Subject name	**Usefulness of Natural Resources of Chemically Degraded Areas in Biotechnology**	
Subject code	**E.2.UNR.SC.ETIE.I**	
Department	**Department of Botany and Plant Physiology; Department of Soil Science and Soil Conservation**	
Faculty	**Faculty of Biotechnology and Horticulture; Faculty of Agriculture and Economics**	
Subject supervisor/Lecturer	**Ewa Hanus-Fajerska Ph.D.; Krystyna Ciarkowska Ph.D**	
General information	**Teaching period**	**1 Semester / summer semester**
	ECTS credit	**6**
	Lectures total	**10**
	Lab classes	**20**
Objective and general description	The objective of the course is to familiarize students with remediation methods of chemically degraded grounds as a result of exploitation and processing of zinc and lead ores with the use of calamine flora. During the course two opposing processes: soil transformation into soil free grounds and soil reforming in places where wastes were stored will be discussed. In field classes, in sites with calamine flora, pits will be done in order to present vertical section of soils and soil free grounds. Additionally, samples of substrata for laboratory analyses and plant material will be taken.	
Lectures **5 x 2 hours**	1. Definition of soil, soil forming factors. 2. Chemical degradation of soils, formation of soil free grounds. 3. Classification of chemically degraded areas. 4. Plant adaptation to the environment contaminated with metallic elements. Characterization of metallophytes 5. Aspects of environmental biotechnology - detoxifying chemically degraded ground using convenient phytoremediation techniques.	
Field classes 10 h **Lab classes** **2 x 4 hours**	Areas degraded as a result of exploitation and processing of zinc and lead ores - characteristics and sampling of flora and substrata (10 h). Chemical properties of substrata, analysis of organic carbon with the use of automatic carbon analyzer TOC (4 h). Description of calamine flora with emphasis to morphology and anatomy of plant species useful in phytoremediation techniques. Micropropagation and other available *in vitro* and *in vivo* techniques advantageous in research, with the aim of protecting those valuable local genotypes, and to create nurseries (4 h).	

Literature	Cabala J., Krupa P., Misz-Kennan M. 2009. Heavy metals in mycorrhizal rizospheres contaminated by Zn-Pb mining and smelting around Olkusz in southern Poland. Water Air Soil Pollution 199: 139-149 Ciarkowska K., Hanus-Fajerska E**.** 2008. Remediation of soil-free grounds contaminated by zinc, lead and cadmium with the use of metallophytes. Polish Journal of Environmental Studies 17/5: 707-712 Neumann K.H., Kumar A., Imani J. 2009. Plant Cell and Tissue Culture – a Tool in Biotechnology. Springer–Verlag, Berlin, Heiderberg, pp 333 Suresh B., Ravishankar G.A. 2004. Phytoremediation – a novel and promising approach for environmental clean-up. Critical Reviews in Biotechnology 24 (2-3): 97-124