**SYLLABUS** (MODULE-ERASMUS+)

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| Course/module (as specified in the approved curriculum for the field of study) **Landscape-ecological impacts of climate changes** | ECTS**3** | Component code**ENVI 3.4** |
| Name in Polish**Krajobrazowo-ekologiczne skutki zmian klimatu** |
| Unit(-s) providing the course/module (Faculty, Institute/Department)**Faculty of Environmental and Mechanical Engineering, Department of Civil Engineering and Geoengineering** |
| Head of course/module (e-mail address)**Klaudia Ziemblińska, PhD (****klaudia.ziemblinska@up.poznan.pl****)** |
| Other teachers**Janusz Olejnik, Prof.**  |
| Course category**Open** | Language**English** | Level**Bachelor/Master** | Profile**Academic-general** | Semester**Winter** |
| **TYPE OF CLASSES/LECTURES AND THE NUMBER OF HOURS**(organised classes/lectures and self-study) |
| Type of studies: full-time |  | Type of studies: extramural |  |
| * lectures
 | 15 | * lectures
 | - |
| * practical classes
 | 15 | * practical classes
 | - |
| * field exercise
 |   | * field exercise
 | - |
| * other lessons
 |  - | * other lessons
 | - |
| * self-study
 |  45 | * self-study
 | - |
| Total number of hours: | 75 | Total number of hours: | - |
| **PRE-REQUSITES**Basics of physics. |
| **OBJECTIVE OF COURSE/MODULE**The main objective of the course is to make students aware of the complexity of climate-landscape interactions, their ecological consequences, processes behind carbon and water cycles, causes and results of intensified climate change on natural ecosystems as well as societies and economy, with a special focus on water resources, seriously threatened by the temperature rise. |
| **TEACHING METHODS**Lectures with open discussion, practical classes. Possibility to use remote teaching tools and techniques in both cases. |
| **LEARNING OUTCOMES** | Referenceto field outcomes |
| Knowledge | O1: Students will have advanced knowledge about the principles of water, heat and carbon balance,O2: Students will discover advanced method of climate change observation and research,O3: Students will know where to find and how to analyze the long series of climate data as well as what are the predictions for the future.  | Notapplicable |
| Skills | O4: Students will have skills of CO2 and H2O fluxes measurements using state-of-the-art techniques,O5: Students will be able to distinguish natural from anthropogenic impacts of climate change and assess some of them quantitatively | Notapplicable |
| Socialcompetences | O6: Students will understand how does human activities change climate-landscape interactions- positive and negative feedbacks,O7: Students will be able to take a part in an open discussion about climate changes and its consequences for natural and urban ecosystems. | Notapplicable |
| **METHODS TO VERIFY LEARNING OUTCOMES**Assessment of participation in a discussion, timeliness, reliability and student’s behaviour (lectures)Assessment of completed exercises (Students report- practical lectures) | Outcome ReferenceNumbersO1-O3,O6-O7O4-O5 |
| **TEACHING CONTENT****Lectures**: 1. Fluxes of mass and energy exchanged between the atmosphere and the earth's surface- what is “flux”, how does the turbulence work? How can me measure trace gases’ fluxes?
2. Anthropogenic sources of changes in the composition of the atmosphere.
3. Greenhouse effect and the change in its intensity in the last century.
4. Basics of climatology including types of climates on Earth.
5. Changes in energy and water balance of various ecosystems due to global warming.
6. Examples of positive and negative feedbacks and their contribution to changes occurring in various ecosystems.
7. Impact of changes in water balance on land ecosystems.
8. Anticipated climatic conditions in the perspective of several decades.
9. Projected changes in the evolution of terrestrial ecosystems due to expected “new” climatic conditions.
10. Role of selected ecosystems in climate changes mitigation.
11. Challenges for hydrotechnical constructions in the face of water balance disruptions
12. Economic consequences resulting from global warming on various ecosystems and the economy on a local and global scale.

**Practical classes:**1. Analysis and calculation of water and heat balance elements with a special focus on evapotranspiration rates change due to landscape disturbances
2. Relationships between precipitation and evapotranspiration fluxes in different ecosystems and changes of climatic water balance in time (based on forest ecosystem example)
3. Field trips to eddy covariance forest sites to perform measurements of CO2 and CH4 fluxes from the soil using chamber method. Calculations of these gasses’ fluxes will be based on the data collected individually during measuring campaigns
4. Where to find climate data for different places worldwide and how to use them to derive trends and patterns?
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| **Forms and criteria for passing of course/module** Writing report | Percentage of final mark100% |
| **LIST OF LITERATURE** 1. Kędziora Andrzej, Podstawy agrometeorologii. Państwowe Wydawnictwo Rolnicze i Leśne. 2008
2. IPCC reports and other international documents regarding climate change scenarios, mitigation and risk assessments (to be presented during lectures).
3. Tuba Zoltan, DSc Editor. Ecological Responses and Adaptations of Crops to Rising Atmospheric Carbon Dioxide. Food Products Press. An Imprint of The Hawort Press, Inc. Binghamton , NY. 2015
4. Brouwer F.M., Thomas A.J. and Chadwick M.J. Land use change in Europe. Processes and shange, environmental transformation and future patterns. Kluwer Academic Publisher. Dordrecht, the Netherlands. 1991.
5. Ryszkowski Lech. Landscape ecology in agroecosystems management. CRC Press LLC, Boca Raton, Florida, USA. 2002.
6. Matyssek R., Clarke N. Cudlin P., Mikkelsen T.N., Touvinen J-P., Wieser G. and Paoletti E. Climate change, air pollution and global challenges. Understanding and perspectives from forest research. Development in Environmental Science, Volume 13. Elsevier Ltd. 2013.
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