Warsaw University of Technology | Doctoral School No. 4

Course offered in the Doctoral School No. 4 – Spring semester of the 2021/2022 academic year

TITLE
Global Climate Change
CONDUCTING UNIT
Doctoral School No. 4
SCIENTIFIC DISCIPLINE
Environmental engineering, mining and energy
IMPLEMENTING UNIT
111000 - Faculty of Building Services, Hydro and Environmental Engineering
SUMMARY DESCRIPTION
The course covers the overview of global climate change science. It includes components of climate system and it's natural and human drivers and climate feedbacks; description of the observations of changes in climate in 20th and 21st centuries. Attributes of key greenhouse gases (GHG). Methods of climate change modelling, global and regional projections. Climate change impacts as well as magnitude and timing of the projected impacts on human health, agriculture, water resources, ecosystems and on economy. Policies, measures and instruments to mitigate climate change, international agreements: form UN Framework Convention of Climate Change (1992) to Paris Agreement (2015) and European Climate Law (2021). Co-benefits/side-effects of mitigation. Overview of the adaptation practices, options, constraints and capacity.
FULL DESCRIPTION
Lectures cover the following topics: Historical overview of climate change science. Components of climate change process. Global climate change assessment – Reports of the Intergovernmental Panel on Climate Change. Causes of global climate change. Changes in human and natural drivers of climate. Atmospheric Greenhouse Gases (GHG). Changes in emissions and concentrations. The cooling factors. Aerosols: sources, types, changes in atmospheric concentrations. Direct aerosol effect. First and second indirect aerosol effects. Radiative forcing: concept and changes; principal components. Summary of natural and human radiative forcing of the last 150 years. Global/regional emission of

GHG. Distribution of GHG emissions by population, GDP, country, sector and gas. The global carbon cycle. Global carbon budget. Attributes of key GHG. Sources and sinks. Lifetimes, radiative efficiencies, global warming potentials. Paleoclimatology. Observations of changes in climate in the 20th and 21st century; instrumental records. Global average temperatures and related variables changes. Changes in cryosphere and in global ocean. Climate change and extreme weather events. Modelling the climate change. Global and regional climate models. Representative Concentration Pathways (RCPs) and Shared Socioeconomic Pathways (SSPs) scenarios. Climate feedbacks. Geophysical and biochemical feedbacks. Climate albedo feedback. Cloud, methane and ocean feedbacks. Future climate projections. Global and regional climate projections and their projected impacts. The most vulnerable sectors and regions. Projected magnitude and timing of impacts. Impacts on economy, agriculture, human health, water resources and ecosystems. Adaptation and mitigation options. Assessment of adaptation practices, options, constraints and capacity. Policies, measures and instruments to mitigate climate change. International agreements: UN Framework Convention of Climate Change (UNFCCC), UNFCCC/Kyoto Protocol, Paris agreement. Key sectoral mitigation technologies and practices currently commercially available/ projected to be commercialized before 2030. Co-benefits/ side-effects of climate mitigation. Climate change and air pollution control.
The seminar accompanying the lecture are designed for students to talk about the course topics in detail and to take an active part in the debate on the challenges and possibilities to achieve the international climatic goals, including EU Climate and Energy Package, European Green Deal and European Climate Law. Each student has to study in detail climate change impacts on selected sector/region. Emission trading system simulation, including negotiations, will be performed in groups.
Grading of the course is based on the scores of the written exam and activity during seminar. The final grade is account for 60% of the exam grade and 40% of the seminar.

LITERATURE

1. IPCC, 2021: Sixth Assessment Report: Climate Change 2021 (AR6), selected materials.
2. IPCC, 2013: Fifth Assessment Report: Climate Change 2013 (AR5), selected materials.
3. IPCC, 2018: Special Report - Global warming of 1.5˚C.
4. Seinfield J.H., Pandis S.N., 2016: Atmospheric Chemistry and Physics: from air pollution to climate change, 3rd edition, Wiley & Sons, Hoboken.
5. EEA, 2020: The European Environment – State and Outlook (SOER) 2020.

LEARNING OUTCOMES

Knowledge
W1. Has in-depth knowledge in the field of ambient air pollution and air pollution control.
W2. Has in-depth knowledge related to possible causes and effects of climate change, as well as possible adaptation and mitigation options.
Skills
U1. Can describe processes, phenomena and activities affecting climate change.
U2. Is able to choose proper control methods and technologies necessary to reduce the emission of greenhouse gases to the atmosphere.

Competences
K1. Can formulate problems related to causes and effects of global climate change and to the possible actions regarding control of air pollution and climate.

ASSESSMENT METHODS AND CITERIA; COURSE COMPLETION FORM
Grading of the course is based on the scores of the written exam and activity during seminar. The final grade is account for 60% of the exam grade and 40% of the seminar.

LANGUAGE OF THE COURSE	ECTS CREDITS
English	3

TYPE OF CLASSES	NUMBER OF HOURS	COURSE INSTRUCTOR
Lecture	30	Katarzyna Juda-Rezler, prof. dr hab. inż.; Magdalena Reizer, dr inż.
Seminar	15	Magdalena Reizer, dr inż.; Katarzyna Maciejewska dr inż.

ADDITIONAL INFORMATION
The course is realized within the SEED Project – NAWA STER Programme. Therefore, in order to take part in it, each participant is obliged to deliver to the PhD Students' Office the Declaration of the Project Participant concerning personal data. The document must be submitted until **March 1, 2022.** The document can be found here: https://www.sd.pw.edu.pl/sd_en/SEED-NAWA-STER