GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Nuclear cogeneration, PG_00065891		
Field of study	Hydrogen Technologies and Electromobility		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2024/2025
Education level	first-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	6	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Electrical Power Engineering -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marcin Jaskólski	
	Teachers	dr inż. Marcin Jaskólski dr inż. Tomasz Minkiewicz	

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	15.0	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	6.0	34.0	100

Subject objectives

The aim of the course is for students to master knowledge related to the technology of nuclear power plants, including systems adapted to heat dissipation for heating systems and/or hydrogen production. Students will also learn about key issues in the field of safety, operation and profitability of nuclear power plants operating in combination.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_K02] can work in a group taking on different roles in it	Presents an analysis of a selected problem in the field of nuclear cogeneration	[SK4] Assessment of communication skills, including language correctness
[K6_W08] has knowledge in the field of energy storage systems: mechanical, thermal, electrical and others, knows the basics of thermodynamics and fluid mechanics, as well as the construction and operation of thermal energy equipment, hydrogen installations, process equipment, including renewable energy sources	Describes the principle of operation of nuclear combined heat and power systems for the production of electricity, heat and hydrogen.	[SW1] Assessment of factual knowledge
[K6_U12] can formulate a specification of simple engineering tasks of a practical nature related to the field of study	Calculates the quantities characteristic of a nuclear combined heat and power plant system.	[SU1] Assessment of task fulfilment

Subject contents	Lecture - "The current state and prospects for the development of nuclear power in the world. Generation of nuclear power reactors. Classification of nuclear power plants. General characteristics of basic equipment and principle of operation of nuclear power plant with pressurized water reactor. Nuclear fuel management. Fuel cycle. Systems of radioactive waste management. Operation of nuclear power plants. Nuclear power safety and security issues. Cogeneration systems in nuclear power - generation of heat and/or hydrogen. Evaluating costs and assesing cost-effectiveness of using cogeneration in a nuclear power plant." Project "Nuclear power plant as a source of heat in the heating system" - construction of a thermal and flow model of a selected nuclear power plant, taking into account heat consumption for heating purposes. Seminar - a presentation on a selected topic, related to cogeneration and nuclear energy.
Prerequisites and co-requisites	Subjects: mathematics, heat transfer, thermodynamics, fluid mechanics

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Project	60.0%	35.0%
Presentation	60.0%	15.0%
Test	60.0%	50.0%

Recommended reading	Basic literature	Zieliński A. (red.): Elektrownie jądrowe w nowoczesnej gospodarce. Wydawnictwo Naukowe PWN, Warszawa 2024. Król K.: Bezpieczeństwo radiologiczne. Wydawnictwo Naukowe PWN, Warszawa 2024. Kubowski J.: Elektrownie jądrowe. Wydawnictwo Naukowe PWN, Warszawa 2017. Bartnik R.: Elektrownie i elektrociepłownie jądrowe z reaktorami HTGR I SMR. Wydawnictwo Naukowe PWN, Warszawa 2024.

	Supplementary literature	[1] M. Jaskólski, A. Reński, T. Minkiewicz, Thermodynamic and economic analysis of nuclear power unit operating in partial cogeneration mode to produce electricity and district heat, Energy. (2017). doi:10.1016/j.energy.2017.04.144. [2] H. Safa, Heat recovery from nuclear power plants, Int. J. Electr. Power Energy Syst. 42 (2012) 553559. doi:10.1016/j.ijepes. 2012.04.052. [3] A. Reński, Nuclear power and heat-and-power (NCHP) plants as a heat source for heating systems (in Polish), Energetyka. 8 (2009) 515520. http://elektroenergetyka.pl/upload/file/2009/8/ elektroenergetyka_nr_09_08_1.pdf. [4] T. Minkiewicz, A. Reński, The concept of the method for selecting the optimal parameters of heat received from the nuclear power unit operating in partial cogeneration mode. (Accepted for publication), Acta Energ. (2017). [5] M. Jaskólski, A. Reński, K. Duzinkiewicz, A. Kaczmarek-Kacprzak, Profitability criteria of partial cogeneration in nuclear power plant., Rynek Energii. 114 (2014) 141147. http://kaprint.pl/taxonomy/term/199 [6] A. Reński, M. Jaskólski, T. Minkiewicz, Technical and economic conditions of supplying residential consumers with heat from nuclear power plant, Polish J. Environ. Stud. 24 (2015) 5559. http:// www.pjoes.com/articlespublished.html. [8] A. Reński, K. Duzinkiewicz, T. Minkiewicz, A. Kaczmarek-Kacprzak, Nuclear Co-generation: The Analysis of Technical Capabilities and Cost Estimates, Acta Energ. 28 (2016) 121132. doi:10.12736/issn. 2300-3022.2016311. [9] T. Minkiewicz, A. Reński, The Possibility to Use a Nuclear Power Plant as a Source of Electrical Energy and Heat, Acta Energ. 3 (2014) 114118. doi:10.12736/issn.2300-3022.2014310. [10] T. Minkiewicz, A. Reński, Nuclear power plant as a source of electrical energy and heat, Arch. Energ. 34 (2011) 155166. [11] F. Jasserand, J.-G. Devezeaux de Lavergne, Initial economic appraisal of nuclear district heating in France, EPJ Nucl. Sci. Technol. 2 (2016) 39. doi:10.1051/epjn/2016028. [12] Y.N. Kuznetsov, L.S. Khrilev, V.P. Brailov, I.M. Livshits, I.A. Smirnov, K.S. Svetlov, An analysis of technical and economic indicators characterizing the development of nuclear cogeneration stations in the Northwestern region, Therm. Eng. 55 (2008) 913925. doi: 10.1134/S0040601508110037. n [13] N. Le Pierrès, L. Luo, J. Berthiaud, N. Mazet, Heat transportation from the Bugey power plant, Int. J. Energy Res. 33 (2009) 135143. doi: 10.1002/er.1429. n [14] D. Majumdar, Desalination and Other Non-electric Applications of Nuclear Energy, in: Work. Nucl. React. Data Nucl. React. Physics, Des. Saf., Trieste, 2002. http://users.ictp.it/~pub_off/lectures/lns020/ Majumdar/Majumdar_2.pdf (accessed January 29, 2014). n

	eResources addresses	Podstawowe https://www.iaea.org/publications/13385/guidance-on-nuclear-energy-cogeneration - Guidance on Nuclear Energy Cogeneration Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. Draw diagrams of the basic cycles of nuclear power plants with PWR, BWR and SFR reactors. 2. Identify the basic equipment in the nuclear power plant in the drawing (eg reactor pressure vessel, primary pump, pressurizer, steam generator, "core catcher"). 3.Calculate the basic values (electrical power, heat output, thermal capacity, coolant flowrate) in the basic cycle of a nuclear power plant with a PWR reactor. 4. Present a method and calculate the costs of generating electricity in a nuclear power plant. 5. Determine the profitabilty conditions for the introduction of the cogeneration in the nuclear power plant unit.	
Work placement	Not applicable	

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