GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Linear algebra with geometry, PG_00034519		
Field of study	Technical Physics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Probability Theory and Biomathematics -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Maciej Kuna	
	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	5.0	60.0	125

Subject objectives

Getting to know the basic knowledge in the field of linear algebra and analytic geometry.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W03] possesses structured knowledge of higher mathematics, including algebra, analysis, probability and numerical methods, sufficient to describe, understand and model complex physical phenomena and selected technical processes.	The student understands problems in linear algebra and analytic geometry; is familiar with complex numbers, matrix calculus, and vector algebra. They are familiar with various methods for solving problems involving complex numbers, matrices, solving systems of linear equations, and methods of analytic geometry in R^3 space, to the extent necessary for engineering work.	[SW1] Assessment of factual knowledge
[K6_U01] demonstrates the ability for lifelong independent learning, including acquiring information from literature, databases and other appropriate sources.	The student is able to independently expand their knowledge of algebra using information from the literature and other sources recommended during the course. They are able to independently perform exercises to consolidate their knowledge.	[SU2] Assessment of ability to analyse information
[K6_U02] is able to analyse and solve complex and non-standard scientific and technical problems using appropriate analytical, computational, numerical, simulation or experimental methods.	The student is able to analyze algebraic problems in various representations and is able to choose the appropriate way to solve them.	[SU3] Assessment of ability to use knowledge gained from the subject

Subject contents	Course content – lecture 1. Definition of group and homomorphizm of groups. Examples. 2. Definition of field, ring and homomorphizm of fields. Examples. 3. Field of complex numbers. 4. Definition of linear space. Linear independence. Basis. 5. Basic constructions in linear space. 6. Linear space of matrices. Determinant and rank of matrices. 7. Homomorphisms of linear spaces - linear operators. 8. Matrix of linear operator. 9. Linear problems. Kronecker-Capelli theorem. 10. Invariants of automorphisms of linear spaces. 11. Inner product spaces. 12. Unitary and hermitian operators. 13. Affine spaces. 14. R^n as affine space. 15. Quadric surfaces. Course content – exercises 1. Exercises with simple algebraic structures. 2. Exercises with groups. 3. Exercises with fields. 3. The field of complex numbers - equations and systems of equations. 4. The field of complex numbers - trigonometric form, roots. 5. Determinant definition and properties. 6. Determinant from Laplace expansion. 7. Matrix multiplication and matrix equations. 8. Cramer systems. 9. Matrix rank. 10. General scheme for solving linear problems. Linear operators and their matrix representations. 11. Invariants of endomorphisms. 12. Unitary spaces. 13. Spectral theorem.
Prerequisites and co-requisites	Basic knowledge of mathematics in the field of secondary school.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
colloquia	50.0%	54.0%
egzamination	50.0%	40.0%
exercises	50.0%	6.0%

Recommended reading

Basic literature	J.Komorowski: Od liczb zespolonych do tensorów, spinorów, algebr Liego i kwadryk. PWN Warszawa 1978R.S. Ingarden L. Górniewicz: Algebra liniowa dla fizyków. Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika Toruń 2000B. Gleichgewicht: Algebra. Oficyna Wydawnicza GiS Wrocław 2004
Supplementary literature	A. Romanowski: Algebra Liniowa. Wydawnictwo Politechniki Gdańskiej Gdańsk 2003S.Przybyło A. Szlachtowski: Algebra i geometria afiniczna w zadaniach. Wydawnictwa Naukowo-Techniczne warszawa 1983
eResources addresses	

Example issues/ example questions/ tasks being completed	Definition of linear space and examples.Theorem of Kronecker- Capelli
Practical activites within the subject	Not applicable

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