring, subring, ring homomorphism, quotient ring.
- Students will learn: polynomial rings, group rings, properties of polynomial rings.
- Students will learn: basics of Galois Theory.

Detailed Description of the Course

1. Introduction to groups: definition and basic properties, dihedral groups, symmetric groups, matrix groups, quaternion groups, homomorphisms and isomorphisms, group actions.
2. Subgroups: definition and examples, centralizers, normalizers, kernels, cyclic groups and cyclic subgroups, subgroups generated b7 subsets, conjugacy relations, lattice of conjugacy classes of subgroups (with examples)

3. Quotient groups and homomorphisms: definition and examples, cosets and Lagrange's theorem, the isomorphism/homomorphism theorem.

4. Group actions: definition of a group action, permutation representation, group acting on themselves, left multiplication, Cayley's theorem, automorphisms, Sylow's theorem, applications of Sylow's theirem.

5. Direct product of groups, semidirect products, classification of subgroups in a product.

6. Introduction to rings: basic definition and examples, polynomial rings, matrix rings, group rings, ring homomorphisms and quotient rings, properties of ideals, rings of fractions, Chinese Remainder theorem

7. Euclidean domains, principal ideal domains and unique factorization theorem

8. Polynomial rings: examples, Gröbner bases.

9. Elements of Galois Theory.

Additional Information

UT Dallas Syllabus Policies and Procedures: The information contained in the following link constitutes the Universitys policies and procedures segment of the course syllabus. Please go to `http://go.utdallas.edu/syllabus-policies` for these policies.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.