GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Internal Combustion Engines, PG_00055520		
Field of study	Mechanical Engineering		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2024/2025
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	assessment
Conducting unit	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	4.0	36.0	100

Subject objectives

Presentation of the modern achievements and tendencies in the area of internal combustion engines, classification, as well as an indication of the possible application nowadays and in the future, with particular emphasis on Polish conditions.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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	Can analyse and evaluate the methods of functioning of the internal combustion engines, understands the specificity of propulsion systems, understands the consequences of the selected solutions in terms of achieved energetics parameters of the system.	[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	Can use modern tools and knowledge in designing, operating and components selecting.	[SU1] Assessment of task fulfilment
[K6_U06] is able to use mathematical and physical models for analysing the processes and phenomena occurring in mechanical devices within the range of material strength, thermodynamics and fluid mechanics	Student designs reciprocating machine, projects components, makes thermal and resistance calculations.	[SU1] Assessment of task fulfilment

<table>
<tr><td>Subject contents</td><td>Lecture: Internal combustion engines. General information about internal combustion 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 internal combustion engines, strength calculations, bearings of internal combustion engines, fuels, fuel and ignition systems, solutions for energy systems, biogas plants, land vehicles, working machines and watercrafts, hybrid vehicle drive systems, electronic diagnostics of engines.

Tutorials: Work cycle modelling, device initial calculations, crank system mechanics, strength calculations, energy analysis, calculations of drive systems.

Laboratory: Construction and identification of internal combustion engine components, measurements of the basic parameters of internal combustion engines, testing of power supply components and electronic diagnostics of CI engines, supply, ignition systems and electronic diagnostics of IG engines, start-up and shutdown of the Stirling engine, displacement compressor drive.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Test (lecture)</td><td>50.0%</td><td>60.0%</td></tr>
<tr><td>Laboratory reports</td><td>90.0%</td><td>10.0%</td></tr>
<tr><td>Test (tutorials)</td><td>50.0%</td><td>30.0%</td></tr>
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</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>Wajand J.A., Wajand J.T.: Tłokowe silniki spalinowe średnio- i szybkoobrotowe. WNT.

Kropiwnicki J. Modelowanie układów napędowych pojazdów z silnikami spalinowymi. AGNI.

Żmudzki S.: Silniki Stirlinga. WNT.

Cantek L., Białas M.: Sprężarki chłodnicze. Wydawnictwo PG.

Ghosh T.K., Prelas M.A.: Energy Resources and Systems. Springer Dordrecht Heidelberg London New York.</td></tr>
<tr><td>Supplementary literature</td><td>http://www.combustion-engines.eu

http://www.ijat.net</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Draw a kinematic scheme of four stroke high speed engine.

Name the methods of forced induction (charging) and their advantages and weaknesses, draw a scheme of turbocharger connected to an engine.

Draw a diagram of fuel injection and heat release during combustion versus crank angle in a compression ignition (Diesel) engine.

Draw a scheme and explain the functioning of Toyota Hybrid System.

Calculate the change in net power of the Stirling engine after replacing the working medium from helium to air.

Perform an analysis of the effect of dead volume influence on the capacity of a reciprocating compressor on the p-V diagram.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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