University of Gdańsk

Subject card

Subject name and code	Algebra I, PG_00188837						
Field of study	Algebra I						
Date of commencement of studies	October 2026		Academic year of realisation of subject		2027/2028		
Education level	Bachelor's studies		Subject group		Obligatory subject group in the field of study		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		5.0		
Learning profile	academic		Assessment form		exam		
Conducting unit	Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Michał Stukow				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	60		3.0		62.0	125
Subject objectives	Learning basic algebraic concepts: rings and ideals, as well as theorems describing the properties of these concepts and the relationships between them.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MATL3_U04] is able to correctly use the concepts of general algebra, is able to apply the theorems and methods of these fields and is able to interpret the obtained results	is able to correctly use the acquired concepts of general algebra (groups, homomorphisms, kernels), is able - at a simple and medium level of difficulty - to apply the known theorems and methods in these fields and is able to interpret the obtained results	[SU4] test/egzamin - ustny lub pisemny [SU6] demonstracja umiejętności praktycznych
[MATL3_W09] knows and understands the role and importance of proof in mathematics, as well as the concept of the importance of assumptions	knows and understands the role and importance of proof in mathematics, as well as the concept of the importance of assumptions	[SW4] test/egzamin - ustny lub pisemny
[MATL3_U08] can formulate definitions and theorems in an understandable manner, both orally and in writing, and present correct mathematical reasoning on the learned topics	s able to formulate definitions and theorems in an understandable way, both verbally and in writing, and present correct mathematical reasoning regarding the acquired issues, is able to examine its properties for a given object, for example whether the ideal is principal, maximal or prime and whether a given mapping is a homomorphism or epimorphism, monomorphism or isomorphism, can decide whether two algebraic objects are isomorphic	[SU4] test/egzamin - ustny lub pisemny [SU6] demonstracja umiejętności praktycznych
[MATL3_W04] knows and understands at an advanced level selected concepts, methods and theorems of general algebra, as well as basic examples both illustrating specific concepts in this field and allowing to refute false hypotheses or invalid reasoning	knows and understands the basic concepts, methods and theorems of general algebra as well as basic examples both illustrating specific concepts (groups, homomorphisms, kernels) and allowing to refute erroneous hypotheses or unauthorized reasoning	[SW4] test/egzamin - ustny lub pisemny

Subject contents

- **Group Theory**

1. Definition of groups, subgroups, examples, cosets, index, Lagrange's theorem.
2. Subgroups generated by subsets, the order of elements, cylic groups.
3. Permutations, decomposition into disjoint cycles and transpositions, permutation sign of a permutation.
4. Homomorphisms of groups, kernel and its properties, normal subgroups, construction of a quotient group, isomorphism theorems for groups.
5. Cayley's theorem on subgroups of permutation groups.
6. Internal and external direct and semidirect sum for groups, relationships between these concepts.
7. Theorem on the structure of finitely generated Abelian groups.
8. Groups acting on sets, examples, Cauchy's theorem, Sylow theorems.

- **The beginning of ring theory:** (If time in the first term should suffice)

1. Definition of rings and ideals, quotient ring.
2. Ring homomorphisms, kernel, isomorphism theorem for rings.
3. Polynomial rings as examples.
4. Degree of a polynomial, division of polynomials, roots of a polynomial, Bezout's theorem and its consequences (otherwise this will be in the second term).

Prerequisites and co-requisites

elementary knowledge of Linear Alegbra

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
exam	51.0%	50.0%
observation of the student's attitude	51.0%	0.0%
tests	51.0%	50.0%

Recommended reading

Basic literature	A. Białynicki-Birula, Algebra, PWN (wiele wydań). J. Rutkowski, Algebra Abstrakcyjna w Zadaniach, PWN.
Supplementary literature	S. Lang, Algebra, PWN 1973. M. Bryński, J. Jurkiewicz, Zbiór zadań z algebry, PWN 1985. K. Szymiczek, Zbiór zadań z teorii grup.
eResources addresses	

Example issues/ example questions/ tasks being completed

Not applicable

Work placement

Not applicable

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