UNIVERSITY
WARMIA AND MAZURY IN OLSZTYN

Faculty of Mathematics and Computer Science

Course title: **Algebra 1**

ECTS credit allocation (and other scores): **4**

Semester: autumn

Level of study: ISCED-6 - first-cycle programmes (EQF-6)

Branch of science: Natural sciences

Language: English /Polish

Number of hours per semester: 30 lectures + 30 classes = 60 hours

Course coordinator/ Department and e-mail: Erasmus coordinator Anna Szczepkowska/ WMiI, erasmuswmii.uwm.edu.pl

Type of classes: classes and lectures

Substantive content

CLASSES:

Solving problems and issues relating to the content shown in the lecture.
Group, Abelian group, subgroup, normal divisor, quotient group. Permutation groups, linear groups, transformation groups. Cyclic group, element order, group order. Cosets of a group relative to its subgroup, subgroup index, Lagrange's theorem. Homomorphism of groups, kernel of homomorphism, image of homomorphism. Decomposition of a finite cyclic group into the product of cyclic groups with relatively prime orders. Rings, subrings, ring homomorphisms, ideals, quotient rings. Isomorphism theorems rings. Euclidean algorithm in the ring of integers Z, fields. The field of a ring fractions. Rings of polynomials R[x] of one variable. Roots of a polynomial. Divisibility and Euclidean algorithm in R[x].

LECTURES:

Group, Abelian group, subgroup, normal divisor, quotient group. Permutation groups, linear groups, transformation groups. Cyclic group, element order, group order. Cosets of a group relative to its subgroup, subgroup index, Lagrange's theorem. Small Fermat's theorem. Homomorphism of groups, kernel of homomorphism, image of homomorphism. Decomposition of a finite cyclic group into the product of cyclic groups with relatively prime orders. The structure of finitely generated Abelian groups. Rings, subrings, ring homomorphisms, ideals, quotient rings. Isomorphism theorems rings. Euclidean algorithm in the ring of integers Z, fields. The field of a ring fractions. Rings of polynomials R[x] of one variable. Roots of a polynomial. Ring of polynomials of many variables. Divisibility and Euclidean algorithm in R[x].

LEARNING PURPOSE

Familiarization with basic algebraic structures (rings, fields and groups) and the ability to notice structures in other areas of mathematics. Use of methods algebra to solve problems in geometry, combinatorics and mathematical analysis. Preparation for further education in algebra.

On completion of the study programme the graduate will gain:

Knowledge:

The student knows basic theorems of abstract algebra. He understands the place and the importance of this subject among other mathematical subjects, sees structures algebra in other areas of mathematics. Knows basic and

illustrative examples specific mathematical concepts, as well as those that help refute incorrect or unauthorized hypotheses reasoning.

Skills:

The student knows how to formulate theorems and definitions in a clear way abstract algebra. Is able to create new algebraic structures by construction quotient structures and Cartesian products. Notices the presence of algebraic structures (group, ring, field) in various mathematical problems, not necessarily
directly related to algebra.

Social Competencies:

The student is ready for further education, can do it independently search for information in the literature.

BASIC LITERATURE

[1] A. Biaynicki-Birula, ,,Zarys algebry", PWN, Warszawa (1987).
[2] M.Bryński, J.Jurkiewicz, ,,Zbiór zadań z algebry", PWN, Warszawa (1978).
[3] A. Mostowski, M. Stark, ,,Elementy algebry wyższej", PWN, Warszawa (1975).
[4] J. Rutkowski, ,,Algebra abstrakcyjna w zadaniach", PWN, Warszawa (2005).
[5] ,,Zbiór zadań z algebry" pod redakcją A.I. Kostrikina, PWN, Warszawa (1995).
[6] K. Szymiczek, ,,Zbiór zadań z teorii grup", Katowice (1979).

SUPPLEMENTARY LITERATURE

[1] S. Lang, ,,Algebra", PWN, Warszawa (1973).
[2] R. Wenzel, ,,Algebra I" (Skrypt do wykładu A), Wrocław, wrzesień (2008).

The allocated number of ECTS points consists of:

Contact hours with an academic teacher: 2,14 ECTS points,

Student's independent work: 1,86 ECTS points,