

1. Field of study	Biotechnology
2. Faculty	Faculty of Natural Sciences
3. Academic year of entry	2021/2022 (winter term)
4. Level of qualifications/degree	second-cycle studies
5. Degree profile	general academic
6. Mode of study	full-time

Module: Phytoremediation

Module code: 2BT_32A

1. Number of the ECTS credits: 2

2. Learning outcomes of the module			
code	description	learning outcomes of the programme	level of competence (scale 1-5)
2BT_32_1	Describes and defines physicochemical methods used to remediate soil contaminated with heavy metals and radionuclides	2BT_W01_P	1
2BT_32_2	Presents phytoremediation as a method of environmental biotechnology	2BT_W04_P 2BT_W05_P	4 1
2BT_32_3	Describes processes which occur in soil during phytoremediation process.	2BT_U03_P 2BT_W03_P	5 5
2BT_32_4	Explains the mechanisms of uptake, accumulation and resistance of plants to heavy metals	2BT_K01_P 2BT_W03_P	2 5
2BT_32_5	Presents processes of stimulation of plant growth by rhizosphere bacteria.	2BT_U02_P 2BT_W03_P	5 1
2BT_32_6	Conducts independently experiments, describes results of experiments, analyses results, draws conclusions and prepares report	2BT_K02_P 2BT_U01_P 2BT_W02_P	5 5 5
2BT_32_7	Has habit of updating of knowledge.	2BT_K01_P	3
2BT_32_8	Describes the role of arbuscular mycorrhiza and ectomycorrhiza as a tool in assistance of phytoremediation.	2BT_W02_P	2

3. Module description

Description	
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	Module Phytoremediation will give students opportunity to learn about physicochemical methods of remediation of heavy metal contaminated soils and phytoremediation as a method of environmental biotechnology. During the course student will learn about: phytoremediation technics (phytoextraction, phytostabilisation, rhizofiltration, phytodegradation, phytovolatilization), processes which occur in the soil during phytoremediation, plant mechanisms of uptake and resistance to heavy metals, and role of rhizosphere bacteria, ectomycorrhiza and arbuscular mycorrhiza in phytoremediation. During laboratories student will gain skills of conducting of hydroponic cultures, measuring of oxidative stress level and investigating of physiological status of plants with modern scientific equipment (e.g. fluorimeter, pigment content sensor, infrared gas analyser)
Prerequisites	Knowledge of Botany and Plant Physiology at Secondary School level.

4. Assessment of the learning outcomes of the module			
code	type	description	learning outcomes of the module
2BT_32_w_1	Coursework	according to the Syllabus	2BT_32_1, 2BT_32_2, 2BT_32_3, 2BT_32_4, 2BT_32_5, 2BT_32_6, 2BT_32_7, 2BT_32_8

5. Forms of teaching						
code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
2BT_32_fs_1	lecture	Lectures with multimedia display	15	To study lectures and suggested by lecturer textbooks.	10	2BT_32_w_1
2BT_32_fs_2	laboratory classes	Independent work in the laboratory, conducting experiments according to the to the instruction, analyses of obtained results.	15	Preparation for laboratories based on literature. Writing a report on performed experiments.	10	2BT_32_w_1