

**56S1-METCIWS**

**HEAVY METALS IN THE ENVIRONMENT**

**ECTS: 3.0**

**HOURS PER SEMESTER/WEEK:** LECTURES: 15/1; CLASSES: 30/2

**FIELD OF THE STUDY:** Environmental protection

**Level of study:** First-cycle (Engineer's degree) program

**Course status:** optional \*

**Year of the study:** IV

**COURSE CONTENTS**

**LECTURES:** The condition of the natural environment. Properties and sources of heavy metals in the environment. Trace elements in the atmospheric air - causes of pollution, effects, protection. Trace elements in surface and underground waters - pollution, effects, legal protection of surface waters, marine and polar environment. Heavy metals in soil - causes of contamination, content, balance, effects, protection and reclamation. The influence of heavy metals on the yield and quality of plants and on the health of humans and animals.

**CLASSES:** Qualitative determination of sorption of heavy metals by different types of soils. The effect of soil liming on the sorption of microelements. Determination of Cu content in soils (AAS method). Determination of Mn content in soils (colorimetric method). Determination of boron content in soils (azomethina H). The influence of heavy metals on plant germination (Cu, Zn, B, Co, Pb) - laboratory experiment. Determination of Cu, Zn, Pb, Cd content in plants.

**EDUCATIONAL PURPOSE:** The aim of teaching the subject is to master the knowledge of the properties of heavy metals and their impact on the natural environment.

**LEARNING OUTCOMES**

**Knowledge.** The student knows the impact of excess or deficiency of heavy metals on plants.

**Skills.** The student is able to identify microelements and their content in soils, water, and plants, and assesses the properties of plants, soil, and waters based on chemical analyses and laboratory experiments.

**Social competences.** Is aware of the impact of fertilizing substances and waste on the content of heavy metals in the soil environment - assesses and explains the causes and effects of pollution of individual elements of the environment.

**TEACHING FORMS AND METHODS**

**Lectures.** Information lecture with a multimedia presentation.

**Classes.** Laboratory exercises.

**FORM AND CONDITIONS FOR VERIFICATION OF LEARNING OUTCOMES**

**Lectures.** Written test of lecture content.

**Classes.** Laboratory exercise report. A multimedia presentation prepared by a student.

**BASIC LITERATURE**

1) Alloway B.J., Ayres D.C., Chemiczne podstawy zanieczyszczeń środowiska, Wyd. PWN, R. 1999. 2) Golimowski J., Rubel S., Siemieński M, Chemia w badaniu środowiska naturalnego, Wyd. WSiP, 1994. 3. Kabata-Pendias A., Pendias H. B, Biogeochemia pierwiastków śladowych, Wyd. PWN, 1999. 4) Namieśnik J., Jamrógiewicz Z., Fizykochemiczne metody kontroli zanieczyszczeń środowiska, Wyd. PWN, 1994. 5) Migaszewski Z., Gałuszka A., Geochemia środowiska, Wyd. PWN, 2016. 6) red. Wierzbička M., Ekotoksykologia. Rośliny - Gleby - Metale, Wyd. UW, 2015.

**ADDITIONAL LITERATURE**

**THE TEACHER/TEACHERS CONDUCTING THE CLASSES:**

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