# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Environmental Physics [S1FT2>FŚ]

## Course

Field of study
Technical Physics

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

## Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

## Number of credit points

2,00

## Coordinators

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## Lecturers

## Prerequisites

1. Basic knowledge of mathematics (differential and integral calculus, operations on operators) and experimental physics, 2. Ability to solve simple physical problems based on the acquired knowledge and to gather information from provided sources. 3. Understanding the need to expand one's competencies and willingness to work in a team. 4. Basic knowledge of CAS (computer algebra systems) supporting symbolic calculations in mathematics, physics and technical disciplines, learned in the 2nd year of studies.

## Course objective

1. To provide students with fundamental knowledge of Atmospheric Physics and problems related to toxicity and general environmental pollution during lectures. 2. To develop students' skills in solving problems in the field of environmental physics. and practical use of CAS computational algebra systems, analyze results, using literature, and prepare presentations on various environmental problems during exercises. 3. To cultivate teamwork skills among students.

## Course-related learning outcomes

Knowledge:
As a result of the course, the student will have knowledge in the following areas:

Has organized knowledge about physical phenomena in the field of classical experimental physics, quantum mechanics, and differential equations
Can apply Laplace transform to solve diffusion equations

Skills:
As a result of the course, the student will have the following skills:
Can use acquired mathematical knowledge and analytical methods to describe specific phenomena, formulate and solve problems
Uses, with understanding, indicated sources of knowledge (literature, databases, and others), interprets them, draws conclusions, formulates and justifies opinions
Can independently and efficiently prepare and present an oral presentation in Polish

Social competences:
As a result of the course, the student will acquire the following social competences:
Can work independently and as part of a team on the assigned task
Is responsible for the outcomes of their work and the reliability of obtained results and their interpretation. Applies professional ethics rules

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written Quiz
Assessment of individual oral presentation using computer software
Assessment of answers to questions related to the presentation and work in exercises
<0–50)% unsatisfactory
<50–60)% - satisfactory;
<60–70)% - satisfactory plus;
<70–80)% - good;
<80–90)% - good plus;
<90–100> - very good.

## Programme content

Current research status on the environment worldwide (atmospheric physics, weather and climate elements, pollution transport, noise and acoustics)
Additional content depending on the topic of the students presentations.

## Course topics

Fundamentals of Environmental Physics:
1. solar radiation and the Earth's atmosphere (basic concepts and laws, the spectrum of sunlight, biological particles and solar ultraviolet)
2. elements of atmospheric thermodynamics (vertical structure of the atmosphere, thermodynamics of dry and humid air, atmospheric equilibrium conditions, horizontal air movement)
3. elements of the physics of climate processes (basic concepts, energy balance of the planet, radiative forcing, positive and negative couplings in the climate system, greenhouse effect, radiation equilibrium, clouds and aerosols in the climate system, carbon cycle, astronomical cycles)
4. transport of pollutions (in the air and rivers)
5. examples of spectroscopic analysis of the environment (satellite monitoring of the upper atmosphere, LIDAR - method of measuring atmospheric pollution, energetically selective spectroscopy of particles)
6. Energy (heat transfer mechanisms)
7. noise (basic concept of acoustics, perceptual capacity and noise criteria, reduction of sound transmission)
8. Additional content depending on the topic of the students presentations.

## Teaching methods

1. Lecture: multimedia presentation, solving example tasks on the board.
2. Laboratory class: numerical experiments, initiating discussions on the obtained solutions, teamwork,

homework, developing individual projects and presentations.

## Bibliography

Basic:
1. Egbert Boeker, Rienk van Grondelle: Fizyka Środowiska, PWN 2002
2. Marcin Popkiewicz, Aleksandra Kardaś, Szymon Malinowski: Nauka o klimacie, Post Factum 2018
3. R. Zarzycki, Wymiana ciepła i ruch masy w inżynierii środowiska, WNT 2010
4. Kazimierz Rup, Procesy przenoszenia zanieczyszczeń w środowisku naturalnym, WNT 2015

Additional:
1. C. Smith, Environmental Physics, Routledge, London and New York, 2006
2. Murry L. Salby, Fundamentals of Atmospheric Physics, Elsevier, 1996
3. Judith A. Curry, Peter J. Webster, Thermodynamics of Atmospheres and Oceans, Elsevier, 1999
4. M.K. Yau, R R Rogers, A Short Course in Cloud Physics, Elsevier, 1989
5. David Archer, Globalne ocieplenie Zrozumieć prognozę, PWN 2010
6. Climate Change 2021: The Physical Science Basis www.ipcc.ch/report/ar6/wg1/

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 50 | 2,00 |
| Classes requiring direct contact with the teacher | 30 | 1,00 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 20 | 1,00 |