**SYLLABUS** (MODULE-ERASMUS+)

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| Course/module (as specified in the approved curriculum for the field of study) **Soil and groundwater remediation** | ECTS**3** | Component code**ENVI 1.5** |
| Name in Polish**Remediacja i ochrona gleb** |
| Unit(-s) providing the course/module (Faculty, Institute/Department)**Faculty of Environmental and Mechanical Engineering, Department of Soil Science, Land Reclamation and Geodesy** |
| Head of course/module (e-mail address)**Jolanta Komisarek, Prof. (****jolanta.komisarek@up.poznan.pl****)**  |
| Other teachers- |
| 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
 | 10 | * lectures
 | - |
| * practical classes
 | 15 | * practical classes
 | - |
| * field exercise
 | -  | * field exercise
 | - |
| * other lessons
 |  - | * other lessons
 | - |
| * self-study
 |  50 | * self-study
 | - |
| Total number of hours: | 75 | Total number of hours: | - |
| **PRE-REQUSITES**None. |
| **OBJECTIVE OF COURSE/MODULE**The main goal of his course is to make students familiar with basic techniques of soil and groundwater remediation and their environmental and economic costs. Additional objective of this course is to acquaint students with natural and artificial processes used in different remediation practices on devastated areas. |
| **TEACHING METHODS**Lectures with multimedia presentations.Practicals will include laboratory analyses and group discussion.Possibility to use distance learning tools and techniques. |
| **LEARNING OUTCOMES** | Referenceto field outcomes |
| Knowledge | O1: Students have extended knowledge in the field of chemistry, agricultural techniques, chemistry and biology of soils and waters adapted to the needs of soil and groundwater remediation techniques.O2: Students have extensive knowledge about the sources of contaminants has an extended knowledge of the adverse effects of strong anthropopressure on the soil and groundwater environment caused by organic and inorganic pollution.O3: Students have extended knowledge in the field of technologies used for treatment of soils contaminated with organic and inorganic compounds of soils and waters. | Notapplicable |
| Skills | O4: Students will have skills to describe and quantify the soil environment for the needs of modelling soil groundwater dynamics, based on archival and measurement data.O5: Students will be able to minimize the adverse impact of pollution on the environment.O6: Students will have skills to plan and carry out an experiment to clean contaminated soils for various soil and groundwater conditions and present it in the form of documentation. | Notapplicable |
| Socialcompetences | O7: Students will be aware of the responsibility for the state of the soil environment,O8: Students will understand the need to learn, is aware of the social role of the graduate, can communicate with the environment and communicate the basic knowledge of remediation of soils and groundwaters.O9: Students will be able to correctly identifies and resolves dilemmas related to the remediation of the soil and groundwater environment. | Notapplicable |
| **METHODS TO VERIFY LEARNING OUTCOMES**Written test.Active participants in discussion. | Outcome ReferenceNumbersO1-O6O1-O3, O7-O9 |
| **TEACHING CONTENT****Lectures**: 1. Natural sources of water-soluble ingredients.
2. Geochemical background. Point and non-point sources of soil and water pollution.
3. Dynamics of organic and inorganic compounds in soils and groundwaters (physical properties, chemical properties, adsorption, evaporation, decomposition).
4. Transformation of organic compounds in soils and groundwaters.
5. Contemporary tendencies in the remediation and elimination of the threat to the soil and groundwater environment.
6. Strategies for soil and groundwater treatment. Limiting the spread of pollutants in the soil and water environment.
7. Methods of supporting self-purification of the soil and groundwater environment.
8. Modern methods of soil and groundwater remediation: physical remediation and in-situ and ex-situ bioremediation.
9. Application of simulation models for the assessment of the quality of the soil and groundwater environment.
10. Management of polluted soils and groundwaters.

**Practical classes:** 1. Phytoremediation
2. Vegetation strips
3. Pesticide loss by runoff
4. The spread of petroleum substances in the soil
5. Soil washing
6. Open-pit mining – task for soil remediation.
7. Types of soil recultivation of post mining soils (field trip)
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| **Forms and criteria for passing of course/module** Results of the written test.Active participation during the course. | Percentage of final mark85%15% |
| **LIST OF LITERATURE** 1. Essington M. E. Soil and water chemistry. An integrative approach. CRC Press
2. Kabata-Pendias, Pendias. Trace elements in soils and plants. CRC Press
3. Meuser H. Soil remediation and rehabilitation. Springer
4. Otten A.M. In situ remediation. Springer
5. Novotny V., Chester G. (1991).Handbook of nonpoint pollution. Sources and management. Wyd. van Nostrad Reinhold Company.
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