GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mathematical modelling of energy plants, PG_00057258		
Field of study	Power 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	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jerzy Głuch	
	Teachers	mgr inż. Stanisław Głuch dr hab. inż. Jerzy Głuch	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	15.0	0.0	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	10.0	20.0	75

Subject objectives

mathematical modelling fundamentals and methods of technical processes and installations

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U03] has the necessary preparation to work in an industrial environment, is prepared to undertake third degree studies, applies the principles of safety and hygiene	student is able to mathemtically formulate problems of energetical installations, can decompose complex mathematical models	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
[K7_W01] has extended and deepened knowledge of mathematics indispensable for describing phenomena related to processes of energy conversion and transfer; uses advanced information technologies	student knows mathematical model identificatiom methods, is conscious of the role of mathematical model sensibility, knows and is conscious of the role of CFD and Matlab	[SW1] Assessment of factual knowledge
[K7_U02] is able to use known mathematical and numerical methods to analyze and design elements, systems and power transmission networks and internal installations	student is able to theoretically and experimentally formulate mathematlical model of technical problem, is conscious of the role and apply mathematical model linearization, knows standard mathematical models, can adapt standard mathematical model to the technical problem	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
[K7_W05] knows basic methods, techniques and tools used in solving complex engineering tasks in the field of modeling of thermal-energy systems	student is able to transform technical problem into mathematical model, applies apropriate mathematical simulation methods	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects

Subject contents	content of the lecture: Expanding information on thermodynamic cycles and expanding information on modelling them using commercial tools. Presentation of balances, constitutive equations, how to specify conditions in CFD type codes. Regulation and control of equipment in the context of heat exchangers. laboratory content:- processing and visualisation of experimental data of systems and equipment,(6 h)- modelling and optimisation of steady state power generation system (5h),- modelling of dynamic states of energy devices (4h)		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	practical exercise - midterm tests	50.0%	50.0%
	lecture - examination	50.0%	50.0%
Recommended reading	Basic literature	1: Stephen Turns: Thermal-Fluid Sciences an integrated approach. Cambrige University Press, New York 2006. 2: Wolfgang Altmann: Practical process control for engineers and technicians. Newnes, Oxford 2005. 3: Rolf Kehlhofer: Combined-cycle gas & steam turbine power plant. The Fairmont Press, Lilburn, 1991. 4: Janusz Badur (2005): Pięć wykładów ze współczesnej termomechaniki płynów. 2005 www.imp.gda.pl/fileadmin/doc/o2/z3/.../2005_piecwykladow.pdf, Gdańsk. 5: Janusz Badur (2003): Numeryczne modelowanie zrównoważonego spalania w turbinach gazowych. Wydawnictwo IMP PAN, Gdańsk 6: Olgierd C. Zienkiewicz (1972): Metoda elementów skończonych. Arkady, Warszawa.	
	Supplementary literature	1. Jackson L.B.: Signals, Systems and Transforms. Adison Wesley, Boston, 1991 2. P. Ziółkowski, J. Badur, P.J. Ziółkowski: An energetic analysis of a gas turbine with regenerative heating using turbine extraction at intermediate pressure - Brayton cycle advanced according to Szewalski's idea. Energy 185 (2019) 763-786. 3. P. Ziółkowski, J. Badur: On Navier slip and Reynolds transpiration numbers. Archive of Mechanics. 70, 3, pp. 269300, Warszawa 2018	
	eResources addresses	Adresy na platformie eNauczanie: Modelowanie matematyczne instalacji energetycznych - Moodle ID: 35891 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=35891	
Example issues/ example questions/ tasks being completed	Mass, momentum and energy conservations in 0D and 3D aproach, role of mathematical modelling, mathematical modelling principles, theoretical and empirical modelling, model parameter evaluation, different types of mathematical models, role of mathematical models equivalence, reason for mathematical model linearization, role of mathematical model sensibility,		
Work placement	Not applicable		