



Subject card

Subject name and code	Mathematical and numerical modelling, PG_00057370						
Field of study	Mechanical Engineering						
Date of commencement of studies	February 2024	Academic year of realisation of subject			2023/2024		
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			4.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jacek Barański					
	Teachers	dr hab. inż. Jacek Barański dr hab. inż. Jerzy Głuch mgr inż. Stanisław Głuch					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	15.0	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	8.0		47.0		100
Subject objectives	The aim of the course is to familiarize students with the basic issues of mathematical and numerical modeling.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_U08] is able to design a procedural equipment or device compliant with the specifications using a design aid system in the form of a design documentation, selecting the appropriate model, performing critical analysis with the proper selection of tools and technologies	The student recognizes the methods of modeling and simulating the structure of mechanical systems and the implemented technological processes			[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		
	[K7_W01] possesses a profound mathematical knowledge useful in the analysis and description of the operation of complex mechanical systems, technological processes and operating properties of machines and devices; is familiar with the main development trends	The student develops a mathematical and numerical description of the phenomena related to the functioning of components and the entirety of mechanical systems, as well as technological processes.			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
	[K7_W02] possesses a wide and profound knowledge on continuum mechanics and materials strength within the range of modelling and simulating multi-function mechanical systems	The student develops elements of mechanics of deformable bodies for modeling and simulation of components and the entirety of mechanical systems, as well as technological processes.			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		

Subject contents	<p>LECTURE. Fundamentals of modeling, basic concepts, issues of fluid mechanics and heat transfer, selected numerical methods, modeling of fluid-solid systems, finite element method, turbulence models in computational fluid mechanics, the influence of mesh density on the results of numerical simulations, validation of numerical simulation results, special issues</p> <p>PROJECT. Numerical implementation of tasks related to topics presented during the lecture.</p>		
Prerequisites and co-requisites	Mathematics, Physics, Fluid mechanics, Heat transfer, Numerical methods, Information technologies		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture - 2 written colloquia	55.0%	70.0%
	Project exercises	55.0%	30.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Tu J., Yeoh G.H., Liu C.: Computational Fluid Dynamics a Practical Approach. Elsevier 2013 2. Fortuna Z., Macukow B., Wąskowski J.: Metody numeryczne. Wydawnictwa Naukowo-Techniczne 2001 3. Thompson J.F., Soni B.K., Weatherhill N.P.: Handbook of Grid Generation. CRC Press 1999 4. Patankar S.V.: Numerical Heat Transfer and Fluid Flow. CRC Press 2018 	
	Supplementary literature	<ol style="list-style-type: none"> 1. Tesch K.: Numeryczna Mechanika Płynów. Wyd. PG 2. Madejski J.: Teoria Wymiany Ciepła. PWN 3. Pope, Stephen B. Turbulent Flows. Cambridge University Press 2000. 	
	eResources addresses	<p>Uzupełniająca</p> <p>Adresy na platformie eNauczanie:</p> <p>Modelowanie matematyczne i numeryczne, W/P, MiBM, sem.1, letni 23/24 - Moodle ID: 38270</p> <p>https://enauczanie.pg.edu.pl/moodle/course/view.php?id=38270</p>	
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Modeling of thermal-flow system 2. Methods for validating numerical simulation results 3. The influence of mesh density on the results of numerical simulations 		
Work placement	Not applicable		

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