

# Representation Theory of Groups

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**Timetable:** 14 hours. March, 2017, Torre Archimede,

**Course requirements:** Basic notions of linear algebra and of group theory

**Examination and grading:** exercises

**SSD:** MAT/02

**Aim:** This course provides an introduction to the representation theory of groups, with focus on character theory for complex representations of finite groups.

## Course contents:

1. Basic notions of representation theory: representations, irreducible representations, completely reducible representations, indecomposable representations.
2. Tensor products, exterior and symmetric powers, duals, representation structure on Hom spaces. Schur's lemma.
3. Characters and their main properties. Orthogonality relations. Isotypical components. Decomposition of the regular representation.
4. Complex irreducible characters are an orthonormal basis for the space of central functions.
5. Construction of irreducible representations for abelian groups. How to enumerate complex 1-dimensional representations in a finite group. Induced representations and their character.
6. Frobenius reciprocity. Algebraic integers. Dimension of an irreducible representation.
7. Frobenius-Schur indicator. Enumerating involutions in a finite group. Compact groups and their representation theory.