

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Ecology/ Environment protection in air transportation		Code 1010621221010623539
Field of study Transport	Profile of study (general academic, practical) (brak)	Year /Semester 1 / 2
Elective path/specialty Aircraft Transport	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: Second-cycle studies	Form of study (full-time, part-time) full-time	
No. of hours Lecture: 1 Classes: - Laboratory: 2 Project/seminars: -		No. of credits 3
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art technical sciences		ECTS distribution (number and %) 3 100%
Responsible for subject / lecturer: Prof. Jerzy Merkisz, D.Sc, Eng. email: jerzy.merkisz@put.poznan.pl tel. (061) 665-2208 Faculty of Machines and Transport 3 Piotrowo street, 60-965 Poznan, Poland		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Basic knowledge of physics, mechanics, fluid mechanics
2	Skills	Able to apply the scientific method to solve problems, implement experiments and reasoning
3	Social competencies	Knows the limitations of own knowledge and skills, is able to accurately formulate questions, understands the need for further education
Assumptions and objectives of the course: Detailed knowledge and analysis of the environmental problems concerning the use of internal combustion engines in aerospace applications. Research of toxic emissions: analysis of existing standards and regulations, including knowledge of the latest methods of measuring emissions of harmful compounds.		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. Has an elementary knowledge of the life cycle of the equipment recycling machine elements and structural materials and consumables - [K2A_W19]		
2. Has an elementary knowledge of the impact of machinery and technology on the environment and global energy balances - [K2A_W20]		
3. Has an elementary knowledge of the impact of changes in technology on the organization of social life and the health and psyche of individuals in touch human-machine - [K2A_W21]		
Skills:		
1. Is able to use a verbal one additional foreign language at the level of everyday language - [K2A_U02]		
2. Is able to prepare and present a short presentation of verbal and dedicated multimedia performance engineering tasks - [K2A_U05]		
3. Is able to apply basic technical standards for the unification and security, and recycling - [K2A_U23]		
Social competencies:		
1. Is able to think and act in a creative and enterprising - [K2A_K05]		
2. Is aware of and understands the validity of the non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for decisions - [-]		
3. Understands the need and knows the possibilities of lifelong learning - [-]		

Assessment methods of study outcomes		
Written test		
Course description		
<p>- Issues related to the ecological production of aircraft engines , their exploitation and utilization. Technical and economical issues associated with recycling.</p> <p>- Issues related to combustion in aircraft engines and the formation of harmful compounds, including the differences between piston and jet engines. Mechanisms of toxic compounds and noise formation. The organization of air traffic, general assumptions and ecological aspects of the construction of airports.</p> <p>Methods of measurement of toxic compounds ? analyzers , chromatography , measurement of particulate emissions test . The standards and test methods for toxic emissions ? forecasts of the development of standards and methods of research. ; emissions testing on- board . Research aircraft engines for motor hamowniach . The specificity of toxic compounds , depending on the design parameters and operating in aircraft engines : piston and flow . Reducing emissions CO2/zuzycia fuel in aircraft engines and flying objects . Problems related to noise ? basic concepts and relationships , sources of noise in aircraft noise reduction standards , the selected method of measuring noise , minimizing noise .</p> <p>The impact of the quality parameters and performance of fuel on the emission of toxic substances ? conventional fuels , alternative fuels, and motor oils.</p> <p>Overview of ecological design of aircraft engines and prospects for their development.</p>		
Basic bibliography:		
<ol style="list-style-type: none"> 1. Stanisław Wiąckowski, Toksykologia środowiska człowieka. Wydawnictwo: Branta, 2010 ISBN: 978-83-616-6806-0. 2. Merkiż Jerzy, Mazurek Stanisław, Pokładowe Systemy Diagnostyczne Pojazdów Samochodowych. Wydawnictwa Komunikacji i Łączności WKŁ, 2006-01-01. 3. Jerzy Merkiż, Ekologiczne problemy silników spalinowych, Wyd. Politechniki Poznańskiej, Poznań 1998. 4. Merkiż J., Pielecha I., Alternatywne napędy pojazdów. Wydawnictwo Politechniki Poznańskiej, Poznań 2006. 		
Additional bibliography:		
<ol style="list-style-type: none"> 1. Wojciech Serdecki, Badania silników spalinowych. Wyd. Politechniki Poznańskiej, Poznań 2012 2. Witold M. Lewandowski, Proekologiczne źródła energii odnawialnej. WNT, Warszawa 2002 3. Zdzisław Chłopek, Ochrona środowiska naturalnego. Pojazdy samochodowe. WKŁ, Warszawa 2003 4. Gronowicz J., Ochrona środowiska w transporcie lądowym. Wyd. ITE, Poznań ? Radom 2003 		
Result of average student's workload		
Activity	Time (working hours)	
1. Preparation for lectures	5	
2. Participation in lectures	15	
3. Office hours	5	
4. Preparation for exam	10	
5. Preparation for exam	1	
6. Preparation for laboratories	5	
7. Participation in laboratories	30	
8. Preparation for laboratory test	10	
9. Participation in laboratory test	1	
Student's workload		
Source of workload	hours	ECTS
Total workload	82	3
Contact hours	45	1
Practical activities	30	2