SUBJECT CARD

Name of subject in Polish:	**ALGEBRA LINIOWA Z GEOMETRIĄ ANALITYCZNĄ B**
Name of subject in English:	**LINEAR ALGEBRA WITH ANALITIC GEOMETRY B**
Profile:	**academic**
Level and form of studies:	**1st level, full-time**
Kind of subject:	**obligatory**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	**30**	**15**			
Number of hours of total student workload (CNPS)	**50**	**50**			
Form of crediting	Examination	crediting with grade*			
For group of courses mark (X) final course					
Number of ECTS points	**2**	**2**			
including number of ECTS points for practical classes (P)		**2**			
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	**1,5**	**0,7**			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

The student has the knowledge required for the Matura exam in Mathematics at least at basic level

SUBJECT OBJECTIVES

C1. Exposition of the basic concepts of linear algebra and analytic geometry.
C2. Exposition of the methods for solving basic problems related to complex numbers, matrices, systems of equations and analytic geometry in Euclidean space R^3.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge a student:
PEU_W01 student knows the basic properties of complex numbers.
PEU_W02 student knows the basic concepts and theorems about the matrix.
PEU_W03 student knows the basic concepts and theorems on polynomial algebra.
PEU_W04 student knows the basic methods of solving linear equations.
PEU_W05 student knows how to describe lines, planes and conic curves.

Relating to skills a student:
PEU_U01 student can carry out calculations with complex numbers
PEU_U02 student can use matrix notation and transformations appropriate for the algebra of

matrices and determinants.
PEU_U03 student can factor a polynomial and factor rational functions for real simple fractions.
PEU_U04 student can effectively solve systems of equations linear.
PEU_U05 student can solve problems concerning mutual position of points, lines and vectors in Euclidean space.

Relating to social competences a student:
PEU_K01 student knows the rules of behavior in the environment academic.
PEU_K02 student improves communication skills.
PEU_K03 student can use reliable scientific information sources.

PROGRAMME CONTENT

Lecture		**Number of hours**
Lec 1	Matrix. Operations on matrices. The transpose of a matrix. Types of matrices (triangular, symmetric, diagonal, etc.).	2
Lec 2	The determinant of a matrix. Laplace expansion. The algebraic complement of a matrix element. minor. Properties of determinants. Calculation of determinants. Cauchy's theorem on the multiplication of determinants. Nonsingular matrix.	3
Lec 3	Inverse matrix. The method of algebraic complements and elementary transformations. Properties of inverse matrices. Matrix equations.	2
Lec 4	System of linear equations. Cramer formulas. Gauss elimination method. Solving arbitrary systems of linear equations.	3
Lec 5	A complex number. Algebraic form. Operations on complex numbers. Coupling. Module. Argument.	2
Lec 6	Geometric interpretation of a complex number. Trigonometric form and exponential form. De Moivre's formula. The nth root of a complex number.	2
Lec 7	Polynomial. Bezout's theorem. Fundamental theorem of algebra. Roots of real polynomials.	2
Lec 8	Linear and square divisors of real polynomials. Factoring a polynomial. A rational function. Real simple fraction. Decomposition of a rational function into real simple fractions.	2
Lec 9	Analytic geometry in R3 space. Operations on vectors. Vector length. Products: scalar, vector, mixed. Application for calculating areas and volumes.	2
Lec 10	Plane. Normal vector. General, parametric, determinant equation. Relative position of the planes.	2
Lec 11	Simple. Parametric, directional and edge equations. The distance of the point from the line and from the plane. Reciprocal position of straight lines. Relative position of a straight line and a plane. Projection of a point onto a straight line and a plane.	2
Lec 12	Conic curves. Circle. Ellipse. Hyperbole. Parabola.	2
Lec 13	Applications of the Linear Algebra.	4
	Total hours	**30**

Classes		Number of hours
Cl 1	Transformations of algebraic expressions	1
Cl 2	Solving tasks related to the topics presented in the lecture.	14
	Total hours	**15**

TEACHING TOOLS USED

N1. Lecture - traditional method.
N2. Classes - traditional method (problems sessions and discussion).
N3. Student's self-study with the assistance of mathematical packages.
N4. Tutorial.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
F, P - Cl	PEU_U1-PEK_U5 PEU_K1_PEU_K3	Tests, oral presentations, quizzes
P - Lec	PEU_W1-PEU_W5	exam

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] T. Jurlewicz, Z. Skoczylas, Algebra i geometria analityczna. Przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2020.
[2] T. Jurlewicz, Z. Skoczylas, Algebra i geometria analityczna. Definicje, twierdzenia, wzory. Oficyna Wydawnicza GiS, Wrocław 2022.
[3] P. Kajetanowicz, J. Wierzejewski, Algebra z geometrią analityczną, PWN 2008.
[4] M. Zakrzewski, Markowe wykłady z matematyki, Algebra z geometrią, Oficyna Wyd. GiS, Wrocław 2015.

SECONDARY LITERATURE:

[1] G. Banaszak, W. Gajda, Elementy algebry liniowej, cz.I, WNT, 2002.
[2] A. Mostowski, M. Stark, Elementy algebry wyższej, PWN, Warszawa 1963.
[3] W. Stankiewicz, Zadania z matematyki dla wyższych uczelni technicznych, Cz. A, PWN, Warszawa 2003.
[4] F. Leja, Geometria analityczna, PWN, Warszawa 1972.
[5] E. Kącki, D. Sadowska, L. Siewierski, Geometria analityczna w zadaniach, PWN, Warszawa 1993.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

Wydziałowa Komisja Programowa ds. przedmiotów kształcenia podstawowego z matematyki

E-mail: w13prodziekan.nauczania@pwr.edu.pl