



Subject card

Subject name and code	Cogeneration systems, PG_00055954						
Field of study	Power Engineering, Power Engineering, Power Engineering						
Date of commencement of studies	October 2023	Academic year of realisation of subject				2025/2026	
Education level	first-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	3	Language of instruction				Polish	
Semester of study	5	ECTS credits				5.0	
Learning profile	general academic profile	Assessment form				exam	
Conducting unit	Division of Ecoengineering and Combustion Engines -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jacek Kropiwnicki					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	15.0	0.0	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		5.0		60.0	125
Subject objectives	Presentation of the latest developments in cogeneration systems using heat engines with particular emphasis on reciprocating engines and Stirling engines, their classification, powering with alternative fuels, energy management in complex cogeneration systems.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K6_W13] has basic knowledge of the operation of energy equipment in the field of thermal power plants, thermal and energy and heating systems, internal combustion engines, compressors and rotating machines, has basic knowledge of the regulation of energy equipment and methods of their selection depending on the needs		Student is able to characterize the technologies used in the combined heat and power systems. Student is able to assess the suitability of each technology and devices in different energy systems. He knows the rules for the selection of the main sources of energy and knows how to combine cooperation of various energy sources.			[SW1] Assessment of factual knowledge	
	[K6_W09] knows the dangers of electrical devices and the principles of protection against them, has basic knowledge of heat exchangers, has basic knowledge of power equipment such as pumps, compressors, turbines, combustion engines, boilers, pipelines and their accessories and methods of their selection depending on the needs		Can analyse and evaluate the methods of functioning of the heat engines, understands the specificity of propulsion systems, understands the consequences of the selected energetics parameters of the system.			[SW1] Assessment of factual knowledge	
	[K6_U06] is able to use the basic knowledge on the operation of energy equipment in the field of thermal power plants, thermal and energy and heating systems, combustion engines, compressors and rotating machines to assess the technical condition of the system		Can use modern tools and knowledge in designing, operating and components selecting of combined heat and power systems.			[SU1] Assessment of task fulfilment	

Subject contents	<p>Lecture: General information about heat engines, their structure and properties, characteristics, modelling of the work cycle, mechanical and thermal loads, mechanics of the crank system, balancing, calculation and design of the flywheel, analysis of the structure of the main components of engines, strength calculations, bearings of engines, fuels, fuel and ignition systems, solutions for energy systems, electronic diagnostics of engines, energy management in complex cogeneration systems.</p> <p>Tutorials: Work cycle modelling, device initial calculations, crank system mechanics, strength calculations, energy analysis, calculations of propulsion systems.</p> <p>Laboratory: Construction and identification of heat engine components, measurements of the basic parameters of heat engines, testing of power supply components and electronic diagnostics of engines, supply, ignition systems and electronic diagnostics of engines.</p>														
Prerequisites and co-requisites															
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="456 557 794 584">Subject passing criteria</th> <th data-bbox="799 557 1137 584">Passing threshold</th> <th data-bbox="1142 557 1481 584">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 591 794 618">Laboratories</td> <td data-bbox="799 591 1137 618">90.0%</td> <td data-bbox="1142 591 1481 618">10.0%</td> </tr> <tr> <td data-bbox="456 624 794 651">Tutorials</td> <td data-bbox="799 624 1137 651">50.0%</td> <td data-bbox="1142 624 1481 651">40.0%</td> </tr> <tr> <td data-bbox="456 658 794 685">Lecture</td> <td data-bbox="799 658 1137 685">50.0%</td> <td data-bbox="1142 658 1481 685">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Laboratories	90.0%	10.0%	Tutorials	50.0%	40.0%	Lecture	50.0%	50.0%
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Example issues/ example questions/ tasks being completed	<p>Draw a kinematic scheme of four stroke high speed engine.</p> <p>Name the methods of forced induction (charging) and their advantages and weaknesses, draw a scheme of turbocharger connected to an engine.</p> <p>Calculate the change in net power of the Stirling engine after replacing the working medium from helium to air.</p> <p>Discuss the principles of selection of combined heat and power units.</p>														
Work placement	Not applicable														

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