GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Ship Power Plants II, PG_00060567						
Field of study	Naval Architecture and Offshore Structures						
Date of commencement of studies	October 2024		Academic year of realisation of subject	2026/2027			
Education level	first-cycle studies		Subject group	Optional subject group 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	6		ECTS credits	9.0			
Learning profile	general academic profile		Assessment form	exam			
Conducting unit	Institute of Ocean Engineering and Ship Technology -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Jacek Rudnicki				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	30.0	30.0	30.0	0.0	135
	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	135		14.0	76.0		225
Subject objectives	Teach the principles of preparation of propulsion characteristics and methods of their analysis. To teach a systemic approach to the problems of ship pipelines. To learning about with typical design solutions and characteristics of the basic elements of the installation. To teach the methodology of calculations and selection of selected elements of the installation.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U05] can formulate a simple engineering task and its specification within the range of design, construction and operation of ocean technology objects and systems	Explains the general structure of of typical solutions of engine room installations systems with diesel engines. Indicates the determinants classification determinants influencing structure of the installation.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
[K6_U06] in compliance with a formulated specification and with the aid of appropriate tools and methods, is able to complete a simple engineering task within the range of design, construction and operation of ocean technology objects and systems	Draws block and schematic diagrams of the discussed installations. Calculates and selects main elements of the installation on the basis of technical documentation of engines and catalogs of factory ship devices.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
[K6_W07] has knowledge of the principles of sustainable development	Student is able to determine the influence of technical solutions applied in ship power system (e.g. a selected pipeline installation) on environmental risks.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_W05] has an organized knowledge on design, construction and operation of ocean technology objects and systems	Calculates and draws the characteristics of the ship's main propulsion system based on general formulas. Explains the principles of cooperation of the engine and propeller in different sailing conditions, based on the relevant charts.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_W06] has an organized knowledge on engineering methods and design tools allowing the conducting of projects within the construction and operation of ocean technology objects and systems	Describes the course of action in the calculation and selection of major components of a combustion engine room installation. Identifies the marine equipment market for the supply of major components and accessories of marine piping systems.	[SW1] Assessment of factual knowledge

Subject contents

Lecture:

Determinants of cooperation of elements of the ship's propulsion system. Principles and assumptions when developing propulsion characteristics. Cooperation of a marine reciprocating engine and propeller under different floating conditions. Towing characteristics. Change of characteristics during use of the propulsion system - preparation of propulsion characteristics based on the results of measurements on the ship. Development trends of ship power plants.

Basic knowledge of ship engine room piping systems functions, design conditions, classification requirements, diagrams, CAD CAM support. Tasks, general construction and typical design solutions of selected engine room piping systems: cooling, fuel, lubricating oil, exhaust gas, compressed air, heating steam. Principles of selection and calculation of basic components of selected piping systems.

Exercises

Performing the necessary calculations and drawing up the propulsion characteristics of the ship's motion system. Preparation of propulsion characteristics based on the results of measurements on the ship. Operation of the propulsion system in special conditions. Economic-energy comparative analysis of selected solutions of ship power systems.

Laboratory

Ship power system simulator - preparation for commissioning, start-up and supervision during operation of selected power piping systems and their components. Modeling of piping systems using dedicated software tools (e.g. Autodesk Inventor). Determination of flow resistance and pressure losses in pipelines on the basis of a 3D model study using numerical fluid mechanics tools (e.g. Autodesk CFD).

Project

Determining the location of the design point in the engine's layout diagram. Development of the engine selection criterion. Procedure for calculating and performing calculations of the components of the engine heat balance. Classification requirements for main propulsion engine operation protection systems in light of the regulations of classification societies affiliated with IACS. Calculations and catalog selection of equipment of cooling, fuel, lubricating oil, compressed air and exhaust gas systems. Calculation and selection of nominal diameters of pipelines. Preparation of classification diagrams of a selected installation.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Practical skills - laboratory	100.0%	15.0%
Project	100.0%	15.0%
Midterm colloquiums	51.0%	70.0%

Recommended reading

Basic literature

1. Balcerski A.: Siłownie okrętowe. Podstawy termodynamiki, silniki i napędy główne, urządzenia pomocnicze, instalacje. Skrypt PG, Gdańsk 1990.
2. Giernalczyk M., Górski Z.: Siłownie okrętowe. Cz. I, Gdynia 2011.
3. Giernalczyk M., Górski Z.: Siłownie okrętowe Część 2 Instalacje
4. okrętowe. Akademia Morska w Gdyni, Gdynia 2016
5. K. Van Dokkum: Ship Knowledge: A Modern Encyclopedia, Dokmar 2013.
6. Urbański P.: Instalacje okrętów i obiektów oceanotechnicznych. Wyd. PG 1991
7. Urbański P.: Podstawy napędu statków, Gdańsk 2005.
8. Wojnowski W.: Okrętowe siłownie spalinowe. Cz. I, II Wyd. PG 1999.
9. Urbański P.: Instalacje spalinowych siłowni okrętowych. Skrypt PG, Gdańsk 1994

	Supplementary literature	1. Więckiewicz W.: Instalacje kadłubowe statków morskich. WSM 1988 2. Szarejko J.: Technologia rurociągów okrętowych WM 1968 3. Przepisy klasyfikacji i budowy statków morskich 4. Shah Ramesh K., Sekulic Dusan P.: Fundamentals ff Heat Exchanger Design. John Wiley & Sons, Inc. New Jersey 2003. 5. Karassik I. J., Messina J. P., Cooper P., Heald C.C.: Pump handbook.McGRAW-HILL New York 2001. 6. Babicz J.: WÄRTSILÄ ENCYCLOPEDIA OF SHIP TECHNOLOGY 2015
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	Lecture 1. Present the towing characteristics of a tugboat propeller when designed for free floating conditions - give and justify the disadvantages (advantages) of such a solution. 2. Draw in the thrust-velocity coordinate system example waveforms of the thrust relationship as a function of ship speed for constant propeller speed, constant torque, and constant power delivered to the propeller. 3. Present the algorithm for the selection of the heavy fuel heater for low-speed main drive engines the necessary input data, calculation scheme, output values. 4. Draw and discuss the block diagram of the high temperature circuit (HT) of the cooling water of the low-speed engine cylinders, indicating how to incorporate the evaporator and preheat engine into this system (only the solution with connected HT and LT circuits). 5. Draw and discuss the schematic diagram of the fuel supply system (from the service tank) of the main drive Diesel engine operating with heavy fuel. 6. Draw and describe the flowchart of the continuous and periodic purification system of circulating oil explain the differences in the functioning of the systems. Auditorium exercises 1. The single propeller powered vessel is powered by a supercharged diesel engine with nominal power Nx and nominal speed nx. The motor has failed and can only generates yy% of rated torque and zz% of rated speed due to allowable heat loads. Present the nominal operating points of the propulsion system before and 2. If the max. permissible flow velocity of the cooling water in the pipeline is xx m/s and the required flow rate is yy m3h, the medium pressure is zz bar and its max. permissible temperature is vv oC, this means that the minimum internal diameter of the pipeline should be approx. . [mm]. 3. Calculate the heat transfer surface of a shell-and-tube cooler or alternatively a plate cooler in a freshwater system cooling the cylinders if the cooler is to dissipate heat Q = xx and the freshwater volume flows V1 = yy and central water V2 = zz are known. Consider parallel configuration of oil and cylinder water coolers and tropical design conditions.	
Work placement	Not applicable	