

Study Programme: Soil Science and Plant Nutrition
Course Unit Title: Bioremediation
Course Unit Code: 3MZI1I09
Name of Lecturer(s): Full professor Ivana Maksimović, Full professor Simonida S. Đurić, Assistant professor Marina Putnik-Delić, Assistant professor Timea Hajnal-Jafari
Type and Level of Studies: Master Academic Studies
Course Status (compulsory/elective): Elective
Semester (winter/summer): Winter
Language of instruction: English
Mode of course unit delivery (face-to-face/distance learning): Face to face
Number of ECTS Allocated: 5
Prerequisites: Passed exam Plant physiology and Microbiology at the BSc level
<p>Course Aims:</p> <p>Acquisition of knowledge on opportunities to reduce the concentration of pollutants, especially heavy metals and pesticides by plant growth and application of micro-organisms.</p>
<p>Learning Outcomes:</p> <p>A student who successfully completes the course "Bioremediation" is qualified to assess the potential for application of bioremediation procedures in order to reduce the concentration of contaminants in the soil and to propose methods of bioremediation in particular situation.</p>
<p>Syllabus:</p> <p><i>Theory</i></p> <p>Phytoremediation. Decontamination of metals. Hyperaccumulation of metal ions in plants. Transport and biotransformation of metal ions in plants. Characteristics of the soil and the plants that affect the transport of metal ions in plants. Plants indicators of soil pollution with heavy metals. Detoxification - phytovolatilisation, chelation, compartmentation. Advantages and disadvantages of phytoremediation. Idiotype of plant for phytoextraction.</p> <p>Microbial remediation of soil contaminated with pesticides, waste materials and heavy metals. Application of microorganisms and microbial products in the bioremediation of soil. Production and introduction of pure cultures of microorganisms-bioremediators in the soil. Determination of the efficiency of bioremediation.</p> <p><i>Practice</i></p> <p>Determination of concentration of elements (heavy metals) in the plant material. Comparison of different plant species with respect to their ability to accumulate and transfer heavy metals to the aboveground organs. Calculation of accumulation and transfer factors. Microbial degradation of pesticides in the soil. Microbiological removal of heavy metals from the soil. Determination of the efficacy of bioremediation of heavy metals from the soil by microorganisms in the laboratory.</p>
<p>Required Reading:</p> <p>Barker AV, Pilbeam DJ (eds), Handbook of Plant Nutrition. Taylor and Francis, 2007</p> <p>Taiz L, Zeiger E, Møller IM, Murphy A (2014) Plant Physiology and Development, Sixth Edition, Sinauer Associates.</p> <p>Alloway, B., J. Heavy metals in soil. Blackie, Glasgow, 1990;</p> <p>Hans Lambers, F. Stuart Chapin III, Thijs L. Pons, Plant Physiological Ecology, second edition. Springer 2008</p>

Surajit Das (ed): Microbial Biodgeradation and Bioremediation, 2014, Elsevier Inc. ISBN 978-0-12-800021-2

Weekly Contact Hours: 4

Lectures: 30

Practical work: 30

Teaching Methods:

Lectures, Practical classes, Consultations, study, research work

Knowledge Assessment (maximum of 100 points):

Pre-exam obligations	points	Final exam	points
Active class participation	5	written exam	
Practical work		oral exam	60
Preliminary exam(s)	30	
Seminar(s)	5		

The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.