

MATH-313

**Introduction to analytic number theory**

Lin Yongxiao, Raju Chandra Sekhar

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

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

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

**Learning Outcomes**

By the end of the course, the student must be able to:

- Analyse and solve a basic problem from analytic number theory.

**Teaching methods**

Ex cathedra lecture with exercises.

**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.

Dans le cas de l'art. 3 al. 5 du Règlement de section, l'enseignant décide de la forme de l'examen qu'il communique aux étudiants concernés.

## Supervision

Office hours	No
Assistants	Yes
Forum	No

## Resources

### Bibliography

- *Introduction to Analytic Number Theory*, T. M. Apostol
- *A Course in Arithmetic*, J.-P. Serre
- *Multiplicative Number Theory*, H. Davenport
- *Multiplicative Number Theory I. Classical Theory*, H. L. Montgomery & R. C. Vaughan

### Ressources en bibliothèque

- [Introduction to Analytic Number Theory](#),
- [A Course in Arithmetic](#)
- [Multiplicative Number Theory Davenport](#)
- [Multiplicative Number Theory Montgomery](#)

## Prerequisite for

MATH-417 Topics in Number Theory