



## Subject card

Subject name and code	Mechanics of solids and fluids I, PG_00039790						
Field of study	Materials Engineering, Materials Engineering, Materials Engineering						
Date of commencement of studies	October 2021		Academic year of realisation of subject		2022/2023		
Education level	first-cycle studies		Subject group		Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Mechanics and Mechatronics -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Krzysztof Lipiński				
	Teachers		dr hab. inż. Krzysztof Lipiński  dr inż. Piotr Patrosz				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	0.0	45
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	45		5.0		50.0	100
Subject objectives	Acquainting students with the essential law of mechanics and forming abilities of solving problems practical, in static issues and kinematics of the point.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K6_U06		Is able to integrate obtained information, make their interpretations, as well as draw conclusions and formulate and justify opinions in the field of solid and fluid mechanics		[SU4] Assessment of ability to use methods and tools		
	K6_K01		understands the need to improve professional competence in the field of solid state mechanics; is aware of its own limitations and knows when to turn to experts, can properly set priorities for the implementation of its or other tasks		[SK5] Assessment of ability to solve problems that arise in practice		
	K6_W05		has knowledge of the statics of a convergent and arbitrary system of forces, both in relation to a solid and a system of solids, and kinematics of a point and a solid in planar motion - two fundamental branches of general mechanics		[SW1] Assessment of factual knowledge		

Subject contents	<p>LECTURES: Introduction: Organization of occupations and the literature of object. Historical outline. Mechanic and its main sub-disciplines. Modelling in mechanics: the real objects, physical model, mathematical model the, ideally stiff body, the material point, force concentrated. Scalar and vector quantities. Newton's laws. Primary notions and axioms. Equivalent sets of forces. Moment of force. The degrees of freedom, constraints and their reactions. Statically determinate, indeterminate and unstable sets of bodies. The couple of forces and its moment. Resultant force and resultant moment. Statics: Basic notions. Force and their source. The division of forces: active and passive forces, external and internal forces. The conditions of equilibrium of arbitrary arranged forces. Alternative conditions of equilibrium. The principle of independence of effects of forces - the principle of superposition. Gravity force, centre of gravity and the notion of static moment. Sliding friction, friction the cords, rolling resistance. Use of matrix calculus and the computer methods in mechanics. Trusses. Kinematics: The principal notions of kinematics of point: the position, speed and the acceleration, equation of movement. The description of movement of point in coordinates: vectorial, rectangular, normal as well as polar. Tangent and normal acceleration. Special cases of movement of point. Kinematics of rigid body. Principal notions. Description of the position of rigid body, speed and angular acceleration of rigid body as well as speed and acceleration of points that belong to rigid body. Special cases of movement of rigid body: translation, rotation, uniplanar motion. Relative motion. Acceleration of Coriolis. EXERCISES: Repetition with vectorial calculus. Vectorial nature of forces. The principle of two forces. Elimination of constraints of bodies, force of reaction of constraints. Orthogonal projection of vector on axis. Moment of force in respect to point and in respect to axis. Equilibrium of any arbitrary arranged sets of forces. Calculation of the coordinates of centres of gravity, mass. Equilibrium of sets with friction. Kinematics of point: differentiating and the integration of the equations of motion. Kinematics of arrangement of points. Kinematics of rigid body, instantaneous centre of velocity.</p>		
Prerequisites and co-requisites	The command of physics and the mathematics on level of school of average, in this particularly: geometry and trigonometry, differential calculus, vectorial and matrix calculus.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
		56.0%	50.0%
		56.0%	50.0%
Recommended reading	Basic literature	Wittbrodt E., Sawiak S.: Mechanika ogólna. Teoria i zadania. Wyd. PG, Gdańsk 2012	
	Supplementary literature	<p>Leyko J.: Mechanika ogólna, t. 1 i 2, PWN, Warszawa 2004</p> <p>Osiński Z.: Mechanika ogólna, PWN, Warszawa 1994</p> <p>Nizioł J.: Metodyka rozwiązywania zadań z mechaniki. WNT, Warszawa 2002</p> <p>Sawiak S., Wittbrodt E.: Mechanika. Wybrane zagadnienia. Teoria i zadania. Wyd. PG, Gdańsk 2007</p>	
	eResources addresses	<p>Adresy na platformie eNauczanie:</p> <p>Mechanika ciała stałego i płynów I, W/C, IM, sem.03, zimowy 22/23 (PG_00039790) - Moodle ID: 26809</p> <p><a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=26809">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=26809</a></p>	

Example issues/  
example questions/  
tasks being completed

1. projection of forces onto the axis
2. dot product of vectors
3. vector product of vectors
4. composing and decomposing of forces (analytically and graphic)
5. moment of force with the respect to the point and with respect to the axis
6. reduction in the free sets of forces to a single force and to a single pair of forces (the main force and the main moment)
7. invariants of the sets of forces
8. conditions of the equilibrium of the free agreement of forces
9. conditions of the equilibrium of special cases of forces (plat, coincident and parallel agreements)
10. Alternative conditions of the equilibrium of plat agreements of forces
11. constraints and their reactions
12. arrangements statically determinable, undeterminable and unstable
13. lateral friction
14. Cone of friction
15. friction of cords
16. rolling resistance
17. typical methods used to determine the coefficient of friction
18. the centres of gravity, the notion and formulas
19. the centres of gravity for homogeneous lines
20. the centres of gravity for homogeneous plane figures
21. the centres of gravity for homogeneous 3D bodies
22. description of the movement of point in the rectangular coordinates
23. description of the movement of point with use of the leading vector
24. description of the movement of point in the natural coordinates
25. path of the particle

	<p>26. the definition of the linear speed and the linear accelerations</p> <p>27. tangent and normal acceleration</p> <p>28. uniform and monotonously accelerated linear motion</p> <p>29. circular motion of particle</p>
Work placement	Not applicable