

。 GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Basics of Mechanics, PG_00047526							
Field of study	Automatic Control, Cybernetics and Robotics							
Date of commencement of studies	October 2022		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	2		Language of instruction			Polish		
Semester of study	4		ECTS credits			3.0		
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					
Lesson types and methods	Lesson type	Lecture	Tutorial	Laboratory	Projec	t	Seminar	SUM
of instruction	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		3.0		27.0		75
Subject objectives	To familiarize students with the necessary knowledge of the modeling in mechanics, the main concepts and theorems of statics. The introduction of methods for modeling sliding friction and rolling resistance. Get to know the stress-strain relationship, and the concepts of allowable stress in tensile elements, compression, bending and torsion. Presentation of methods of determining the stresses and line deflection of beams, for statically determinable and indeterminable systems. Introduction of the basic concepts and theorems kinematics and dynamics of mechanical systems.							

Learning outcomes	Course outcome	Subject outcome	Method of verification	
	[K6_U02] can perform tasks related to the field of study in an innovative way as well as solve complex and nontypical problems, applying knowledge of physics, in changing and not fully predictable conditions	Students solve elementary, non- typical and innovative problems of statics and kinematics Students solve elementary, non- typical and innovative problems of strength of materials: he determines stress and strain of simple deformable elements Students solve elementary, non- typical and innovative problems of dynamics of mechanical systems	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment	

Course outcome	Subject outcome	Method of verification	
[K6_W02] knows and understands, to an advanced extent, selected laws of physics	Student prepares physical models of real objects. Student presents basic concepts, principia and laws	[SW1] Assessment of factual knowledge	
and physical phenomena as well as methods and theories explaining the complex	of statics and kinematics. Student replaces constraints by reaction forces and torques. Student writes		
relationships between them, constituting the basic general	equilibrium conditions for concurrent planar systems of		
knowledge in the field of technical	forces, he/she calculates reactions		
study	writes equilibrium conditions for		
	general planar systems of forces. Student		
	determines friction forces for sliding friction and		
	rolling resistance. Student writes		
	equilibrium conditions for concurrent spatial systems of		
	forces. Student writes equilibrium conditions for general spatial		
	systems of forces. Student		
	coordinates of gravity forces and		
	centers. Student determines limit stresses for tension, compression.		
	bending, torsion.		
	bending and torsion moments for		
	beams. Student determines second moments of area of the		
	beam cross-section. Student		
	beams, he/she solves statically		
	determines yield stresses in		
	uniaxial tension for complex stress states. Student describes		
	kinematics of a		
	systems of coordinates. Student		
	determines relations between position, velocity and acceleration		
	of the particle. Student determines		
	different		
	point of a body. Student determines position of temporal		
	center of rotation, he/she use it to determinate velocities of		
	different point of a rigid body.		
	principia and laws of dynamics.		
	Student solves practical problems referring to dynamics of particles		
	Student evaluates work, power,		
	energy of particles. Student		
	determines inertia parameters of rigid bodies(statical moment,		
	moments of inertia, inertia		
	linear		
	momentum and angular momentum of bodies. Student		
	solves practical problems referring		
	bodies. Student determines		
	oynamical reactions at supporting point of		
	rotating body. Student evaluates kinetic energy and potential		
	energy of bodies, he/she used		
	problems referring to dynamics of		
	particles and bodies.		

Subject contents	Information on the organization of the course. Bibliography. Historical overview. Mechanics and its main topics. Modeling in mechanics. Concepts of real object, physical model, mathematical model, algorithm. Concepts of rigid body, material particle, concentrated force. Newton's laws. Primitive notions and axioms. Equivalent systems of forces. Net force for a concurrent et of forces and its torque. Net torque for a concurrent and general set of forces. Main net force and main net torque. Degrees of freedom, constraints, reactions. Statically determinable system of forces, statically undeterminable system of forces, mechanisms. Statics. Basic concepts. Equilibrium conditions for planar systems. Particular cases of systems and their equilibrium conditions: concurrent system so forces parallel system of forces. Alternative equilibrium conditions. Principle of independent actions of forces parallel system of forces. Alternative equilibrium conditions, principle of independent actions of forces of forces of the gravity centers. Static momentum of inertia. Sliding friction, belt friction, rolling resistance. Strain/stress characteristics. Limit stresses for tension, compression, bending, torsion, Hook law, Young modulus, termall stresses, factor of safety. Diagrams of bending and torsion moments for beams. Secend moments of area of the beam cross-section. Deflection line for beams, statically indeterminate beams. Yield stresses in uniaxial tension for complex stress statees. Kinematics of a point: basic concepts and principles: Dosition velocity acceleration. Amonic motion, spherical coordinates, natural coordinates. Tangent and normal acceleration. Paricular cases of motion of translational motion. Rectilinear motion with Cartesian coordinates, polar coordinates, cylindrical coordinates, spherical coordinates, natural coordinates. Tangent and normal acceleration. Thermitical coordinates, spherical coordinates, natural coordinates. Tangent and normal acceleration for a point of a body. Particular cases of motion. Tra				
Prerequisites and co-requisites	Completed course of Mathematics Completed course of Physics Main attention set on basic knowledge about geometry, trigonometry, vector calculus (analysis), matrix calculus, abilities in integrations and derivation of basic mathematical formulas				
Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade		
and criteria	Midterm colloquium	56.0%	66.0%		
	qualifying test of the theory	56.0%	34.0%		
Recommended reading	Basic literature	1. Wittbrodt E., Sawiak S.: Mechani PG, Gdańsk 2005 2. Sawiak S., Wit zagadnienia. Skrypt PG, Gdańsk 20 t. I i 2, PWN, Warszawa 1980 4. Nie Zbiór zadań z mechaniki ogólnej, P ¹ Z.,Jakubowicz A., Orłoś Z.: Wytrzyn t.I 1996, t.II 1997	ka ogólna. Teoria i zadania. Wyd. tbrodt E.: Mechanika. Wybrane 003 3. Leyko J.: Mechanika ogólna, zgodziński M.E., Niezgodziński T.: WN, Warszawa 1997 5. Dyląg nałość materiałów, Warszawa WNT,		
	Supplementary literature	 Osiński Z.: Mechanika ogólna, t. I i 2, PWN, Warszawa 1987 2. Leyko J., Szmelter J.: Zbiór zadań z mechaniki ogólnej, t. I i 2, PWN, Warszawa 1976 3. Mieszczerski I. W.: Zbiór Zadań z mechaniki, PWN, Warszawa 4. Niezgodziński T.: Mechanika ogólna. WNT, Warszawa 1999 5. Nizioł J.:Metodyka rozwiązywania zadań z mechaniki. WNT, Warszawa 2002 			
	eResources addresses	Adresy na platformie eNauczanie: Mechanika (PG_00047526),W+C, ACiR, sem 4, wiosna, 2023/24 - Moodle ID: 38344 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=38344			
Example issues/ example questions/ tasks being completed	Determination of reaction forces for Determining of deflections of the ca force distributed continuously within Determination of speed of some cal	s for the system of known geometrical structure and known structure of load ne cantilever beam loaded by some lateral within specified distance on the beam.			
	Balance between the kinetic and potential energy of the mechanical system				
Work placement	Datance between the kinetic and potential energy of the mechanical system				
work placement					

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