

**MATH 110.409 – INTRODUCTION  
TO ALGEBRAIC NUMBER THEORY**

**LECTURE TIME AND PLACE.** MTW 1-2, 315 Hodson Hall.

**PROFESSOR.** Dr. Cristian D. Popescu (office: Krieger 216, telephone: 6-5116, e-mail: cpopescu@math.jhu.edu, <http://www.math.jhu.edu/~cpopescu>)

**OFFICE HRS.** MT 2-3, or by appointment.

**PREREQUISITES AND TEXT.** The prerequisites for this course are the 401-402 Algebra sequence. The main source will be **Number Fields** by Daniel Marcus. For additional exercises and examples, I strongly recommend **Problems in Algebraic Number Theory** by R. Murty and J. Esmonde. I also recommend Chapters I-VI of Serre's exquisite book **A Course in Arithmetic** as a "bedside reading companion" for this course.

**DETAILED SYLLABUS.**

1. Motivation - a special case of Fermat's Last Theorem.
2. Number Fields and Rings of Algebraic Integers.
  - (1) Definitions and examples.
  - (2) Traces and norms.
  - (3) Integral bases.
  - (4) Discriminants.
3. Ideal Decomposition in Rings of Algebraic Integers.
  - (1) Dedekind domains.
  - (2) The unique decomposition theorem.
4. Prime Splitting in Finite Extensions.
  - (1) Ramification and inertia indices.
  - (2) Discriminants revisited.
  - (3) The different.
5. The Ideal-class Group and the Unit Group of a Number Field.
  - (1) Definitions.
  - (2) The finiteness theorem for ideal-class groups.
  - (3) Dirichlet's unit theorem.
6. **(time permitting)** Zeta and  $L$ -functions. Distribution of primes.

**TESTS.** There will be a two hour comprehensive final examination, at a date and time to be announced.

**HOMEWORK.** Explicit homework assignments will be given every week. Homework will be collected and graded every other week. No late homework will be accepted. Homework must be neatly done and stapled if more than one page long. Sloppy homework will not be graded.

**GRADING POLICY.** Your course score will be determined by your final exam and homework scores, according to the following weighting:

$$\begin{aligned} \text{final exam} &= 100 \text{ pts.} \\ \text{best 5 homework scores} \times 20 \text{ pts.} &= 100 \text{ pts.} \\ \text{Total} &= 200 \text{ pts.} \end{aligned}$$

A letter grade will be assigned according to the scale:

**A:** 90%–100%, **B:** 75%–90%, **C:** 60%–75%, **D:** 45%–60%.

**CLASS EXPECTATIONS.** Students are responsible for the material discussed in class or posted on the course web page.

The strength of the university depends on academic and personal integrity. In this course you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition.