

**MATH 4306A / MATH 5306W ALGEBRAIC NUMBER THEORY  
WINTER 2020**

**Instructor:** Şaban Alaca, HP 4364  
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**Calendar Description:** Algebraic number fields, bases, algebraic integers, integral bases, arithmetic in algebraic number fields, ideal theory, class number.

**Prerequisite:** MATH 3158 or permission of the School

**Lectures:** Tuesdays and Thursdays 8:30 - 10:00 am in DT 1006

**Text book:** Introductory Algebraic Number Theory, by Ş. Alaca and K. S. Williams, Cambridge University Press

**Office hours:** TBA

**Grading scheme:**

1. **Assignments (30%):** There will be three assignments to be handed in during the term. The exercises may contain some computations requiring the use of a programming language.
2. **Presentation (30%):** Students will select up to three research papers of their choice (relating to algebraic number theory and/or its applications) and consult with me for approval. Each student will study their chosen paper(s) in depth and prepare a presentation of approximately 30 minutes to the class. Presentations must include an introduction/overview of the chosen paper(s), background content, why the paper(s) is/are of interest, an in-depth explanation of the research contribution of the paper(s), and possible extensions of the work.

Students will prepare electronic slides and e-mail them to me one day before their presentation. The grading will be based on the student's overall presentation quality and their ability to answer questions from the instructor and students.

Presentations will take place during the last three weeks of classes.

3. **Final Exam (40%):** There will be a take-home final exam, details of which will be announced in class.

**Academic accommodations:** Students who would like to request academic accommodations due to religious obligations, pregnancy or disabilities should inform the instructor as soon as possible.

A selection of topics from the following chapters of the textbook will be covered:

**Chapters 1, 2 and 3:** Review of Integral Domains, Euclidean Domains and Noetherian Domains

**Chapter 4:** Elements Integral over a Domain

**Chapter 5:** Algebraic Extensions of a Field

**Chapter 6:** Algebraic Number Fields

**Chapter 7:** Integral Bases

**Chapter 8:** Dedekind Domains

**Chapter 9:** Norms of Ideals

**Chapter 10:** Factoring Primes in a Number Field

**Chapter 11:** Units in Real Quadratic Fields

**Chapter 12:** The Ideal Class Group

**Chapter 14:** Applications to Diophantine Equations

Depending on our progress, we may cover additional topics from the textbook or other resources.