



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Elements of measurement theory and environmental protection

### Course

Field of study

Aviation and Astronautics

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

3/6

Profile of study

general academic

Course offered in

polish

Requirements

elective

### Number of hours

Lecture

45

Laboratory classes

45

Other (e.g. online)

Tutorials

15

Projects/seminars

### Number of credit points

7

### Lecturers

Responsible for the course/lecturer:

Dr hab. inż. Rafał Ślęfarski

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Wydział Inżynierii Środowiska i Energetyki

ul. Piotrowo 3 60-965 Poznań

Responsible for the course/lecturer:

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Wydział Inżynierii Lądowej i Transportu

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### Prerequisites

A student starting this subject should have basic knowledge of chemistry, physics, mathematics, natural sciences and knowledge about transport impact on the surrounding environment. In addition student should be able to solve simple problems using publicly available databases such as scientific articles, legal acts or the Internet.

Has basic knowledge of physics, mechanics and strength of materials.

### Course objective

To acquaint students with the knowledge about basics of environmental protection in aviation industry and related industries using fuel combustion processes.



Understanding the methods of measuring mechanical quantities.

### Course-related learning outcomes

#### Knowledge

1. has basic knowledge in the scope of the main departments of technical mechanics: statics of kinematics and material point dynamics as well as rigid body and strength of materials, including the basics of the theory of elasticity and plasticity, strain hypotheses, methods of calculating beams, membranes, shafts, joints and other simple structural elements, as well as methods for testing the strength of materials and the state of deformation and stress in structures
2. has basic knowledge in the field of metrology, knows: measurement methods, characteristics of measuring instruments and their classification by purpose, principles of operation and metrological features, workshop metrology, sensors and measuring transducers, registration of results, measurement systems, measurement errors - the influence of external factors, statistical analysis of measurement results, principles of organization of active and passive experiment
3. has detailed knowledge related to selected issues in the field of the most important phenomena occurring in the Earth's atmosphere, the possibility of their prediction, recognition, research, as well as limiting the negative impact of human activities on the surrounding environment

#### Skills

1. is able to communicate using various techniques in a professional environment and other environments using the formal record of construction, technical drawing, concepts and definitions of the scope of the studied field of study
2. is able to prepare and present a short verbal and multimedia presentation devoted to the results of an engineering task
3. is able to analyze objects and technical solutions, can search in the catalogs and on the manufacturers' websites ready components of machines and devices, including transport and storage equipment and devices, assess their suitability for use in own technical and organizational projects
4. is able to develop a safety instruction for a simple and medium complex on-board device, machine or technical flying object in specified environmental conditions

#### Social competences

1. understands the need for lifelong learning; can inspire and organize the learning process of others
2. is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment, and the associated responsibility for the decisions taken
3. can think and act in an entrepreneurial manner
4. is aware of the social role of a technical university graduate, and in particular understands the need for formulation and communication to the public, in particular through the mass media, information and



opinions on the achievements of technology and other aspects of engineering activities; endeavors to provide such information and opinions in a generally understandable way

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: the written examination, test 5-10 questions, 90 min, minimum for positive mark is 50%

Laboratory - final test and rewarding knowledge necessary for the accomplishment of the problems in the area of the subject, evaluation of student report,

### Programme content

Introduction to fuel combustion processes, methods of reducing fuel consumption in aviation, analysis of the formation of toxic compounds during the combustion of fossil fuels used in aviation, carbon dioxide balance in the atmosphere, photovoltaic smog, alternative fuels, noise and prevention methods, EU energy policy and environmental protection, international protocols related to environmental protection

Scientific knowledge. Methodology of empirical research. Tests of machines and devices at the stages of construction, manufacture and operation. Metrological concepts: size, property, property, value. Measurement; definitions, unit systems. General principles of measuring methods of mechanical quantities. Measurement of stress, force, torque and rotational speed. Construction of the measuring system. Measurement system: sensor, transducer, meter, recorder. Computer software for conducting: analysis of recording and archiving measurements. Analysis of errors, preparation of results and formulation of conclusions from measurements.

### Teaching methods

Lecture: multimedia presentation, illustrated with examples on the board

Laboratory exercises: practical exercises carried out in research test rig

### Bibliography

Basic

1. Józef Jarosiński: Techniki czystego spalania
2. Jerzy Merkisz, Ireneusz. Pielecha: Alternatywne paliwa i układy napędowe
3. Molenda J. Steczko K. Ochrona środowiska w gazownictwie i użytkowaniu gazu
4. Warych Jerzy: Oczyszczanie przemysłowych gazów odlotowych
5. Hagel R., Zakrzewski J.: Miernictwo dynamiczne, WNT Warszawa 1984
6. Nawrocki W.: Komputerowe systemy pomiarowe, WKŁ Warszawa 2002



Additional

1. John C. Mycock: Handbook of air pollution control engineering and technology
2. PEP2040 Energy Policy of Poland to 2040
3. EU and domestic acts and standards for environmental protection in transportation and energy
4. Piotrowski J.: Podstawy miernictwa, WNT Warszawa 2002

**Breakdown of average student's workload**

	Hours	ECTS
Total workload	210	7,0
Classes requiring direct contact with the teacher	105	3,5
Student's own work (literature studies, preparation for laboratory classes, consolidation of the content of classes, preparation for tests,) <sup>1</sup>	105	3,5

<sup>1</sup> delete or add other activities as appropriate