



Exchange programme Vrije Universiteit

Vrije Universiteit Amsterdam - Exchange programme Vrije Universiteit - 2022-2023

Exchange

Vrije Universiteit Amsterdam offers many English-taught courses in a variety of subjects, ranging from arts & culture and social sciences, neurosciences and computer science, to economics and business administration.

The International Office is responsible for course approval and course registration for exchange students. For details about course registration, requirements, credits, semesters and so on, please [visit the exchange programmes webpages](#).

Group Theory

Course Code	X_401105
Credits	6.00
Period	P4+5
Course Level	200
Language Of Tuition	English
Faculty	Faculty of Science
Course Coordinator	dr. I. Canakci
Examiner	dr. I. Canakci
Teaching Staff	dr. I. Canakci
Teaching method(s)	Partial Exam, Lecture, Seminar

Course Objective

- * The student knows Z/nZ , $(Z/nZ)^*$, the Chinese remainder theorem, and the Euler phi-function, and can solve problems about and with these.
- * The student knows basic concepts from group theory (including subgroups, cyclic groups, generators, dihedral groups, permutation groups, centre, commutator subgroup, normal subgroup, coset, homomorphism, quotient group, group action, stabiliser, orbit) and can solve problems about and with those in explicit situations.
- * The student knows basic theorems from group theory (including the theorems of Cauchy, Lagrange, and the first isomorphism theorem) and can use these to compute and/or prove certain properties in explicit situations.

Course Content

We study an algebraic structure (called a group) with one binary operation that satisfies certain properties. Examples of such groups are the integers or real numbers under addition, invertible matrices (of a fixed size) under matrix multiplication, or bijections from a given set to itself under composition of functions. Groups also show up in many situations as the symmetries of an object or structure. By formalising their common properties we can prove various general results about groups, which we also illustrate by working out what they mean in various concrete cases.

We treat the following topics.

- * The integers modulo n ; Chinese remainder theorem, Euler phi-function.
- * Abstract definition of a group, order of a group or element of a group.
- * Examples of groups (the integers, the integers modulo n , dihedral groups, matrix groups, etc.).
- * Subgroups, generators, homomorphisms.
- * Normal subgroups and quotient groups.
- * Cosets, index of a subgroup, Theorem of Lagrange.
- * The first isomorphism theorem.
- * Commutator subgroup, homomorphism theorem.
- * Group actions, orbits, the class equation, Burnside's lemma.
- * Theorem of Cauchy.

Additional Information Teaching Methods

Lectures and tutorials, both two hours per week during 14 weeks, and study sessions, two hours every other week. Students also make a number of computer-supported assignments, and must hand in a written assignment every other week.

Method of Assessment

For this course there will be two partial exams, six written assignments to be handed in (out of which the best five count towards the grade), some computer-supported assignments, as well as a resit. The grade is determined as follows:

A. Based on the two partial exams: the written assignments count for 5% in total, the computer-supported assignments count for 5% in total, the average score for the two partial exams counts for 90%;

B. Based on the resit: the written assignments count for 5% in total, the computer-supported assignments count for 5% in total, the score of the resit counts for 90%; or, if this results in a higher grade, the score of the resit counts for 100%.

NB: In order to take part in the partial exams, you must have been present at at least 70% of the study sessions and tutorials (full time students only). There is no such attendance requirement in order to take part in the resit.

Literature

David S. Dummit, Richard M. Foote, "Abstract algebra", 3rd edition (2003), John Wiley and Sons.

Additional Information Target Audience

BSc Mathematics Year 1

Recommended background knowledge

The VU course Basic Concepts in Mathematics, as well as some parts of the VU courses Linear Algebra (in particular, matrices) and Discrete Mathematics (in particular, the part on permutation groups).