

First day handout
Algebraic Number Theory
Math 627, Section 600
Fall 2009

TR 9:35–10:50 in BLOC 624

Instructor: Dr Paula TRETAKOFF

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Office Hours: Tuesday 11:45am to 1:15pm, Wednesday 3:00pm to 4:30pm in Milner 332; also by appointment

Course Topics: This course will be an introduction to the study of algebraic numbers and algebraic integers. In number theory the key motivating problem is to understand the basic arithmetic of the integers. Algebraic number theory is the study of generalizations of integers to other domains, especially to number fields, i.e. finite algebraic extensions of the rational numbers. Interesting problems arise in the study of rings of algebraic integers that shed light on many basic number theory problems. The course will cover the following topics as time permits:

- Review of prerequisites from Algebra: rings, ideals, fields, modules, abelian groups
- Algebraic number fields, rings of algebraic integers
- Conjugates, discriminants, norms and traces
- Examples of algebraic number fields: quadratic and cyclotomic fields
- Arithmetic in algebraic number fields: unique factorization domains, principal ideal domains, factorization of algebraic integers into irreducibles may not be unique
- Ideals: unique factorization of ideals into prime ideals
- Minkowski's theorem on the existence of a non-zero lattice point in a bounded symmetric convex body
- Sums of two squares and sums of four squares
- The ideal class group and the finiteness of the class number
- Dirichlet's unit theorem

Textbook: *Algebraic Number Theory and Fermat's Last Theorem*, 3rd. edition, by Ian Stewart and David Tall. Published by A K Peters Ltd in 2002. ISBN 1-56881-119-5. The full text of this book is available electronically from the website of the TAMU libraries (libcat.tamu.edu).

Prerequisites: MATH653 (Algebra I), or permission from the instructor.

Grading: Final grades will be based on weekly homework problems (30%), on a short paper (8-10 pages) (50%), and on class participation (20%). The paper should be on a topic of your choice that is not covered in class, but is related to algebraic number theory: typically this will involve working through a topic in a research paper or advanced text and showing you have synthesized the topic well enough to write a short report on it. Class participation is based on attendance and involvement in class discussions.

Due Dates: Homework will be assigned every Thursday and will be due in class on the Thursday of the following week. There will be 4 graded homework questions per week. Extra ungraded optional homework questions may also be assigned. The due date for the short paper (50% of the final grade) is Tuesday November 24th. No extensions of this due date will be granted. If your paper is not completed by November 24th, you will be asked to submit an incomplete version on that date. You will be required to hand in a print-out of your paper in class on November 24th, and also to submit a .pdf file of your paper the same day to my e-mail address: paulatretkoff@neo.tamu.edu

Missed Homework: Making up of missed homework will be arranged according to university policies only. A university approved excuse must be provided to the instructor in writing (e-mail is sufficient) within 2 working days of the due date.

Academic dishonesty: “An Aggie does not lie, cheat, or steal or tolerate those who do.” It is not permissible to hand in work of others for a grade, including work on homework. You are allowed to discuss homework with others, but your write-ups are expected to be done on your own and in your own words. Copying the work of others will be prosecuted to the full extent possible under University policies. Please see the Honor Council Rules and Procedures on the web at <http://www.tamu.edu/aggiehonor/>.

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