GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Space Mechanisms and Constructions, PG_00050014		
Field of study	Space and Satellite Technologies		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2024/2025
Education level	second-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	1	ECTS credits	2.0
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 inż. Marek Chodnicki	
	Teachers	dr inż. Marek Chodnicki	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	15.0	0.0	0.0	0.0	30

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	30	5.0	15.0	50

Subject objectives

The student becomes familiar with the literature on the theory of machines and mechanisms in space structures. The student becomes familiar with with the most important sections of Theory of machines and mechanisms in space structures. Learns about the principles of Structural Analysis, Kinematics and Dynamics of planar mechanisms. The student uses vector and matrix methods to describe the geometry of mechanisms, knows the methods of kinematic analysis of spatial mechanisms and the Denavit-Hartenberg notation.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W04] Knows and understands, to an increased extent, processes occurring in the life cycle of equipment, objects and technical systems, including software systems.	The student knows the life cycle of mechanical devices	[SW1] Assessment of factual knowledge
[K7_W02] Has well-ordered and theoretically based knowledge of mechatronics in space applications, as well as mechanical technologies and the design of space mechanisms and structures.	The student has knowledge of the mechanisms	[SW1] Assessment of factual knowledge
[K7_K03] Can analyse and implement assigned tasks while maintaining high technical standards. Is able to work and interact in a group, taking on different roles. Adheres to the principles of professional ethics and respects the diversity of views and cultures.	The student analyses and solves tasks on space mechanisms and constructions, working in workgroup. At the same time he/ she provides high technical standards of the work.	[SK3] Assessment of ability to organize work

<table>
<tr><td>Subject contents</td><td>Familiarize students with the classification of the most important elements of mechanisms and machines, open kinematical chains, closed kinematic chains, classification of kinematical pairs and kinematic assemblies. Review of the most popular types of mechanisms. An introduction of the main concepts of structural analysis - structural equation of mobility of mechanisms, degrees of freedom, Assur structural groups, classes, orders and forms of the groups. Introduction to the selected methods used for determining the position, velocity and acceleration. Presentation of methods of dynamics of mechanisms - equations of kinetostatics, determination of forces present in kinematic pairs, differential equations of motion of mechanisms. Introduction to the free and forced vibration of discrete systems. To familiarize student with methods of vector and matrix description of kinematics of mechanisms, including the coordinates of constituting elements, coordinate systems, as well as the matrix notation. The analytical methods in kinematics of planar mechanisms, as well as the Denavit-Hartenberg notation for spatial mechanisms and manipulators are presented. The student become familiar with the methods of numerical determination of velocities and accelerations of selected points of planar and spatial mechanisms. Presentation of numerical methods for solving simple and inverse. The student become familiar with the numerical methods used in the dynamics of manipulators, especially the direct and inverse

problems of dynamics. Discussion of the energy balance of the machine to familiarize students with the calculation of mechanical efficiency of machines and self-locking conditions.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>1) Mechanism theory and dynamics of machines I, including aspects of structural analysis, kinematics anddynamics of planar mechanisms, vibrations of systems with one degree of freedom and with many degreesof freedom without damping.2) Mechanics including statics, kinematics, dynamics of mechanical systems.3) Mathematics including algebra, matrix calculus, differential and integral calculus, linear differential equations.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Exercises</td><td>56.0%</td><td>60.0%</td></tr>
<tr><td>Exam</td><td>56.0%</td><td>40.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. Morecki A., Knapczyk J., Kędzior K.: Teoria mechanizmów i manipulatorów WNT 2002

2. Olędzki A.: Podstawy teorii maszyn i mechanizmów. WNT 1978

3. Morecki A., Knapczyk J., Kędzior K.: Teoria mechanizmów i manipulatorów. Podstawy i przykłady zastosowań w praktyce. WNT, Warszawa 2001

4. Wawrzecki J.: Teoria maszyn i mechanizmów. Wyd Polit. Łódzkiej, Łódź 1994</td></tr>
<tr><td>Supplementary literature</td><td>1. Miller S.; Teoria maszyn i mechanizmów analiza układów kinematycznych; Oficyna Wydawnicza Politechniki Wrocławskiej; Wrocław 1996

2. Młynarski T., Listwan A., Pazderski E.; Zbiór zadań z teorii mechanizmów i maszyn do analizy kinematycznej mechanizmów; skrypt Politechniki Krakowskiej; Kraków 1992</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Structural classification of mechanisms: groups, classes, orders, forms.

Direct and inverse problem of kinematics of the mechanism, trajectory planning problem

Methods of modeling of loads carried by rotating and prismatic kinematic pairs, known and searched parametersIntroduce, define and comment the concept of the inertia reduced on the drive shaft, Homogeneous transformations: the idea and propertiesDenavitaHartenberga coordinates: orientation of the axes</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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