

MATH-313

**Number theory I.b - Analytic number theory**

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Cursus	Sem.	Type
Mathematics	BA5	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Written
Workload	150h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Courses	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**Summary**

The aim of this course is to present the basic techniques of analytic number theory.

**Content**

This course provides an introduction to analytic number theory. After introducing the basic definitions and methods, our aim will be to prove Dirichlet's theorem on primes in arithmetic progressions and the prime number theorem.

Covered topics include:

1. Arithmetic functions: Multiplicative functions, Dirichlet convolutions
2. Asymptotic estimates: Euler's summation formula, Summation by parts, Dirichlet's hyperbola method
3. Elementary results on the distribution of prime numbers: Chebyshev's theorem, Mertens' theorems
4. Dirichlet series: Euler product, Perron's formula
5. Primes in arithmetic progressions: Dirichlet characters, Dirichlet L-functions, Proof of Dirichlet's theorem on primes in arithmetic progressions
6. The Riemann zeta function: Analytic continuation, Functional equation, Hadamard product
7. The prime number theorem: Explicit formula, Zero-free region, Proof of the prime number theorem
8. Primes in arithmetic progressions refined: Siegel zeros, Siegel-Walfisz theorem

**Learning Prerequisites****Required courses**

- Analyse I, II, III
- Algèbre Linéaire I, II
- Algèbre I

**Teaching methods**

Lectures with exercise sheets.

**Expected student activities**

Proactive attitude during the course and the exercise sessions, possibly with individual presentation of the solution of exercise problems.

**Assessment methods**

Written exam.

**Supervision**

Office hours	No
Assistant.e.s	Yes
Forum	No

## Resources

### Bibliography

- *Introduction to Analytic Number Theory*, T. M. Apostol
- *Multiplicative Number Theory I. Classical Theory*, H. L. Montgomery & R. C. Vaughan
- *Multiplicative Number Theory*, H. Davenport

### Ressources en bibliothèque

- [Find the references at the Library](#)

### Moodle Link

- <https://go.epfl.ch/MATH-313>