

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Ecology in aviation</b>		Code <b>1010601131010633507</b>
Field of study <b>Mechanical Engineering</b>	Profile of study (general academic, practical) <b>(brak)</b>	Year /Semester <b>2 / 3</b>
Elective path/specialty <b>Aircraft Engines</b>	Subject offered in: <b>Polish</b>	Course (compulsory, elective) <b>obligatory</b>
Cycle of study: <b>Second-cycle studies</b>	Form of study (full-time, part-time) <b>full-time</b>	
No. of hours Lecture: <b>1</b> Classes: <b>-</b> Laboratory: <b>-</b> Project/seminars: <b>-</b>		No. of credits <b>1</b>
Status of the course in the study program (Basic, major, other) <b>(brak)</b>		(university-wide, from another field) <b>(brak)</b>
Education areas and fields of science and art <b>technical sciences</b>		ECTS distribution (number and %) <b>1 100%</b>
<b>Responsible for subject / lecturer:</b>  prof. dr hab. inż. Jerzy Merkisz email: jerzy.merkisz@put.poznan.pl tel. (061) 665-2207 Faculty of Working Machines and Transportation ul. Piotrowo 3; 60-965 Poznań		
<b>Prerequisites in terms of knowledge, skills and social competencies:</b>		
1	<b>Knowledge</b>	Basic knowledge of recycling, chemicals, noise emissions
2	<b>Skills</b>	Can apply the scientific method to solve problems, implement experiments and reasoning
3	<b>Social competencies</b>	Knows the limits of their own knowledge and skills, able to clearly formulate questions, understands the need for further education
<b>Assumptions and objectives of the course:</b> - Detailed understanding and analysis of environmental problems, the use of internal combustion engines in aerospace applications. Emission of toxic compounds: analysis of existing standards and regulations, including knowledge of the latest methods of measuring emissions of harmful compounds.		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b> 1. Has an extended knowledge of the life cycle of machines, operating principles of working machines and destructive processes taking place during the operation, such as tribological wear, corrosion, fatigue and surface aging. - [K2A_W13] 2. Has a general understanding of the types of tests and test methods for working machines using modern measurement techniques and data acquisition. - [K2A_W20]		
<b>Skills:</b> 1. Is able to freely use an international language in contacts with professionals from the same field of study. - [K2A_U01] 2. Is able to assess potential negative impacts for the natural environment and humans, originating from the designed machine or a vehicle from the selected equipment group. - [K2A_U14]		
<b>Social competencies:</b> 1. Is able to think and act in an entrepreneurial manner. - [K2A_K05] 2. Is aware of and understands the importance and impact of non-technical aspects of mechanical engineering activities and its impact on the environment, is aware of responsibility for decisions. - [K2A_K02] 3. Is able to set priorities for realization of undertaken tasks. - [K2A_K04]		

<b>Assessment methods of study outcomes</b>
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- written test		
<b>Course description</b>		
<p>- ssues related to the organic : production of aircraft engines , their exploitation and utilization . Technical and economic issues associated with recycling.</p> <p>Issues related to combustion in aircraft engines and the formation of toxic compounds , including a breakdown between piston and jet engines . Mechanisms of toxic exhaust and noise. The organization of air traffic ? general assumptions , and environmental aspects 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 for 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 CO<sub>2</sub>/zużycia fuel in aircraft engines and flying objects . Problems related to noise ? Basic concepts and relations , sources of noise in aircraft noise reduction standards , the selected method of measuring noise , minimizing noise .</p> <p>Influence of fuel quality and service to the emission of toxic substances ? conventional fuels , alternative fuels and engine oils .</p> <p>Overview of ecological design of aircraft engines and the prospects for their development.</p>		
<b>Basic bibliography:</b>		
<ol style="list-style-type: none"> <li>1. J. Merkisz ? Emisja cząstek stałych przez silniki spalinowe. WPP, Poznań 1997.</li> <li>2. J. Merkisz ? Ekologiczna aspekty stosowania silników spalinowych. WPP, Poznań 1994.</li> <li>3. E. Sher ? Handbook of Air Pollution from Internal Combustion Engines. Pollutant Formation and Control. Academic Press. Boston 1998</li> <li>4. Merkisz J. ? Ekologiczne problemy silników spalinowych. Tom I (1998), Tom II (1999), WPP, Poznań.</li> <li>5. Merkisz J. ? Emisja cząstek stałych przez silniki spalinowe. WPP, Poznań 1997.</li> <li>6. Merkisz J. ? Ekologiczne aspekty stosowania silników spalinowych. WPP, Poznań 1994</li> <li>7. Merkisz J., Bielaczyc P., Pielecha J. ? Stan cieplny silnika spalinowego a emisja związków szkodliwych. Wydawnictwo Politechniki Poznańskiej, Poznań 2001</li> <li>8. Sher E. ? Handbook of Air Pollution from Internal Combustion Engines. Pollutant Formation and Control. Academic Press. Boston 1998.</li> <li>9. Praca zbiorowa: Turbinowe zespoły napędowe źródłem skażeń powietrza na lotniskach wojskowych. Wyższa Szkoła Oficerska Sił Powietrznych, Dęblin 2003.</li> </ol>		
<b>Additional bibliography:</b>		
<b>Result of average student's workload</b>		
<b>Activity</b>	<b>Time (working hours)</b>	
1. Preparing to pass the course	5	
2. Participation in completing	2	
3. Participation in lectures	15	
<b>Student's workload</b>		
<b>Source of workload</b>	<b>hours</b>	<b>ECTS</b>
Total workload	27	1
Contact hours	17	1
Practical activities	10	0