COURSE DESCRIPTION CARD - SYLLABUS

Course name
Abstract algebra [S1MwT1>AA]

Course

Field of study
Mathematics in Technology

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
30

Projects/seminars
0

Number of credit points

4,00

Coordinators

dr Anna Iwaszkiewicz-Rudoszańska
anna.iwaszkiewicz-rudoszanska@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge of linear algebra and calculus. Logical and scientific thinking. Logical and scientific thinking.

Course objective

The course is intended to give basic skill in the concepts and methods of abstract algebra and its applications.

Course-related learning outcomes

Knowledge:
1. Formulates definitions and the main theorems from the theory of groups, rings and fields, identify examples of specific constructs.
2. Applies methods of algebra in selected areas of science and engineering.

Skills:
1. Relate abstract algebraic constructs (group, ring, field) to any set of mathematical objects under certain operations in various issues of mathematical and other fields of knowledge and know how to use

them.
2. Uses the concepts of homomorphism, isomorphism and automorphism of algebraic structures and the basic concepts of factorization theory in integral domains.

Social competences:
1. Knows the limits of her/his own knowledge and understands the need for further education.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: written test.
Tutorials: two tests in the middle and at the end of semester.

Programme content

Lecture:
Algebraic structures: operations, properties of operations, external operations, algebraic structures and their homomorphisms and isomorphisms.
Groups: definition and examples, order of a group, order of an element of a group, subgroups, cosets, normal subgroups, Lagrange"s theorem, quotient group, group homomorphisms, kernels and images of homomorphisms, first isomorphism theorem, cyclic groups, permutation groups, direct product of groups, structure of finite abelian groups.
Rings: definitions and examples, zero divisors and invertible elements, integral domains, subrings, ring homomorphisms, polynomial rings, ideals and quotient rings, principal ideals prime and maximal ideals, Chinese reminder theorem, field of fractions, factorization in integral domains, irreducible elements, unique factorization, prime elements, GCD i LCM, principal ideal domains, Euclidean domains, Euclidean algorithm.
Fields: characteristic of a field, examples, subfields and field extensions, finite fields.
Boolean algebras: definition, switching circuits.
Tutorials:
Properties of operations. Groups, subgroups, cosets, normal subgroups, quotient group, group homomorphisms, kernels and images of homomorphisms, first isomorphism theorem, cyclic groups, permutation groups, structure of finite abelian groups. Rings, zero divisors and invertible elements, subrings, ring homomorphisms, polynomial rings, ideals and quotient rings, principal ideals prime and maximal ideals, factorization in integral domains, irreducible elements, unique factorization, prime elements, GCD i LCM, Euclidean algorithm. Field extensions, finite fields.

Teaching methods

Lectures: lecture with presentation supplemented with proofs and examples on the blackboard, with questions formulating to group; theory presented with connections of current knowledge.
Tutorials: solving on board example tasks, initiating disscussion of solutions.

Bibliography

Basic
1. William J. Gilbert, W. Keith Nicholson, Algebra współczesna z zastosowaniami, WNT, Warszawa 2008
2. Andrzej Białynicki-Birula, Algebra, PWN, Warszawa 2009
3. Andrzej Białynicki-Birula, Zarys algebry, PWN, Warszawa 1987
4. Aleksiej Kostrikin, Wstęp do algebry, Podstawy algebry, t. 1, PWN, Warszawa 2015
5. Jerzy Rutkowski, Algebra abstrakcyjna w zadaniach, PWN, Warszawa 2005
Additional
1. Garret Birkhoff, Saunders Mac Lane, Przegląd algebry współczesnej, PWN, Warszawa 1963
2. A.I. Kostrikin, Zbiór zadań z algebry, Warszawa 2015

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	2,00