COURSE SPECIFICATION

Course code	full-time programme:	**M#2-S2-ME-101**
	part-time programme:	
Course title in Polish	**Mechanika analityczna**	
Course title in English	**Analytical Mechanics**	
Valid from (academic year)	**2024/2025**	

GENERAL INFORMATION

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

COURSE OVERVIEW

Course type		**programme-specific**
Course status		**compulsory**
Language of instruction		**English**
Semester of delivery	full-time programme	**Semester I**
	part-time programme	**Semester I**
Pre-requisites		
Examination required (YES/NO)		**NO**
ECTS value		**2**

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

LEARNING OUTCOMES

Category of outcome	Outcome code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	The student has basic knowledge of general mechanics extended by the concepts of generalized coordinates and generalized forces.	MiBM2_W02
	W02	The student has knowledge of the use of the principle of virtual works.	MiBM2_W02
	W03	The student has knowledge enabling him to describe mechanical systems using: Lagrange's equations and d'Alembert's principle.	MiBM2_W02
Skills	U01	The student is able to describe the dynamics of complex mechanical systems with one or many degrees of freedom.	MiBM2_U01
	U02	The student is able to determine the equilibrium conditions of mechanisms in terms of analytical mechanics.	MiBM2_U01
	U03	The student is able to describe oscillating systems with one or many degrees of freedom.	MiBM2_U01
Competence	K01	Understands the importance and possibilities of continuous learning (third-cycle studies, postgraduate studies, courses), which leads to the improvement of professional, personal and social competences.	MiBM2_K01

COURSE CONTENT

Mode of instruction	Topics covered
lecture	Constraints and their types, classification of systems according to the types of constraints. Generalized coordinates, generalized velocities. Virtual displacement. Perfect restraints. Generalized equation of dynamics. General dynamics equation for rotational and planar motion of rigid body (examples). The principle of virtual works. d'Alembert's principle. Generalized forces. Lagrangian function. Lagrange equations of the II kind - examples: construction of dynamic equations for a material point, a rigid body, a mechanical system with one and many degrees of freedom. Vibrations of many degrees of freedom systems.
class	Kinematics of a rigid body in rotation and plane motion. Kinematics of the mechanical system. Generalized coordinates. The principle of virtual work. Determination of reaction forces (beams), balancing forces (mechanisms). Determining the equilibrium position of mechanical systems. Work of force. Kinetic energy of a system of material points, a rigid body, a mechanical system. Potential energy of the gravity force, elastic force. The principle of equivalence of kinetic energy and work. Principle of conservation of mechanical energy. Lagrange's equations: construction of dynamic equations for a material point, a rigid body, a mechanical system with one and many degrees of freedom.

ASSESSMENT METHODS

Outcome code	Methods of assessment					
	Oral examination	Written examination	Test	Project	Report	Other
W01			X			
W02			X			
W03			X			
U01			X			

U02			X			
U03			X			
K01						X

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	non-examination assessment	Obtaining at least 50% of points in the test.
class	non-examination assessment	Obtaining at least 50% of points in the test.

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	15									
2.	Other contact hours (office hours, examination)	2	2									h
3.	**Total number of contact hours**	34										h
4.	**Number of ECTS credits for contact hours**	1,4										ECTS
5.	**Number of independent study hours**	16										h
6.	**Number of ECTS credits for independent study hours**	0,6										ECTS
7.	**Number of practical hours**	25										h
8.	**Number of ECTS credits for practical hours**	1,0										ECTS
9.	**Total study time**	50										h
10.	**ECTS credits for the course** *1 ECTS credit = 25-30 hours of study time*	2										ECTS

READING LIST

1. Engineering Mechanics: Dynamics, Third Edition Andrew Pytel and Jaan Kiusalaas Cengage Learning 2010
2. Analytical Mechanics An Introduction Antonio Fasano Stefano Marmi Oxford University Press 2006
3. DYNAMICS OF MULTIBODY SYSTEMS Third Edition Ahmed A. Shabana Cambridge University Press 2005