STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Abstract algebra**		Code **1010341741010340007**
Field of study **Mathematics in Technology**	Profile of study (general academic, practical) **general academic**	Year /Semester **2 / 4**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies** **(Polish Qualifications Framework level six)**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **30** Classes: **30** Laboratory: **-** Project/seminars: **-**		No. of credits **4**
Status of the course in the study program (Basic, major, other) **basic**	(university-wide, from another field) **university-wide**	
Education areas and fields of science and art **The sciences** **Mathematical sciences**		ECTS distribution (number and %) **4 100%** **4 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of linear algebra and calculus. [K_W01 (P6S_WG)]
2	**Skills**	Logical and scientific thinking. [K_U01 (P6S_UW), K_U02 (P6S_UW)]
3	**Social competencies**	Understanding the necessity of expanding own competences. [K_K01 (P6S_KK), K_K02 (P6S_KK)]

Assumptions and objectives of the course:

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

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Formulates definitions and the main theorems from the theory of groups, rings and fields, identify examples of specific constructs - [K_W03 (P6S_WG)]
2. Applies methods of algebra in selected areas of science and engineering - [K_W01 (P6S_WG)]

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 - [K_U01 (P6S_UW)]
2. Uses the concepts of homomorphism, isomorphism and automorphism of algebraic structures and the basic concepts of factorization theory in integral domains - [K_U01 (P6S_UW)]

Social competencies:

1. Knows the limits of her/his own knowledge and understands the need for further education. - [K_K02 (P6S_KK)]

Assessment methods of study outcomes

Lecture: Written and oral exam.

Exercises: Continuous evaluation, including homeworks. Two tests in the middle and at the end of semester.

Course description

ALGEBRAIC STRUCTURES (2 h)

Operations, properties of operations, external operations, algebraic structures and their homomorphisms and isomorphisms.

GROUPS (10 h)

Basic concepts: definition and examples, order of a group, order of an element of a group, subgroups, cosets, normal subgroups, Lagrange's theorem, quotient group (3 h).Group homomorphisms, kernels and images of homomorphisms, first isomorphism theorem (2 h).

Cyclic groups (2 h). Permutation groups (2 h). Direct product of groups, structure of finite abelian groups (1 h).

RINGS (14 h)

Definitions and examples, zero divisors and invertible elements, integral domains, subrings, ring homomorphisms (2 h). Polynomial rings (2 h). Ideals and quotient rings, principal ideals prime and maximal ideals, Chinese reminder theorem (4 h). Field of fractions (1 h). Factorization in semigroups and in integral domains, irreducible elements, unique factorization, prime elements, GCD i LCM, principal ideal domains, Euclidean domains, Euclidean algorithm (5 h).

FIELDS (4 h).

Characteristic of a field, examples, subfields and field extensions, finite fields.

The applied methods of education: lectures - lecture with presentation supplemented with proofs and examples on the blackboard, with questions formulating to group; theory presented with connections of current knowledge; classes - solving on board example tasks, detailed the reviewing by leader the solutions of tasks of practice and the discussions over comments.

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Basic bibliography:

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 bibliography:

1. Zdzisław Opial, Algebra wyższa, PWN, Warszawa 1975
2. Bolesław Gleichgewicht, Algebra, PWN, Warszawa, 1983
3. Garret Birkhoff, Saunders Mac Lane, Przegląd algebry współczesnej, PWN, Warszawa 1963
4. Andrzej Mostowski, Marceli Stark, Elementy algebry wyższej, PWN, Warszawa 1975
5. Jerzy Browkin, Wybrane zagadnienia algebry, BM31, wyd. II, PWN, Warszawa, 1970
6. Andrzej Mostowski i Marceli Stark, Algebra wyższa, BM4, wyd. III, PWN, Warszawa, 1967
7. A.I. Kostrikin, Zbiór zadań z algebry, Warszawa 2015

Result of average student's workload

Activity	Time (working hours)
1. lectures	30
2. exercises	30
3. consultations	6
4. preparation for exercise classes	13
5. preparation for the credit of exercise classes	4
6. preparation for the credit of lectures (10+1h)	11

Student's workload

Source of workload	hours	ECTS
Total workload	100	4
Contact hours	70	3
Practical activities	0	0