Representation Theory 1, 7.5 hp

Course period:
August 31 - December 18, 2015

Last day for application:
August 31, 2015

Course leader / Address for applications:
Michael Björklund / micbjo@chalmers.se

Course description (Advertisement for Ph.D. students):
Representation theory is an important part of mathematics with fundamental applications in number theory, geometry and combinatorics. It is a huge field, and the aim of this course is to discuss the basic features of this theory in the context of *finite* groups.

This is the first course in a planned series of courses in representation theory. The course will start in September and run once a week (2 hours) until December (LP1-2). The schedule will be decided by participants in late August/early September.

Responsible department and other participation departments/organisations:
Mathematics Department

Teacher:
Michael Björklund

Examiner:
Michael Björklund

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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
Basic knowledge of algebraic structures and commutative algebra.

4. Course content
The following topics will be covered:

- Introduction to groups and representation theory of abelian groups.
- Spherical pairs and their representation theory.
- Applications of spherical pairs: Character theory.
- Induced representations - Frobenius reciprocity.
- Examples: Semi-direct products (Little group method).
- Examples: Symmetric groups (Young tableaux, the Johnson scheme, elements from Gelfand-Tsetlin theory).
- Examples: Wreath products and products acting on rooted trees.
- Finite groups of Lie type.

5. Outcomes
Students who have attended the course should be able to determine the irreducible representations for a wide variety of finite groups, to decompose arbitrary linear representations of these groups into irreducibles and determine the corresponding characters. They will also have seen numerous applications of these techniques in different examples which stem from algebra, number theory and combinatorics.

6. Required reading

- Terras, *Fourier Analysis on Finite Groups and Applications*
- Serre, *Linear Representations of Finite Groups*
- Ceccherini-Silberstein et al, *Representation Theory and Harmonic Analysis of Wreath Products of Finite Groups*
- Lecture notes from class

7. Assessment
Oral exam + student project.

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.