GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mechanics , PG_00055374		
Field of study	Mechanical Engineering		
Date of commencement of studies	October 2022	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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	9.0
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. Grzegorz Banaszek prof. dr hab. inż. Marek Krawczuk dr inż. Natalia Stawicka-Morawska	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	60.0	0.0	0.0	0.0	105
	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	105	9.0	111.0	225

Subject objectives	Theoretical and exercises in technical mechanics

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W04] possesses knowledge on mechanics, including the processes of modelling mechanical systems, statics, kinematics and dynamics of rigid objects and basic knowledge on vibrations	Student describes real systems using physical and mathematical models. Student recognizes meanings: ideal rigid body, dimension-less point, concentrated force.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
	[K6_U01] is able to acquire information from specialized literary sources, databases and other resources, essential for solving engineering tasks; is able to compile the obtained information pieces and to interpret them, additionally is able to form conclusions and present justified opinion	Student defines substitute conditions of equilibrium	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject
	[K6_U06] is able to use mathematical and physical models for analysing the processes and phenomena occurring in mechanical devices within the range of material strength, thermodynamics and fluid mechanics	Student describes real systems using physical and mathematical models. Student recognizes meanings: ideal rigid body, dimension-less point, concentrated force. Student presents basic Newton's principles, primitive notions and axiom's of mechanics. Student differentiates equilibrant forces'; systems. Student characterizes the resultant force and the resultant momentum systems of forces. Student describes degrees of freedom, strengths and their reactions, and also statically determinate and indeterminate of systems. Student characterizes conditions of equilibrium of spatial force system, and particular systems: coplanar, concurrent, and parallel. Student defines substitute conditions of equilibrium. Student characterizes types of forces, and their sources, describes active and reactivity forces, as well as external and internal forces. Student characterizes gravity force and coordinates of the centre of gravity. Student describes friction forces, rolling resistance, and belt drive friction. Student characterizes forces in bars of truss. Student recognizes basic meanings of kinematics of point: position coordinates, velocity and acceleration. Student recognizes: vector, Cartesian, normal, and polar co-ordinates of point kinematics. Student characterizes parameters of kinematics of particular systems: linear track motion, circle and ellipse track motion, uniform and uniformly accelerated motion, harmonic motion, crank-shaft system motion	[SU1] Assessment of task fulfilment
	[K6_W02] possesses an organized knowledge on physics, including classic mechanics, acoustics, optics, electricity and magnetism, shows knowledge of the elements of quantum physics	Student can apply mechanics fundamentals to solve engineering problems related to the mechanical engineering area	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge

Subject contents	**Lectures/Tutorials** 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 in determinate 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: dAlembert, 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 dAlembert principle in calculation of bearings reaction forces of rotor, and to balance it dynamically. Gyroscopes effect. Analysis of strait 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.
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.: Mechanika ogólna. Teoria i zadania. Wyd. PG, Gdańsk 2012
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	Adresy na platformie eNauczanie: Mechanika Wykład PG_00055374 MiBM sem.letni 2022/23 - Moodle ID: 27842 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27842 Mechanika, C, MiBM, sem. 02, letni 22/23, (PG_00055374) - Moodle ID: 29561 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29561
Example issues/ example questions/ tasks being completed	
Work placement	Not applicable

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