MODULE DESCRIPTION

Module code	**Z-0085z**
Module name	**Algebra Liniowa**
Module name in English	**Linear Algebra**
Valid from academic year	**2016/2017**

A. MODULE PLACEMENT IN THE SYLLABUS

Field of study	**Management and Production Engineering**
Level of education	**1st degree** *(1st degree / 2nd degree)*
Studies profile	**General** *(general / practical)*
Form and method of conducting classes	**Full-time** *(full-time / part-time)*
Specialisation	**All**
Unit conducting the module	**The Department of Applied Computer Science and Applied Mathematics**
Module co-ordinator	**Beata Maciejewska, PhD**
Approved by:	

B. MODULE OVERVIEW

Type of subject/group of subjects	**Basic** *(basic / major / specialist subject / conjoint / other HES)*
Module status	**Compulsory** *(compulsory / non-compulsory)*
Language of conducting classes	**English**
Module placement in the syllabus - semester	**1st semester**
Subject realisation in the academic year	**Winter semester** *(winter semester/ summer)*
Initial requirements	**No requirements** *(module codes / module names)*
Examination	**No** *(yes / no)*
Number of ECTS credit points	**3**

Method of conducting classes	Lecture	Classes	Laboratory	Project	Other
Per semester	**15**	**15**			

C. TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

Module target	The aim of the module is to familiarise students with the matrix analysis, the methods of solving systems of linear equations, the complex numbers field, with calculus of vectors and analytic geometry in the three-dimensional space.

Effect symbol	Teaching results	Teaching methods *(l/c/lab/p/other)*	Reference to subject effects	Reference to effects of a field of study
W_01	A student has basic knowledge of complex numbers, matrix analysis and calculus of vectors, the methods of solving linear equations and analytic geometry.	l/c	K_W01	T1A_W01 T1A_W07
U_01	A student can apply matrix calculus to solve matrix equations and to solve systems of linear equations.	l/c	K_U01	TA1_U01
U_02	A student can evaluate the usefulness of familiar methods concerning solving equations and systems of linear equations; a student is also able to select the appropriate method in order to solve a system of equations.	l/c	K_U02	TA1_U02
U_03	A student is able to geometrically interpret the basic concepts of complex numbers, knows how to perform calculations in the set of complex numbers, and solve equations in the complex domain.	l/c	K_U01	TA1_U01
U_04	Student is able to geometrically interpret solutions of linear equations systems. He can connect the basic concepts of analytical geometry with vector calculus.	l/c	K_U01 K_U02	TA1_U01 TA1_U02
K_01	A student understands the need to improve the acquired skills and knowledge. A student can comprehend the elementary relationship between the workload and its effect.	c	K_K01	TA1_K01
K_02	A student knows the possibilities of improving the acquired knowledge and skills as regards linear algebra and analytic geometry.	l/c	K_K01	TA1_K01
K_03	A student is aware of the responsibility for his/her own work and is ready to comply with the rules of team work and to bear the consequences of the tasks completed collectively.	c	K_K04	T1A_K03 T1A_K04

Teaching contents:

1. Teaching contents as regards lectures

Lecture number	Teaching contents	Reference to teaching results for a module
1	Matrices: types of matrices, operations and calculations on matrices and their properties.	W_01 K_01 K_02
2	Determinant of a quadratic matrix: the notion of a matrix determinant and basic properties. Laplace`s rule. Inverse matrix. Solving matrix equations.	W_01 K_01 K_02
3	Systems of linear equations. Cramer's rule. Matrix method of solving Cramer's systems. Solving systems of equations with the elementary operations method.	W_01 K_01 K_02
4	Vectors in space. Operations on vectors. Dot product of vectors. Cross product of vectors.	W_01 K_01 K_02

5	Analytic geometry in the three-dimensional space: a straight line and plane in space.	W_01 K_01 K_02
6	Relative position of points, straight lines and planes.	W_01 K_01 K_02
7	Complex numbers. Rectangular form of a complex number and calculations on the set of complex numbers. Polar form of a complex number – geometric interpretation. Euler`s formula. De Moivre's formula. A root of complex number. Solving polynomial equations in a complex domain.	W_01 K_01 K_02
8	A test.	W_01 U_01 U_02 U_03 U_04

2. Teaching contents as regards classes

Class number	Teaching contents	Reference to teaching results for a module
1	Matrices: operations on matrices and the properties of operations. Matrix determinant – the definition and basic properties.	W_01 U_01 K_01 K_02 K_03
2	Inverse matrix and its application in solving matrix equations.	W_01 U_01 K_01 K_02 K_03
3	Systems linear equations. The application of determinants in solving systems of linear equations (Cramer's rule). Matrix method of solving Cramer's systems.	W_01 U_01 U_02 K_01 K_02 K_03
4	Solving systems of equations with the elementary operations method.	W_01 U_01 U_02 K_01 K_02 K_03
5	Operations on vectors in space. Dot and cross products of vectors.	W_01 U_04 K_01 K_02 K_03
6	The description of a straight line and a plane in space. Relative position of pionts, straight line and a plane in space.	W_01 U_04 K_01 K_02 K_03
7	Complex numbers in an rectangular form and basic operations on complex numbers. Geometric interpretation of a complex number. A root of complex number. Solving polynomial equations in a complex domain.	W_01 U_03 K_01 K_02 K_03
8	A test.	W_01 U_01 U_02

		U_03 U_04

3. Teaching contents as regards laboratory classes

Laboratory class number	Teaching contents	Reference to teaching results for a module

4. The characteristics of project assignments

The methods of assessing teaching results

Effect symbol	Methods of assessing teaching results *(assessment method, including skills – reference to a particular project, laboratory assignments, etc.)*
W_01	Tests, a student's initiative during the classes, and homework assignments.
U_01	Tests, a student's initiative during the classes, and homework assignments.
U_02	Tests, a student's initiative during the classes, and homework assignments.
U_03	Tests, a student's initiative during the classes, and homework assignments.
U_04	Tests, a student's initiative during the classes, and homework assignments.
K_01	Observing a student's involvement during his/her independent work during the classes; a discussion during the lectures and classes.
K_02	Observing a student's involvement during his/her independent work during the classes; a discussion during the lectures and classes.
K_03	Observing a student's involvement during his/her independent work during the classes; a discussion during the lectures and classes.

D. STUDENT'S INPUT

ECTS credit points		
	Type of student's activity	**Student's workload**
1	Participation in lectures	**15**
2	Participation in classes	**15**
3	Participation in laboratories	
4	Participation in tutorials (2-3 times per semester)	**10**
5	Participation in project classes	
6	Project tutorials	
7	Participation in an examination	
8		
9	**Number of hours requiring a lecturer's assistance**	**40** *(sum)*
10	**Number of ECTS credit points which are allocated for assisted work** *(1 ECTS point=25-30 hours)*	**1.5**
11	Unassisted study of lecture subjects	**10**
12	Unassisted preparation for classes	**16**
13	Unassisted preparation for tests	**10**
14	Unassisted preparation for laboratories	
15	Preparing reports	
15	Preparing for a final laboratory test	
17	Preparing a project or documentation	
18	Preparing for an examination	**4**
19		
20	**Number of hours of a student's unassisted work**	**40** *(sum)*
21	**Number of ECTS credit points which a student receives for unassisted work** *(1 ECTS point=25-30 hours)*	**1.5**
22	**Total number of hours of a student's work**	**80**
23	**ECTS points per module** *1 ECTS point=25-30 hours*	**3**
24	**Work input connected with practical classes** *Total number of hours connected with practical classes*	**41**
25	**Number of ECTS credit points which a student receives for practical classes** (1 ECTS point=25-30 hours)	**1.5**

E. LITERATURE

Literature list	1. Gdowski B., Pluciński E., *Zadania z rachunku wektorowego i geometrii analitycznej*, PWN, Warszawa 1982. 2. Grysa K., *Zastosowania matematyki w zarządzaniu i ekonomii. Część I. Elementy algebry*, Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2003. 3. Hożejowska S., Hożejowski L., Maciąg A., *Matematyka w zadaniach dla studiów ekonomiczno-technicznych*, Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2003. 4. Trajdos T., *Matematyka. Część III*, Wydawnictwa Naukowo-Techniczne, Warszawa 1981. 5. Skrypt z Algebry w formie elektronicznej zamieszczony na stronie: http://wzimk-moodle.tu.kielce.pl/

Module website	