FACULTY OF COMPUTER SCIENCE AND MANAGEMENT

SUBJECT CARD

Name in English	**ALGEBRA AND ANALYTIC GEOMETRY**
Name in Polish	**ALGEBRA Z GEOMETRIĄ ANALITYCZNĄ**
Main field of study (if applicable)	***Computer Science***
Level and form of studies	**I level, full time**
Kind of subject	**obligatory**
Subject code	**MAT001685**
Group of courses	**YES**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	30			
Number of hours of total student workload (CNPS)					
Form of crediting	exam	crediting with grade			
For group of courses mark (X) final course	X				
Number of ECTS points					
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

It is recommended that the knowledge of mathematics is equivalent to high school certificate at the basic level.

SUBJECT OBJECTIVES

C1 Presentation of basic theorems and algorithms concerning the theory of linear equations.
C2 Presentation of basic notions concerning matrix calculus, eigenvalues and eigenvectors of matrices.
C3 Exposition of rudiments of the theory of complex numbers, polynomial and rational functions.
C4 Exposition of rudiments of analytic geometry in R^3.
C5 Expalining the basic notions of theory of vector spaces.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge a student

PEK_W1 knows basic methods of solving systems of linear equations,
PEK_W2 knows basic properties of complex numbers,
PEK_W3 knows basic algebraic properties of polynomials,
PEK_W4 knows characterizations of lines and planes in R^3.
PEK_W5 knows basic notions of theory of vector spaces.

Relating to skills a student:
PEK_U1 can add and multiply matrices and calculate determinants,
PEK_U2 can solve systems of linear equations,
PEK_U3 can find eigenvalues and eigenvectors of a matrix,
PEK_U4 can carry out calculations with use of complex numbers,
PEK_U5 can find line and plane equations in the space R^3.

PROGRAM CONTENT		
Form of classes - lectures		**Hours**
Lec1	Mathematical induction. Newton's binomial formula.	1
Lec2	The notion of a matrix. Operations on matrices. Transposition. Examples of matrices (triangular, symmetric, diagonal etc.).	2
Lec3	The determinant of a matrix. The Laplace expansion. Cofactor of an element of a matrix. Minors. Properties of determinants. Calculation of determinants by elementary row and column operations. Cauchy's theorem. Nonsingular matrix.	3
Lec4	Inverse matrix. Computation of inverse matrix by cofactors or by elementary row operations. Properties of inverse matrices. Matrix equations. Rank of a matrix. Applications of determinants, their connections with rank and invertibility.	2
Lec5	Systems of linear equations. Rouché–Capelli theorem. Cramer's formulas. Gaussian elimination. Solving arbitrary systems of linear equations.	3
Lec6	Complex numbers. Operations on complex numbers in algebraic form. Complex conjugate. Modulus. Argument.	2
Lec7	Geometric interpretation of a complex number. Polar form of a complex number. De Moivre's formula. Roots of complex numbers.	2
Lec8	Polynomials. Polynomial remainder theorem. Fundamental theorem of algebra. Roots of polynomials with real coefficients.	2
Lec9	Linear and quadratic factors of a real polynomial. Decomposition of a polynomial into factors. Rational functions. Real partial fractions with irreducible denominators. Partial fraction decomposition of a real rational function.	2
Lec10	Eigenvalues and eigenvectors of a matrix.	2
Lec11	Analytic geometry in the space R^3. Operations on vectors. Length of a vector. Scalar product, cross product and triple product of vectors - computing area and volume.	2
Lec12	Planes. Normal to a plane. Equations of a plane. Relative location of planes.	1
Lec13	Line in the space. Equations of a line (parametric, directional). Line as an intersection of planes. Relative location of two lines. Relative location of a line and a plane. Orthogonal projection of a point onto a line or a plane.	3
Lec14	Vector spaces (finite dimensional). Linear combination of vectors. Linear independence. Basis and dimension of a vector space.	3
	Total hours	**30**

Form of classes – classes		**Hours**
Cl1	Transformation of algebraic expressions. Newton's binomial formula.	1
Cl2	Operations on matrices.	1
Cl3	Calculation of matrix determinants with use of their properties. Laplace expansion. Computation of an inverse matrix. Solving matrix equations. Evaluation of the rank of a matrix.	4

Cl4	Kronecker-Capelli theorem. Cramer's formulas. Gaussian elimination. Solving of arbitrary systems of linear equations.	4
Cl5	Operations on complex numbers in algebraic form. Polar form. Geometric interpretation. Powers and roots of complex numbers. Solving simple equations and inequalities.	6
Cl6	Finding roots of polynomials. Decomposition of a polynomial into irreducible components. Partial fraction decomposition of a real rational function.	4
Cl7	Eigenvalues and eigenvectors of a matrix.	2
Cl8	Vector operations. Scalar, cross or triple product of vectors and their applications to calculating area and volume.	2
Cl9	Solving problems in analytic geometry in R^3 – finding equations of lines and planes, finding projections of vectors etc.	4
Cl10	Test.	2
	Total hours	**30**

TEACHING TOOLS USED
N1 Lectures – traditional or using multimedia tools. N2 Classes – traditional method (problems sessions and discussion). N3 Student's self-study with the assistance of mathematical packages. N4 Tutorial.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F-forming; P - concluding)	Educational effect number	Way of evaluating educational effect achievement
F – Cl	PEK_U1 - PEK_U5	oral presentations, quizzes, tests
F – Lec	PEK_W1 - PEK_W5	exam
P - rules set by the lecturer		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] T. Jurlewicz, Z. Skoczylas, Algebra i geometria analityczna. Przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2015.

[2] T. Jurlewicz, Z. Skoczylas, Algebra i geometria analityczna. Definicje, twierdzenia, wzory. Oficyna Wydawnicza GiS, Wrocław 2014.

[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] B. Gleichgewicht, Algebra, Oficyna Wydawnicza GiS, Wrocław 2004.

[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 SUPERVISORS
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CORRELATION MATRIX BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

ALGEBRA AND ANALYTIC GEOMETRY MAT001685

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY ***Computer science***

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W1	K1INF_W01	C1, C2	Lec5, Cl4	N1-N4
PEK_W2	K1INF_W01	C3	Lec6-Lec9, Cl5, Cl6	N1-N4
PEK_W3	K1INF_W01	C3	Lec8, Lec9, Cl6	N1-N4
PEK_W4	K1INF_W01	C4	Lec11-Lec13, Cl8, Cl9	N1-N4
PEK_W5	K1INF_W01	C5	Lec14	N1, N3, N4
PEK_U1	K1INF_W01	C2	Lec2-Lec4, Lec10, Cl2, Cl3	N1-N4
PEK_U2	K1INF_W01	C1, C2	Lec5, Cl4	N1-N4
PEK_U3	K1INF_W01	C2	Lec10, Cl7	N1-N4
PEK_U4	K1INF_W01	C3	Lec6-Lec9, Cl5, Cl6	N1-N4
PEK_U5	K1INF_W01	C4	Lec11-Lec13, Cl8, Cl9	N1-N4