MA361 – Abstract Algebra II

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Course Description

Math 361 is a continuation of Math 360. We will study the basic structures of modern algebra (groups, rings, and fields) in greater depth, culminating with the systematic study of symmetry groups of extension fields and its implications for solvability of polynomial equations by radicals (Galois theory).

Prerequisites

Admission to the course is contingent upon successful completion of MA360.

Text

There is one required text for the course: *A First Course in Abstract Algebra*, Seventh Edition, by John Fraleigh.

Grading

Course grades are based on weekly quizzes (20%), two in-class tests (20% each), and a cumulative final exam (40%).

Reading and class preparation

There is a reading assignment associated with each class period. Although it is not generally possible to discuss every topic in class, students are responsible for the entire content of the reading assignment. *Test and exam questions may cover reading material not discussed explicitly in class.* Consequently it is very important to complete the reading assignments on time and to come to class prepared with questions.

Make-up tests

Tests may be rescheduled only in cases of serious illness, bereavement, or other circumstances of similar gravity. Whenever possible, arrangements for make-up tests must be made *in advance* of the regularly scheduled testing time.

Student conduct

Students are required to adhere to the University Policy on Academic Standards and Cheating, to the University Statement on Plagiarism and the Documentation of Written Work, and to the Code of Student Conduct as delineated in the catalog of Undergraduate Programs, pp. 44–45 and 48–52. The Code is available online at the following web site:

`http://www.umb.edu/editor_uploads/images/life_on_campus/CSC.pdf`

Web page

This syllabus and other course materials are available on-line at

`http://cartan.math.umb.edu/wiki/index.php/Math_361,_Spring_2014`

Course Calendar

Homework problems should be done prior to the due date but ***are not to be handed in.*** *One problem from each assignment will appear on the weekly quiz.*

Monday, January 27: Introduction.

Wednesday, January 29: Homomorphisms and factor rings.

Read before class: Section 26.

Friday, January 31: More on homomorphisms and factor rings.

Monday, February 3: Prime ideals and maximal ideals.

Read before class: Section 27.

Do before class: Assignment 1.

Wednesday, February 5: Introduction to extension fields.

Read before class: Section 29.

Friday, February 7: More on extension fields.

Monday, February 10: Vector spaces.

Read before class: Section 30.

Do before class: Assignment 2.

Wednesday, February 12: Algebraic extensions.

Read before class: Section 31.

Friday, February 14: More on algebraic extensions.

Wednesday, February 19: Geometric constructions.

Read before class: Section 32.

Do before class: Assignment 3.

Friday, February 21: Finite fields.

Read before class: Section 33.

Monday, February 24: Isomorphism theorems.

Read before class: Section 34.

Do before class: Assignment 4.

Wednesday, February 26: Series of groups.

Read before class: Section 35.

Friday, February 28: More on series of groups.

Monday, March 3: Exam 1, sections 26, 27, 29, 30, 31, 32, and 33.

Do before class: Assignment 5.

Wednesday, March 5: Sylow theorems.

Read before class: Section 36.

Friday, March 7: More on Sylow theorems.

Monday, March 10: Applications of the Sylow theory.

Read before class: Section 37.

Do before class: Assignment 6.

Wednesday, March 12: Free groups.

Read before class: Section 39.

Friday, March 14: More on free groups.

Monday, March 24: Group presentations.

Read before class: Section 40.

Do before class: Assignment 7.

Wednesday, March 26: Unique factorization domains.

Read before class: Section 45.

Friday, March 28: More on unique factorization.

Monday, March 31: Euclidean domains.

Read before class: Section 46.

Do before class: Assignment 8.

Wednesday, April 2: Gaussian integers and multiplicative norms.

Read before class: Section 47.

Friday, April 4: More on Gaussian integers and multiplicative norms.

Monday, April 7: Splitting field of a polynomial. Examples of splitting fields.

Do before class: Assignment 9.

Wednesday, April 9: Uniqueness of the splitting field.

Friday, April 11: Solvability by radicals.

Monday, April 14: Exam 2, sections 34, 35, 36, 37, 39, 40, 45, 46, and 47.

Do before class: Assignment 10.

Wednesday, April 16: The Galois group.

Friday, April 18: The Galois correspondence. Obstructions to bijectivity of the correspondence.

Wednesday, April 23: Normal extensions.

Do before class: Assignment 11.

Friday, April 25: Separable extensions.

Monday, April 28: The fundamental theorem of Galois theory.

Do before class: Assignment 12.

Wednesday, April 30: More on the fundamental theorem.

Friday, May 2: Radical extensions.

Monday, May 5: The role played by roots of unity. Cyclotomic extensions.

Do before class: Assignment 13.

Wednesday, May 7: Galois' criterion for solvability by radicals.

Friday, May 9: Insolvability of the general quintic.

Monday, May 12: Further examples in Galois theory.

Do before class: Assignment 14.

Wednesday, May 14: Review.

Do before class: Assignment 15.