GDAŃSK UNIVERSITY OF TECHNOLOGY

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_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
[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

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	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	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	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