GDAŃSK UNIVERSITY OF TECHNOLOGY

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 componentsand 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	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 PROJECT. Numerical implementation of tasks related to topics presented during the lecture.
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	1. Tu J., Yeoh G.H., Liu C.: Computational Fluid Dynamics a Practical Approach. Elsvier 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	1. Tesch K.: Mumeryczna Mechanika Płynów. Wyd. PG 2. Madejski J.: Teoria Wymiany Ciepła. PWN 3. Pope, Stephen B. Turbulent Flows. Cambridge University Press 2000.
eResources addresses	Uzupełniające Adresy na platformie eNauczanie: Modelowanie matematyczne i numeryczne, W/P, MiBM, sem.1, letni 23/24 - Moodle ID: 38270 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=38270

Example issues/ example questions/ tasks being completed	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