

ANALYTIC NUMBER THEORY

Fall 2025

Instructor: Dr. Shaoming Guo and Dr. Huixi Li

Time and Location:

Monday 16:00 - 17:40, odd and even weeks, A312

Wednesday 10:00 - 11:40, even weeks, A110

Office Hours: by appointment

Emails: 9920240805@nankai.edu.cn and lihuixi@nankai.edu.cn

Textbook: “Analytic Number Theory” by Iwaniec and Kowalski. We will mainly follow the outline of the book “Introduction to Analytic Number Theory” by Apostol and the book “Multiplicative Number Theory” by Davenport.

Recommended Books: “Additive Number Theory: the Classical Bases” by Nathanson, “Additive Number Theory: Inverse Problems and the Geometry of Sumsets” by Nathanson, and “Multiplicative Number Theory I. Classical Theory” by Montgomery and Vaughan.

Course Prerequisites: elementary number theory and complex analysis.

Course Description: Analytic number theory is an important branch of number theory, which uses methods from mathematical analysis to solve problems about the integers. There are many well-known questions in analytic number theory, such as the Goldbach Conjecture, twin prime conjecture, and Riemann hypothesis. The objective of this course is to introduce the questions, methods, and current status of analytic number theory to the students. The main topics include the complex analysis method and the Riemann hypothesis, the sieve methods together with the Goldbach Conjecture and twin prime conjecture, the circle method and the Waring’s problem, and the exponential sums method together with the Vinogradov’s three primes theorem and the lattice points problem. Students who have taken Functions with Complex Variables can take this course. After taking this course, the students will know the main research objects and the current status of the open problems in analytic number theory, the students will learn the commonly used methods in analytic number theory and develop innovation ability.

Grading:

Homework and Tasks	40 %
Project Notes and Presentation	20 %
Final Exam	40 %

Homework and Tasks: I will assign a few homework assignments during the semester. You are allowed and encouraged to work together, but you must each write up your own solutions. You are to write the proofs as you would write them in a research paper to receive full credit. Please finish the following list of tasks in time.

- Install Sage, register for SageMath.org

- Install Latex, register for overleaf
- Subscribe to Number Theory on arXiv or visit [their website](#) daily
- Visit MathSciNet and spend some time there
- Visit NumberTheoryWeb and spend some time there
- Visit Journal of Number Theory, International Journal of Number Theory, Ramanujan Journal, and Acta Arithmetica; read titles of the papers in latest issues
- Visit the library of Chern Institute of Mathematics
- Find a paper you are interested in, read it, and come up with questions you might work on
- Attend an online seminar, take notes, and find related questions you might work on
- Attend an in-person seminar, take notes, and find related questions you might work on
- Watch a number theory video, take notes and share with others
- Collect number theorists' stories; post the stories or links in our shared file
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Project Notes and Presentation: You and your teammates may pick an analytic number theory topic, write up some notes and make a presentation. The notes should be about 10 pages long and should be turned in to the instructors at least TWO WEEKS before your presentation, together with your title and abstract.

Final Exam: The final exam is comprehensive and mandatory.