Analytic Number Theory 1, 7.5 hp

Course period:
January 18 - May 14, 2016

Last day for application:
January 18, 2016

Course leader / Address for applications:
Julia Brandes / brjulia@chalmers.se

Course description (Advertisement for Ph.D. students):
Number theory is one of the oldest parts of mathematics, with many classical and famous problems. The course will give an introduction to some of the highlights of analytic number theory and simultaneously present some of the most influential methods. After a brief revision of relevant material of the elementary number theory class, we will give a full proof of the Prime Number Theorem. Further topics include an introduction to sieve techniques and the theorem of Bombieri and Vinogradov about the distribution of primes in arithmetic progressions, and a proof of Vinogradov's theorem that every sufficiently large number can be written as a sum of three prime numbers. These methods have played important roles in the recent breakthrough results of Zhang–Maynard–Tao on twin primes and Helfgott on the ternary Goldbach conjecture.

The course will start in mid-January and run once a week (2 hours) until mid-May (LP3-4). The schedule will be decided by participants at an introductory meeting.

Responsible department and other participation departments/organisations:
Mathematics Department

Teacher:
Julia Brandes

Examiner:
Peter Hegarty

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1. Confirmation
The syllabus was confirmed by the Head of the Department of XXX 200X-XX-XX, 200X-XX-XX.

Disciplinary domain: Science
Department in charge: Department of Mathematical Sciences
Main field of study: Mathematics

2. Position in the educational system
Elective course; third-cycle education

3. Entry requirements
Number Theory, Complex Analysis

4. Course content
The course will cover a suitable subset of the following topics. The final curriculum will be decided upon during the course.

- Revision of relevant topics in number theory and basic counting methods
- Prime Number Theorem and related questions
- Large Sieve and the theorem of Bombieri and Vinogradov
- Counting solutions to additive equations and Vinogradov's Three Primes Theorem

5. Outcomes
At the end of the course, the students will have acquired knowledge about some of the main results and techniques of analytic number theory.

6. Required reading
There are many good books on analytic number theory, focussing on different aspects of the topic. The following list is a selection with no claims to completeness.

- T. M. Apostol, Introduction to Analytic Number Theory
- J. Brüdern, Einführung in die analytische Zahlentheorie
- H. Davenport, Multiplicative Number Theory
- H. Iwaniec and E. Kowalski, Analytic Number Theory
- H. L. Montgomery and R. C. Vaughan, Multiplicative Number Theory
- G. Tenenbaum, Analytic and Probabilistic Number Theory

7. Assessment
There will be a few homework sheets, and an oral exam at the end of the course

A Ph.D. student who has failed a test twice has the right to change examiners, if it is possible. A written application should be sent to the Department.

In cases where a course has been discontinued or major changes have been made a Ph.D. should be guaranteed at least three examination occasions (including the ordinary examination occasion) during a time of at least one year from the last time the course was given.

8. Grading scale
The grading scale comprises Fail, (U), Pass (G)

9. Course Evaluation
The course evaluation is carried out together with the Ph.D. students at the end of the course, and is followed by an individual, anonymous survey. The results and possible changes in the course will be shared with the students who participated in the evaluation and to those who are beginning the course.

10. Language of instruction
The language of instruction is English.