# Abstract Algebra II - Fall 2017

Professor: David Karpuk (email: da.karpuk@uniandes.edu.co, office: H006)
Course number: MATE-3101
Lectures, all in AU401: Tuesday and Thursday, 14:00 - 15:50
Office hours: by appointment, but preferably right after class
Language of instruction: English (but if you don't understand something, please say so!)

**Course Summary:** This is a second semester course in Abstract Algebra for undergraduates. The goal of this course is quite explicit, namely to prove that the the general quintic equation

$$x^5 + a_4x^4 + a_3x^3 + a_2x^2 + a_1x + a_0 = 0$$

with $a_i \in \mathbf{Q}$ has no explicit solution in $x$. That is, you can't write down a nice formula for $x$ the way you could with, for example, a quadratic equation. However, we will take our time arriving at this result, developing our knowledge of rings, fields, and Galois Theory along the way.

**Textbook:** Dummit and Foote, *Abstract Algebra*, Third Edition.

**Schedule:** Here is an approximate schedule of the topics to be covered (here DF = Dummit and Foote). One item in the list corresponds to about one day of lecture. Some topics may be covered a day early or a day late, but the dates of the exams are fixed.

- DF 7.5, 7.6: Fields of Fractions, The Chinese Remainder Theorem
- DF 8.1: Euclidean Domains
- DF 8.2: Principal Ideal Domains (PIDs)
- DF 8.3: Unique Factorization Domains (UFDs)
- DF 9.1, 9.2: Polynomial Rings, Polynomial Rings over Fields
- DF 9.3, 9.4: Polynomial Rings that are UFDs, Irreducibility Criteria
- DF 9.5: Polynomial Rings over Fields (again), review for Exam 1
- EXAM 1 (September 19th)
- DF 13.1, 13.2: Basic Theory of Field Extensions, Algebraic Extensions
- DF 13.3: Ruler and Compass Constructions

- DF 13.4, 13.5: Splitting Fields and Algebraic Closures, Separable and Inseparable Extensions
- DF 14.1: Galois Theory - Basic Definitions
- DF 14.2: The Fundamental Theorem of Galois Theory
- DF 14.3: Finite Fields
- DF 14.4: Composite Extensions and Simple Extensions
- DF 13.6, 14.5: Cyclotomic Fields, Cyclotomic Extensions and Abelian Extensions over $\mathbf{Q}$
- DF 14.6: Galois Groups of Polynomials
- DF 14.7: The Insolvability of the Quintic, review for Exam 2
- EXAM 2 (October 31st)
- DF 10.1: Modules - Basic Definitions and Examples
- DF 10.2, 10.3: Quotient Modules, Module Homomorphism, Direct Sums, Free Modules
- DF 11.1, 11.2: Vector Spaces, Linear Algebra
- DF 12.1: Modules over Principal Ideal Domains - The Basic Theory
- DF 12.2: The Rational Canonical Form
- DF 12.3, The Jordan Canonical Form, review for Exam 3
- EXAM 3 (November 23rd, last day of classes)

**Evaluation:** Your final grade will be based on three exams (each 25%), and the homework assignments (worth 25%). Homework will be assigned approximately every other week, and you will have two weeks from the day it is assigned to hand it in.