



Subject card

Subject name and code	Basic principles of steam, gas and water turbines, PG_00040110						
Field of study	Mechanical Engineering						
Date of commencement of studies	October 2021	Academic year of realisation of subject			2023/2024		
Education level	first-cycle studies	Subject group			Optional subject group Subject group related to scientific research in the field of study		
Mode of study	Part-time studies	Mode of delivery			at the university		
Year of study	3	Language of instruction			Polish		
Semester of study	6	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Energy and Industrial Apparatus -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Marian Piwowarski				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	22.0	0.0	15.0	0.0	0.0	37
	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	37		10.0		78.0	125
Subject objectives	Present the principles of turbomachinery theory and design.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_W09] possesses basic knowledge within the range of thermodynamics and fluid mechanics, construction and operation of heat generating devices, process equipment, including renewable energy sources, cooling and air conditioning	Students has the basic backgrounds of thermodynamics and fluid flow mechanics.			[SW1] Assessment of factual knowledge		
	[K6_U07] is able to design a typical construction of a mechanical device, component or a testing station using appropriate methods and tools, adhering to the set usage criteria	Student can perform the preliminary design of the steam, gas and water turbine.			[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment		
	[K6_W11] possesses knowledge on design, technology and manufacturing of machine parts, metrology, and quality control; knows and understands methods of measuring and calculating basic values describing the operation of mechanical systems, knows basic calculating methods applied to analyse the results of experiments	Students has the basic backgrounds of design and experimental investigations of turbomachinery			[SW1] Assessment of factual knowledge		

Subject contents	LECTURE: HYDRAULIC TURBINES: Hydropower economy in Poland and the world. Types of hydropower plants and their key parameters. Principles of operation and types of hydraulic turbines. Power profile of a turbine. Geometric parameters of turbines. Model and full-scale characteristics. Basic equation of hydraulic turbines. Assumptions of simplified turbine theory. Characteristic equation of hydraulic turbines and their application. Speed quotient. Design and design calculation of hydraulic turbines. STEAM AND GAS TURBINES: Actualizing power cycles. The Carnot cycle: cycle and heat flow diagrams. Comparison of steam, gas, and combined cycle efficiencies. The Brayton cycle. The Rankine cycle. Methods for carnotization of cycles. The steam-gas cycle. Effect of process irreversibilities on cycle efficiency. Efficiency of the power plant. Purpose of main components of steam and gas turbines. Principle of operation of a turbine stage. Course of the thermodynamic process in a turbine stage. Characteristics of turbine stages. LABORATORY: Measurements of model hydraulic turbine operating parameters. Preparation of the I propeller water turbine characteristics. Preparation of the universal characteristic of Kaplan turbine.		
Prerequisites and co-requisites	Fluid Mechanics, Thermodynamics		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratory experiment reports	100.0%	30.0%
	Lecture written test	60.0%	70.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Krzyżanowski W.: Turbiny wodne. Konstrukcja i zasady regulacji. WNT. Warszawa, 1971. 2. Perycz S.: Turbiny parowe i gazowe. Maszyny przepływowe tom 10. Zakład Narodowy im. Ossolińskich Wydawnictwo Polskiej Akademii Nauk. Wrocław 1992. 3. Kosowski K. at al, Steam and Gas turbines, Alstom 	
	Supplementary literature	No requirements	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Discuss the principle of operation of the Kaplan water turbine. 2. Discuss the principle of operation of the Pelton water turbine. 3. Discuss the energy transformations in the Clausius - Rankine cycle. 4. Explain the effect of medium parameters on the efficiency of the Clausius-Rankine cycle. 		
Work placement	Not applicable		