

The Department of Mathematics

2021–22–B term

Course Name Introduction to representation theory of groups

Course Number 201.1.0511

Course web page

<https://www.math.bgu.ac.il/en/teaching/spring2022/courses/representation-theory>

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Office Hours <https://www.math.bgu.ac.il/en/teaching/hours>

Abstract

Requirements and grading¹

Course topics

- .1 Introduction: Actions of groups on sets. Induced linear actions. Multilinear algebra.
- .2 Representations of groups, direct sum. Irreducible representations, semi-simple representations. Schur's lemma. Irreducible representations of finite abelian groups. Complete reducibility, Maschke's theorem.
- .3 Equivalent representations. Morphisms between representations. The category of representations of a finite group. A description using the group ring. Multilinear algebra of representations: dual representation, tensor product (inner and outer).
- .4 Decomposition of the regular representation into irreducible representations. The number of irreducibles is equal to the number of conjugacy classes. Matrix coefficients, characters, orthogonality.
- .5 Harmonic analysis: Fourier transform on finite groups and the non-commutative Fourier transform.

¹Information may change during the first two weeks of the term. Please consult the webpage for updates



- .6 Frobenius divisibility and Burnside $p^a q^b$ theorem.
- .7 Constructions of representations: induced representations. Frobenius reciprocity. The character of induced representation. Mackey's formula. Mackey's method for representations of semi-direct products.
- .8 Induction functor: as adjoint to restrictions, relation to tensor product. Restriction problems, multiplicity problems, Gelfand pairs and relative representation theory.
- .9 Examples of representations of specific groups: SL_2 over finite fields, Icosahedron group, Symmetric groups.
- .10 Artin and Brauer Theorems on monomial representations