



Subject card

Subject name and code	Mathematical methods of physics and technics II, PG_00037303						
Field of study	Technical Physics						
Date of commencement of studies	October 2026	Academic year of realisation of subject				2027/2028	
Education level	first-cycle studies	Subject group				Optional subject group 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				4.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Division of Atomic Molecular and Optical Physics -> Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Radosław Szmytkowski					
	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		35.0	100
Subject objectives	Introduction to Lagrangian and Hamiltonian methods in physics and technology.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_U02] is able to analyse and solve complex and non-standard scientific and technical problems using appropriate analytical, computational, numerical, simulation or experimental methods.	Can apply Lagrangian and Hamiltonian methods to solve scientific and technical problems.			[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools		
	[K6_W03] possesses structured knowledge of higher mathematics, including algebra, analysis, probability and numerical methods, sufficient to describe, understand and model complex physical phenomena and selected technical processes.	Has knowledge of the fundamentals of Lagrangian and Hamiltonian methods and their applications in selected areas of physics and technology.			[SW1] Assessment of factual knowledge		

Subject contents	<p>Course content – lecture</p> <ol style="list-style-type: none"> 1. Constraints and their classification. 2. d'Alembert's principle. 3. Lagrange equations of the first kind. 4. Lagrange equations of the second kind. 5. Small oscillations. 6. Elements of the calculus of variations. 7. Hamilton's variational principle. 8. Hamilton equations. 9. Poisson and Lagrange brackets. 10. Canonical transformations. 11. Hamilton-Jacobi equation. 12. Applications of the Lagrangian and Hamiltonian formalisms in geometrical optics and electromagnetic field theory. <hr/> <p>Course content – exercises</p> <p>Solving problems illustrating topics presented during the lecture.</p>								
Prerequisites and co-requisites									
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade						
	End-of-semester written assignment	37.5%	100.0%						
Recommended reading	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%; padding: 5px;">Basic literature</td> <td style="padding: 5px;"> <ol style="list-style-type: none"> 1. H. C. Corben, P. Stehle, Classical mechanics, 2nd ed., Dover, New York, 1994 2. H. Goldstein, C. Poole, J. Safko, Classical mechanics, 3rd ed., Addison-Wesley, San Francisco, 2002 3. G. L. Kotkin, V. G. Serbo, Exploring classical mechanics, 2nd ed., Oxford University Press, Oxford, 2020 4. G. L. Kotkin, V. G. Serbo, A. I. Chernykh, Lectures on analytical mechanics, Oxford University Press, Oxford, 2024 </td> </tr> <tr> <td style="padding: 5px;">Supplementary literature</td> <td style="padding: 5px;">-</td> </tr> <tr> <td style="padding: 5px;">eResources addresses</td> <td style="padding: 5px;"></td> </tr> </table>			Basic literature	<ol style="list-style-type: none"> 1. H. C. Corben, P. Stehle, Classical mechanics, 2nd ed., Dover, New York, 1994 2. H. Goldstein, C. Poole, J. Safko, Classical mechanics, 3rd ed., Addison-Wesley, San Francisco, 2002 3. G. L. Kotkin, V. G. Serbo, Exploring classical mechanics, 2nd ed., Oxford University Press, Oxford, 2020 4. G. L. Kotkin, V. G. Serbo, A. I. Chernykh, Lectures on analytical mechanics, Oxford University Press, Oxford, 2024 	Supplementary literature	-	eResources addresses	
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Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Solution to a problem concerning d'Alembert's principle. 2. Solution to a problem concerning Lagrange equations of the first kind. 3. Solution to a problem concerning Lagrange equations of the second kind. 4. Solution to a problem concerning Hamilton's equations. 								

Practical activities within the subject	Not applicable
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