GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00069993		
Field of study	Modelowanie numeryczne procesów cieplno-przepływowych w elektrowniach jądrowych		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	6.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Faculty of Mechanical Engineering and Ship Technology -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Paweł Ziółkowski	
	Teachers	dr inż. Paweł Ziółkowski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	30.0	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	0.0	0.0	60

Subject objectives

The aim of the course is to provide students with knowledge and skills related to modeling thermal and flow processes in nuclear power plants. Analysis of the possibility of using numerical methods to determine the performance of advanced nuclear cycles.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U11] communicates and justifies opinions on specialized topics in a manner understandable to diverse audiences, including the use of modern techniques, including information technology	The student communicates and justifies opinions on the subject of nuclear cycles in a manner understandable to diverse audiences, also using modern techniques, including IT, especially software for calculating thermodynamic cycles.	[SU4] Ocena umiejętności korzystania z metod i narzędzi
[K7_U14] integrates information obtained from literature and other properly selected sources, including those in a foreign language, creatively interpreting and critically evaluating them, and drawing conclusions	The student integrates information about thermodynamic principles and is able to use it in developed thermodynamic cycles. Verifies the completeness and validity of the results obtained and draws conclusions in terms of the performance achieved.	[SU4] Ocena umiejętności korzystania z metod i narzędzi [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu [SU1] Ocena realizacji zadania
[K7_W03] demonstrates structured and theory supported knowledge encompassing key issues in the field of Nuclear Power Technologies, enabling design of energy processes and systems	The student demonstrates structured and theoretically grounded knowledge covering key issues in the field of nuclear energy, enabling the design of energy processes in devices such as reactors, turbines, compressors, and heat exchangers.	[SW1] Ocena wiedzy faktograficznej
[K7_U04] creatively designs or modifies, either entirely or at least in part, nulear power systems, considering both technical and non-technical aspects, estimating costs and utilizing design techniques appropriate for tasks within the scope of Nuclear Power Technologies	The student creatively designs or modifies thermodynamic cycles used in the field of nuclear energy. This is done in accordance with the given specifications, taking into account technical and non-technical aspects and using design techniques appropriate for 0D approach.	[SU5] Ocena umiejętności zaprezentowania wyników realizacji zadania [SU2] Ocena umiejętności analizy informacji

Subject contents

Course content – lecture

Assumptions used in numerical calculations for nuclear cycles.
Possibilities for using nuclear cycles in various energy and marine applications.
Parameters characterizing nuclear cycles and systems.
Methods of calculation and interpretation of results.
Drawing conclusions from numerical results, also in the context of computational limitations.

Course content – laboratory
Presentation of diagrams of new thermodynamic systems and provision of information on their analysis using commercial codes

Course content – project
Verification of thermodynamic parameters at nodal points and overall system performance using numerical calculations in various cycle configurations.

Prerequisites and co-requisites

The ability to analyze thermodynamic cycles analytically.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Project – presentation of calculations and discussion of their correctness	60.0%	50.0%
Lecture - assessment in the form of answering questions	60.0%	25.0%
Laboratory - attendence	60.0%	25.0%

Recommended reading

Basic literature

Ziółkowski, Selected topics in numerical methods.2025 Gdańsk

DrosińskaKomor, M., Głuch, J., Ziółkowska, N., ... Blaut, J., Ziółkowski, P.: Integrating fourthgeneration reactors into maritime transport. Ocean EngineeringOpen source preview, 2025, 342, 122891

Głuch, J., Kodlewicz, T., Drosińska-Komor, M., ... Breńkacz, Ł., Ziółkowski, P. Thermodynamic Efficiency of an Advanced 4th Generation VHTR Propulsion Engine for Large Container Ships. Polish Maritime ResearchOpen source preview, 2024, 31(4), pp. 7688

Supplementary literature

https://www.sciencedirect.com/science/article/pii/S0196890417304624?via%3Dihub

https://asmedigitalcollection.asme.org/energyresources/article/146/3/030903/1171779/Selected-Aspects-of-Performance-of-Organic-Rankine

https://iopscience.iop.org/article/10.1088/1742-6596/1101/1/012050/pdf

https://www.e3s-conferences.org/articles/e3sconf/pdf/2019/63/e3sconf_rdpe2019_01023.pdf

eResources addresses

Example issues/ example questions/ tasks being completed

Balance of mass, momentum and energy in 0D and 3D approach.

Analysis of the physical phenomenon and the possibility of analysis in the numerical code.

Solving engineering problems using advanced commercial tools.

Creating a numerical model

Ways of defining of thermal and flow boundary conditions

Analysis of received the results of numerical simulations and their interpretation

Practical activites within the subject	Not applicable

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