Course: Group Theory

Course instructors: Igor Dolinka, Petar Marković

Course type: elective

**Credit points ECTS: 10** Prerequisites: none

# **Course objectives:**

Introduction to the fundamental ideas, concepts and results of group theory, including both the core of the classical topics, and the basics of combinatorial group theory as well.

### Learning outcomes:

Upon completing the course, the student should absorb the basic ideas, concepts and results of group theory. The main goal is to arrive at the operative level of knowledge of the theory, whereupon one can apply it in scientific research within a wide range of mathematical areas.

### **Course description (outline):**

Basic properties of groups. Properties of subgroups and normal subgroups, quotient groups and homomorphisms. Isomorphism theorems, the correspondence theorem. Direct and semidirect products of groups. Permutation groups and group actions. Sylow theorems and their applications in the classification of finite groups. Finitely generated abelian groups and the Krull-Schmidt theorem. Normal and composition series. Solvable and nilpotent groups. The extension problem, automorphism groups, wreath products. Simple groups and some classes of linear simple groups.

Free groups and free products. Presentations of groups. Term rewriting systems. Tietze transformations. Subgroups of free products. Generalised free products. Gruško-Neumann's theorem. Geometric methods. Cayley graphs of presentations. Van Kampen diagrams and the Van Kampen lemma. The word problem and the conjugacy problem. Britton's lemma. Dehn's algorithm. Small cancellation theory. One-relator groups and the Magnus-Moldavanskii theory.

## **References:**

- 1. J.J.Rotman, An Introduction to the Theory of Groups, 4th edition, Springer, New York, 1994
- 2. M.I.Kargapolov, Yu.I.Merzlyakov, Fundamentals of the theory of groups. Springer, New York, 1979.
- 3. O.Bogopolski, Introduction to Group Theory, European Mathematical Society, 2008.
- 4. R.Lyndon, P.Schupp, Combinatorial Group Theory, Springer-Verlag, Berlin, New York, 1977.
- 5. W.Magnus, A.Karrass, D.Solitar, Combinatorial Group Theory: Presentations of Groups in Terms of Generators and Relations, Wiley, New York, 1966.
- 6. D.L.Johnson, Presentations of Groups, Cambridge University Press, 1997.
- 7. M.Z.Grulović, Osnovi teorije grupa, Univerzitet u Novom Sadu, 1997.

Active teaching hours: 5	Theoretical classes: 5	Practice classes:
Methods of teaching.		

## Methods of teaching:

The lectures use classical teaching methods, aided by contemporary information and communication technology and interaction with students. Students' progress during the course is monitored by homework assignments and by means of writing and defending seminar papers. The goal of the final oral exam is to test the comprehensive understanding of the material of the course.

#### Grading structure (100 points)

Homework and seminars: 30 points. Final oral exam: 70 points.