Module/Subject Syllabus Summary
Mechanical Engineering
Undergraduate studies (BA)

Subject:	Propulsion systems in mechanical engineering
Subject type:	*Major*
Subject code:	
Year:	
Semester:	
Form of studies:	*Full-time course*
Form of classes and Number of hours per semester:	*60*
Lecture	*30*
Exercise	-
Laboratory practice	*30*
Project	-
ECTS points:	*2*
Form of credit:	*Examination*
Lecture language:	*English*

Subject objective	
C1	Getting acquainted with knowledge of piston and turbine engines
C2	Basics of piston and turbine engines design

Prerequisites in knowledge, skills and other competencies	
	Knowledge:
1	Fundamentals of mechanics, thermodynamics, fluid mechanics
	Skills:
2	Computer skills in basic programs such as WORD, EXCEL, POWER POINT
3	Thinking and acting in an intelligent way

Educational effects	
	Knowledge:
EK 1	The student knows the definitions of basic concepts in the field of piston and turbine combustion engines
EK 2	The student knows the types and forms of piston and turbine engines
EK 3	The student knows the principles of piston and turbine engines operation
EK 4	The student knows the general structure of piston and turbine engines
EK 5	The student knows the systems of piston and turbine combustion engines
	Skills:
EK 6	The student classifies piston and turbine combustion engines
EK 7	The student calculates the basic values of piston and turbine engines

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w ramach Europejskiego Funduszu Społecznego

	Social competencies:

Curriculum content of Subject	
Class form: lecture	
	Curriculum content
W1	Introduction. Basic concepts and terms. The operating principle of the combustion engine. Basic parameters of the combustion engine. Classification of combustion engines. Benchmark circuits and real mileage. Introduction on piston and turbine engines. History of the development of piston and turbine engines. Fuels for piston and turbine engines.
W2	The design of a piston engine. Crank-piston system. The system piston, rings, cylinder. Replacing the load. Timing gear system. Inlet manifold. Air filters. Outlet manifold. The design of auxiliary systems. Cooling systems. Lubrication systems. Additional systems.
W3	Power-supply systems for piston engines. Power carburetors. Single point injection. Multipoint injection. Direct injection. Power-supply for diesel engines.
W4	Rotary piston engines. The principle of operation of the Wankel engine. Kinematics of the Wankel engine. The design and performance of the Wankel engine.
W5	Turbine engines compressors. Reaction stage of axial-cum-centrifugal compressor and axial compressor. Unitary work of compression. Types of losses and efficiency of the gas compression ratio. Multistage axial compressor.
W6	Construction of combustion turbines. Reaction stage of the axial-flow turbine. Types of losses and efficiency of the degree of reaction of turbine. Multi-stage turbine. Power gas generators and propulsion engines with a power takeoff.
W7	Turbine engine combustion chamber. Types of chambers used in jet engines and propeller and helicopter engines. Fundamentals of organization of in-chamber processes. Aerodynamics of chambers and combustion process in the piston flow. Continuous fuel injection and the formation of combustible mixture. In-flame processes in the combustion chamber. Combustion temperature and lowering the combustion gasses temperature. The total excess air ratio. Fuel consumption. Construction of chambers. Load states of basic components of the chamber.
W8	Auxiliary components of turbine engines. Starters components, fuel and ignition systems.
W9	Toxic components of the exhaust gasses.
W10	The characteristics of the motors. The speed characteristics. Load characteristics. Control characteristics. General characteristics. Features of the propeller. Characteristics of altitude.
W11	Superstructure of engines in machines.
Form of classes – Laboratory practice	
	Curriculum content
L1	Construction of piston engines laboratory
L2	Construction of turbine engines laboratory.

Teaching methodology	
1	Lecture with multimedia presentation
2	Laboratory exercises

Student workload	
Form of activity	Average hours to complete activity
Teacher contact hours, including:	
Lecture	30
Project	-
Laboratory practice	30
Examination	2
Consultation regarding lecture	2
Consultation regarding project	
Consultation regarding laboratory practice	2
Total student work time, including:	
Preparation for examination	6
Project	30
Reports of laboratory practice	20
Total student work time	125
Total ECTS for the subject:	2
Number of ECTS credits in courses of a practical nature	2

Basic and complementary reference literature	
1	Dzierżanowski P., Łyżwiński M., Szczeciński S.: „Napędy Lotnicze. Silniki tłokowe", Wydawnictwo Komunikacji i Łączności, Warszawa 1981
2	Niewiarowski K.: „Tokowe silniki spalinowe", Wydawnictwa Komunikacji i Łączności, Warszawa 1983
3	A. Kowalewicz, „Tworzenie mieszanki i spalanie w silnikach o zapłonie iskrowym", Wydawnictwa Komunikacji i Łączności, Warszawa 1984, ISDN 83-206-0399-4
	Complementary reference literature
4	Cheda W., Malski M.: „Techniczny poradnik lotniczy. Silniki", Wydawnictwa Komunikacji i Łączności, Warszawa 1984
5	Wardziński F.: „Samochodowe silniki spalinowe", Państwowe Wydawnictwa Szkolnictwa Zawodowego, Warszawa 1972
6	Kasedorf J.: „Układy wtryskowe i katalizatory", Wydawnictwa Komunikacji i Łączności, Warszawa 1996
7	Basshuysen R., Schafer F.: "Modern Engine Technology from A to Z", SAE International, Warrendale, Pensylwania, USA 2006
8	Mattingly J., Heiser W., Pratt D.: "Aircraft Engine Design", American Institute of

	Aeronautics and Astronautics, Education Series, Inc. 1801 Aleksander Bell Drive, Reston, VA20191-4344, 2002
9	Kasedorf J.: „Gaźniki", Wydawnictwa Komunikacji i Łączności, Warszawa 2001
10	Kasedorf J.: „Układy wtryskowe benzyny", Wydawnictwa Komunikacji i Łączności, Warszawa 2000
11	Kasedorf J.: „Zasilanie wtryskowe benzyną", Wydawnictwa Komunikacji i Łączności, Warszawa 1989
12	Dzierżanowski P. i inni: Turbinowe silniki odrzutowe. WKiŁ. Warszawa 1983
13	Antas S., Wolański P.: Obliczenia termo-gazodynamiczne silników turbinowych. Wyd. Politechnika Warszawska, Warszawa 1989
14	Dzierżanowski P. i inni: Turbinowe silniki śmigłowe i śmigłowcowe. WKiŁ, Warszawa 1985
15	Dżygadło Z. i inni: Zespoły wirnikowe silników turbinowych. WKiŁ, Warszawa 1982.
16	Szczeciński S.: Turbinowe napędy samochodów. WKiŁ, Warszawa 1974
17	Muszyński M., Orkisz M.: Modelowanie turbinowych silników odrzutowych. Biblioteka Naukowa Instytutu Lotnictwa, Warszawa 1997
18	Gajewski T. i inni: Przepływowe silniki odrzutowe. WNT, Warszawa 1973

Evaluation methods and criteria		
Evaluation method symbol	Evaluation method description	Pass threshold
O1	Examination	*50%*
O2	Assessment of laboratory practice	*70%*

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