GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Design of IC Engines and Engine Drives, PG_00039974		
Field of study	Mechanical Engineering, Mechanical Engineering		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2022/2023
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	4.0
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. Jacek Kropiwnicki	
	Teachers	dr inż. Sławomir Makowski dr hab. inż. Jacek Kropiwnicki	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	0.0	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	8.0	32.0	100

Subject objectives

Teaching students of basics of internal combustion engines design, shaping of engine components, calculation methods and used materials, exploitation damages, as well as basics of propulsion systems with IC engines design, especially vehicles hybrid drives.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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 designs internal combustion engine, projects engine components, makes thermal and resistance calculations, makes drawings of engine components, propose design solutions of propulsion systems with IC engine, chooses propulsion systems components from catalog, evaluates usefulness of proposed solutions.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
[K6_W08] possesses basic knowledge including the methodology of designing machine parts, mechanical devices, selection of construction materials, manufacturing and operation, with the lifetime cycle	Student interprets construction of internal combustion engines, recognizes engine components, specifies methods of thermal and mechanical resistance calculation, recognizes exploitation damages, describes construction of propulsion systems with IC engines, interprets construction and functioning of vehicles hybrid drives.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

Subject contents	LECTURE: General info about internal combustion engines, their construction and main features. Performance curves of engines, operating field of an engine. Combustion in engines, combustion chambers. Mathematical modeling of combustion process. Calculated diagram of engine working cycle. Mechanical and thermal loads on engine elements: stipulated types of crank mechanism loads, temperature field and their determination, thermal loading of elements surrounding combustion chamber, temperature stresses and methods of their calculation. Choice of engine design solution, determination of swept volume and engine main dimensions, comparison parameters. Kinematics and dynamics of crank mechanism, engine equilibration, flywheel calculation and design. Design analysis of main IC engine components: piston assembly, connecting rods, con rods bolts, crankshafts, camshafts and valves - purposes and shaping, models of loading, stresses calculation, typical damages and their causes. IC engines bearings: sliding and rolling bearings, design examples. Cylinder blocks and heads - design and materials. Propulsion systems of vehicles, working machines and ships. Vehicles hybrid electric drives: structures, advantages and drawbacks, construction analysis of selected systems. LABORATORY EXERCISES: Disassembly and assembly of engine parts, identification of parts and measurement techniques. Measurements of basic parameters of IC engines. Drive system of a volumetric compressor. Investigation of the fuel supply system of CI engines. Diagnostics of fuel supply and ignition systems of SI engines.Establishing of engine specific fuel consumption map on the ground of measurements of basic parameters,
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Final exam of the lecture	60.0%	90.0%
Reports of the laboratory experiments	100.0%	10.0%

Recommended reading	Basic literature	1. Haywood J.B.: Internal combustion engines fundamentals. McGraw-Hill Book Company, New York 1988. 2. Taylor C.F.: The internal combustion engines in theory and practice. The MIT Press, Cambridge, Mass. 1980.
	Supplementary literature	1. Fenton J.: Gasoline engine analysis. MEP Ltd, London 1986. 2. Fenton J.: Advances in vehicle design. PEP Ltd, London 1999. 3. Szumanowski A.: Fundamentals of hybrid vehicle drives. Warsaw-Radom 2000.
	eResources addresses	Adresy na platformie eNauczanie: Konstrukcja silników i napędów spalinowych - Moodle ID: 30559 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30559
Example issues/ example questions/ tasks being completed	1. Give the definition of engine forced induction, name the methods of forced induction and their advantages and weaknesses. Draw a scheme of turbocharger connected to an engine. 2. Calculate brake torque Mo of a four stroke, four cylinder IC engine with the cylinder diameter D = ... mm and stroke S = ... mm. Indicated mean effective pressure pi = ... kPa and mechanical efficiency m = ...%. 3. Draw the scheme and describe operation modes of Toyota Hybrid System (THS).	
Work placement	Not applicable	