COURSE SPECIFICATION

Course code	full-time programme:	**M#2-S1-ME-101**
	part-time programme:	
Course title in Polish	**Algebra liniowa**	
Course title in English	**Linear algebra**	
Valid from (academic year)	**2024/2025**	

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**first-cycle**
Type of education	**academic**
Mode of study	**full-time programme**
Specialism	**all**
Department responsible	**Department of Mechanics and Heat Transfer**
Course leader	**dr hab. Sylwia Hożejowska, prof. PŚk**
Approved by	**dr hab. Jakub Takosoglu, prof. PŚk, Dean of the Faculty of Mechatronics and Mechanical Engineering**

COURSE OVERVIEW

Course type		**basic**
Course status		**compulsory**
Language of instruction		**English**
Semester of delivery	full-time programme	**Semester I**
	part-time programme	
Pre-requisites		**none**
Examination required (YES/NO)		**YES**
ECTS value		**4**

Mode of instruction		**lecture**	**class**	**laboratory**	**project**	**seminar**
No. of hours per semester	full-time programme	**15**	**30**			
	part-time programme					

LEARNING OUTCOMES

Category of outcome	**Outcome code**	**Course learning outcomes**	**Corresponding programme outcome code**
Knowledge	W01	The student has structured knowledge of complex numbers. He can provide solutions to polynomial equations in the complex domain.	MiBM1_W01

	W02	The student has advanced knowledge of matrix algebra and methods of solving systems of linear equations.	MiBM1_W01
	W03	The student has knowledge of analytical geometry.	MiBM1_W01
Skills	U01	The student is able to solve a polynomial equation in the complex domain.	MiBM1_U01
	U02	The student is able to apply matrix calculus to solve matrix equations and to solve systems of linear equations. Is able to solve systems of linear equations.	MiBM1_U01
	U03	The student is able to solve problems met in engineering practice and concerning linear algebra and analytic geometry.	MiBM1_U01
Competence	K01	The student is ready to critically evaluate his/her knowledge and to use expert opinions or reliable sources of information in case of difficulties in solving engineering problems.	MiBM1_K01
	K02	The student critically evaluates his/her knowledge and recognizes the need to independently supplement and expand it, particularly in applying mathematical methods for solving engineering problems in mechanics and machine construction	MiBM1_K03

COURSE CONTENT

Type of instruction lecture	Topics covered
lecture	Algebraic, trigonometric, and exponential forms of a complex number. Geometric interpretation of complex numbers – the complex plane. Operations on complex numbers in algebraic, trigonometric, and exponential forms. Solving polynomial equations in the complex domain. Matrices: operations on matrices and properties of these operations. Determinant of a matrix: definition and basic properties. Inverse matrix. Solving matrix equations. Systems of linear equations. Cramer's Rule. Matrix method for solving Cramer's systems. Kronecker-Capelli theorem. Solving systems of equations using elementary row operations (Gauss and Gauss-Jordan elimination). Vectors in three-dimensional space. Algebraic operations on vectors. Scalar, cross and mixed product :properties and applications. Equation of a line in 3D and equation of a plane. Mutual position of points, lines and planes in three-dimensional space. Quadrics - canonical equations and graphs of basic quadric surfaces.
class	Algebraic, trigonometric, and exponential forms of a complex number. Geometric interpretation of complex numbers – the complex plane. Operations on complex numbers in algebraic, trigonometric, and exponential forms. Solving polynomial equations in the complex domain. Matrices: operations on matrices and properties of these operations. Determinant of a matrix: definition and basic properties. Inverse matrix. Solving matrix equations. Systems of linear equations. Cramer's Rule. Matrix method for solving Cramer's systems. Kronecker-Capelli theorem. Solving systems of equations using elementary row operations (Gauss and Gauss-Jordan elimination). Vectors in three-dimensional space. Algebraic operations on vectors. Scalar, cross and mixed product :properties and applications. Equation of a line in 3D and equation of a plane. Mutual position of points, lines and planes in three-dimensional space.

ASSESSMENT METHODS

Outcome code	Methods of assessment *(Mark with an X where applicable)*					
	Oral examination	Written examination	Test	Project	Report	Other
W01		x	x			x
W02		x	x			x
W03		x	x			x
U01		x	x			x
U02		x	x			x
U03		x	x			x
K01						x
K02						x

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	examination assessment	Final exam score 50% or higher
class	non-examination assessment	Overall test score 50% or higher

OVERALL STUDENT WORKLOAD

ECTS weighting												
No.	Activity type	Student workload										Unit
		full-time programme					part-time programme					
1.	Scheduled contact hours	L	C	Lb	P	S	L	C	Lb	P	S	h
		15	30									
2.	Other contact hours (office hours, examination)	4	2									h
3.	**Total number of contact hours**	**51**										h
4.	**Number of ECTS credits for contact hours**	**2,0**										ECTS
5.	**Number of independent study hours**	**49**										h
6.	**Number of ECTS credits for independent study hours**	**2,0**										ECTS
7.	**Number of practical hours**	**67**										h
8.	**Number of ECTS credits for practical hours**	**2,7**										ECTS
9.	**Total study time**	**100**										h
10.	**ECTS credits for the course** *1 ECTS credit = 25-30 hours of study time*	**4**										ECTS

READING LIST

1. Gdowski B., Pluciński E.: Zadania z rachunku wektorowego i geometrii analitycznej, PWN, Warszawa 2006.
2. Hożejowska S., Hożejowski L., Maciąg A.: Matematyka w zadaniach dla studiów ekonomiczno-technicznych, Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2005.
3. Jurlewicz T., Skoczylas Z.: Algebra liniowa 1. Definicje, twierdzenia, wzory, Oficyna wydawnicza GiS, Wrocław 2004.
4. Trajdos T.: Matematyka. Cz. 3, WNT, Warszawa 1987.
5. Skrypt z Algebry zamieszczony na stronie: https://wzimk-modle.tu.kielce.pl.
6. Lipschutz S., Lipson M.L., Linear Algebra, Schaum's Outline Series, Sixth Edition, Mc Graw Hill Education