



## Subject card

Subject name and code	Mechanics, PG_00060473						
Field of study	Mechatronics						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2023/2024		
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			7.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Mechanics and Mechatronics -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Marek Krawczuk					
	Teachers	dr hab. inż. Wojciech Macek mgr inż. Kornel Piłat prof. dr hab. inż. Edmund Wittbrodt mgr inż. Grzegorz Banaszek					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	30.0	15.0	0.0	0.0	90
	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	90	11.0		74.0	175	
Subject objectives	Theoretical and exercises in technical mechanics						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_U03] has self-learning skills	Is able to acquire knowledge independently			[SU3] Assessment of ability to use knowledge gained from the subject		
	[K6_W02] has a knowledge in term of physics that includes mechanics, thermodynamics, optics, electricity, magnetism, atomic physics, nuclear physics, solid state physics, including the knowledge necessary to understand basic phenomena occurring in mechatronic elements and systems and its surroundings	Understands the basic laws of statics, kinematics and dynamics			[SW1] Assessment of factual knowledge		
	[K6_W04] has organized and theoretically supported, advanced knowledge in the field of general mechanics, strength of materials, theory of mechanisms and machine dynamics, fluid dynamics, hydraulics and pneumatics, machine construction and engineering graphics	Has knowledge of solid mechanics			[SW1] Assessment of factual knowledge		
[K6_U01] is able to acquire information from literature, databases and other, properly chosen sources, integrate these information, interpret them, draw conclusions and formulate opinions	Has the ability to self-educate			[SU1] Assessment of task fulfilment			

Subject contents	<p><b>Lectures/Tutorials</b></p> <p>Modeling in mechanics: real system, physical and mathematical models, and also meanings of: ideal rigid body, dimension-less point, concentrated force. The basic Newtons principles, and primitive notions and axioms of mechanics. Equilibrant systems of forces. Resultant force of concurrent system of forces. Momentum of pair of forces. Resultant force and resultant momentum of spatial system of forces. Degrees of freedom, strains and their reaction forces. Statically determinate and indeterminate systems. Conditions of equilibrium of system of forces, and particular systems: coplanar, concurrent, and parallel. Substitute conditions of equilibrium. Formulas of superposition, and independence of force acting. Forces, and their sources. Division of forces: reactive and active, external and internal. Gravity force and coordinates of centre of gravity. Friction forces, rolling resistance and belt drive friction. Analysis of forces in bars of truss. Basic meanings in kinematics of point: position coordinates, velocity, acceleration, and equations of motion. Description of motion of point in: vector, Cartesian, normal, and polar coordinates. Analysis of kinematics parameters of particular systems: linear track motion, circle and ellipse track motion, uniform and uniformly accelerated motion, harmonic motion, crank-shaft system motion. Kinematics of the rigid body. Basic definitions: angular coordinates, velocities and accelerations of the body, and linear velocity and acceleration of the point of the body. Dependency in-between velocities and accelerations of points of the body. Particular cases of the rigid body kinematics: transitional, rotational and coplanar motion. Description of coplanar motion as transitional and rotational motion superposition, and as rotational motion around contemporary center of velocity and center of acceleration. Analysis of kinematics parameters of planar and planetary toothed transmit boxes. Relative motion and Coriolis acceleration. Dynamics of inertial point in: Cartesian, polar, and normal coordinates. Particular cases of dynamics of point motion of: linear track motion, oblique projection motion, free motion in gravity field including resistance forces, harmonic motion, mathematical pendulum. Dynamics of the inertial points system. Dynamic analysis of the inertial point using principles of mechanics: d'Alembert, conservation of energy, conservation of momentum and impulse, conservation of moment of momentum. Inertia parameters of the rigid body: mass, coordinates of centre of mass, mass moments of inertia. Parameters of the principal moments of inertia and principal axes of inertia of the body. Differential equation of motion and dynamic principles in analysis of transitional, rotational and coplanar motion of the body. The d'Alembert principle in calculation of bearings reaction forces of rotor, and to balance it dynamically. Gyroscopes effect. Analysis of straight and diagonal central collision, and calculation of the centre of percussion. Basis principles of analytical mechanics in analysis of dynamics of inertial points and bodies systems. Virtual displacement. Principle of virtual work. Generalized coordinates and forces. The Lagrange equation of the second kind.</p>														
Prerequisites and co-requisites	Physics and mathematics on the secondary level school, including in particular: geometry, trigonometry, and also vector calculus.														
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="456 1016 794 1046">Subject passing criteria</th> <th data-bbox="799 1016 1137 1046">Passing threshold</th> <th data-bbox="1142 1016 1481 1046">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 1052 794 1081">Laboratory</td> <td data-bbox="799 1052 1137 1081">56.0%</td> <td data-bbox="1142 1052 1481 1081">20.0%</td> </tr> <tr> <td data-bbox="456 1088 794 1117">Written exam</td> <td data-bbox="799 1088 1137 1117">56.0%</td> <td data-bbox="1142 1088 1481 1117">40.0%</td> </tr> <tr> <td data-bbox="456 1124 794 1153">Practical exercise</td> <td data-bbox="799 1124 1137 1153">56.0%</td> <td data-bbox="1142 1124 1481 1153">40.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Laboratory	56.0%	20.0%	Written exam	56.0%	40.0%	Practical exercise	56.0%	40.0%
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Example issues/ example questions/ tasks being completed	<p>Principles of static</p> <p>Kinematics of plane motion</p> <p>Dynamics of a material point in polar coordinates</p>														
Work placement	Not applicable														