



Subject card

Subject name and code	Mechanics I, PG_00072244						
Field of study	Mechanical Engineering						
Date of commencement of studies	October 2026		Academic year of realisation of subject			2026/2027	
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	1		Language of instruction			Polish	
Semester of study	2		ECTS credits			5.0	
Learning profile	general academic profile		Assessment form			exam	
Conducting unit	Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Edmund Wittbrodt				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	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	60		5.0		60.0	125
Subject objectives	Teaching the basics of solid mechanics in the field of statics, kinematics and dynamics						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W01] possesses advanced knowledge of mathematics, physics, and mechanics, applied to the modeling, analysis, and description of phenomena and processes occurring in mechanical systems	Determines the equilibrium conditions of any force system, as well as specific systems: plane, concurrent, and parallel.	[SW1] Assessment of factual knowledge
	[K6_W04] knows and understands the principles of operation, integration and evaluation of technical systems, including mechanical, automation, robotics, electrical, electronic and energy systems, as well as measurement, experimental and computational methods used in research, data analysis and performance assessment	Can apply the principles of mechanics to solve engineering problems in mechanics and mechanical engineering.	[SW1] Assessment of factual knowledge
	[K6_U06] uses mathematical and physical models to analyze processes and phenomena occurring in mechanical devices	Can solve simple problems in solid mechanics in the areas of statics, kinematics, and dynamics.	[SU3] Assessment of ability to use knowledge gained from the subject
	[K6_U01] is able to acquire information from professional literature, databases, and other sources, integrate and interpret it, and formulate justified conclusions and opinions for solving engineering problems	Describes real systems using physical and mathematical models. Recognizes the concepts of ideally rigid body, point mass, and concentrated force. Presents Newton's basic laws, primitive concepts, and axioms of mechanics. Distinguishes between equivalent force systems. Determines the principal force and principal moment of any force system. Describes the degrees of freedom, constraints, and their reactions, as well as the static determinacy, indeterminacy, and instability of a system. Determines the equilibrium conditions of any force system, as well as specific systems: plane, concurrent, and parallel. Defines equivalent equilibrium conditions. Determines the types of forces and their sources, describes active and passive forces, external and internal forces, as well as gravity and the coordinates of the center of gravity. Describes sliding friction forces, tendon friction, and rolling resistance. Determines forces in truss members. Introduces the basic concepts of point kinematics: position, velocity, and acceleration. Recognizes vector, Cartesian, natural, and polar coordinates in the description of point kinematics. Describes the kinematic parameters of specific cases of point motion: rectilinear uniform and uniformly accelerated motion, harmonic motion, piston motion in a crank mechanism, and point motion along a circle and an ellipse. Describes and solves problems related to the dynamics of particles.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools

Subject contents	Course content – lecture		
	Mechanics: role, classification, and modeling. Newton's laws. Primitive concepts and axioms. The resultant of a system of forces. A pair of forces and their moment. Equivalent systems of forces. Degrees of freedom, constraints, and their reactions. Statically determinate systems. Forces, classification, and sources. Principal force and principal moment, invariants of mechanics. Basic and equivalent conditions for equilibrium of a system of forces. Gravity and the center of gravity. Resistance forces: sliding friction, tendon friction, and rolling resistance. Calculating forces in truss members. Kinematics of a point: position, velocity, and acceleration, and relationships. Description of motion in rectangular, vector, natural, and polar coordinates. Tangential and normal acceleration. Special cases of point motion: plane motion, including: oblique projection, circular and ellipse motion, the crosshead mechanism. Position, velocity, and angular acceleration of a body, and the velocity and acceleration of a point in a body. Relationships between the velocities of points in a rigid body. Special cases of solid motion: translational, rotational, and plane motion. Plane motion as a combination of translational and rotational motion and rotation about an instantaneous center of velocity. Velocity and acceleration of a point in solid motion. Kinematics of gears. Relative motion of a point. Coriolis acceleration. Spherical motion of a solid, Euler angles. Kinematics of a solid in arbitrary motion. Differential equations of the dynamics of a material point in vector, rectangular, natural, and polar coordinates. Types of problems. Special cases: rectilinear motion, oblique projection, free fall, harmonic motion, mathematical pendulum. Laws of dynamics: d'Alembert's, momentum and impulse, angular momentum and slewing, energy and work. Dynamics of a system of points. Collisions of points.		
	Course content – exercises		
	Scalar and vector quantities, vector operations. The resultant of a system of forces acting on a solid. Moment of a force vector about a point and about an axis. Static determinacy of mechanical systems. Reduction of a system of forces to a principal force and a moment. Equilibrium of force systems: plane, coincident, and parallel, as well as the rule of two and three forces acting on a solid. Equilibrium of spatial systems of forces acting on solids. Substitute equilibrium conditions. Calculation of the center of gravity. Sliding friction. Tendon friction and rolling resistance. Calculation of trusses using the analytical method and the Ritter section method. Calculation of the trajectory, velocity, and acceleration of a point in rectangular (Cartesian) and natural coordinates. Calculation of the trajectory, velocity, and acceleration of a point in polar coordinates. Calculation of the velocity and acceleration of a point in circular motion, an ellipse, and in oblique projection. Calculation of the velocity and acceleration of a solid and of a point in translational and rotational motion of a solid. Dynamics of a material point. Principles of point dynamics. Dynamics of a solid in rotational, translational, and arbitrary motion. Point collisions.		
Prerequisites and co-requisites	Phisics and mathematics on the secondary level school, including in particular: geometry, thrigonometry, and also vector calculus.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	56.0%	50.0%
	Practical exercise	56.0%	50.0%
Recommended reading	Basic literature	Wittbrodt E., Sawiak S.: General Mechanics. Theory and exercises. Published by GUT, Gdansk 2020 (in Polish)	
	Supplementary literature	Osiński Z.: Mechanika ogólna. T. I i 2, PWN, Warszawa 1987	
		Nizioł J.: Metodyka rozwiązywania zadań z mechaniki. WNT, Warszawa 2002	
		Sawiak S., Wittbrodt E.: Mechanika. Wybrane zagadnienia. Teoria i zadania. Wyd. PG, Gdańsk 2007	
	eResources addresses		
Example issues/ example questions/ tasks being completed	Equilibrium conditions of a plane system of forces. Give the equations of motion of a solid in plane motion, in Cartesian coordinates. What do I understand by the concept of a system of material points? What are the conditions for the disappearance of dynamic reactions of bearings?		
Practical activites within the subject	Not applicable		

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