

Module name	Environmental biotechnology and sustainability
Module code	
ISCED code	0511: Biology
Study cycle	I ^o
Semester	summer
Responsible for this module	dr Ewa Ozimek, Department of Industrial and Environmental Microbiology e-mail: ewa.ozimek@mail.umcs.pl
Language of instruction	English
Website	
Prerequisites	Microbiology course
ECTS	6
ECTS points hour equivalents	Contact hours (work with an academic teacher) – 60h - lectures: 30h - labs: 30h Non-contact hours (students' own work) –90h - preparation for the exam: 30 - preparation for labs: 25 - literature study: 20 -preparations of reports from laboratory exercise: 15 Total number of ECTS points for the module – 6
Learning outcomes verification methods	Laboratory: continuous assessment of laboratories, final test written at the end of laboratories Lecture: attendance at lectures, written exam
Course full description	The module covers the knowledge of challenges and opportunities in the area of environmental biotechnology, possibilities of using biological processes (with the participation of Bacteria, Archaea, Fungi, Algae and Protozoa) to reduce or to prevent the environmental pollution. Lecture includes the following issues: <ol style="list-style-type: none"> 1. Biomonitoring, biosensors for the determination of environmental pollution; 2. Microbiological preparations (e.g. biofertilizers and biopesticides) as an example of reducing the use of chemicals; 3. Microbial production of biodegradable polymers - techniques that use renewable and waste resources that can successfully lessen waste accumulation; 4. Compost production (basic parameters, properties) and use in agriculture (bioremediation); 5. Biological treatment of wastewater (activated sludge and biological deposits); 6. Bioremediation of soils contaminated with organic compounds and metals;

	<ol style="list-style-type: none"> 7. Biogas production (commercial, agricultural biogas plants); 8. Microorganisms and other organisms for biofuel production: metabolic engineering, applications, and challenges; <p>Laboratory classes include the following issues:</p> <ol style="list-style-type: none"> 1. Laboratory operations and safety rules; 2. Microorganisms existing in various forms in different environments: soil, water, air, rhizosphere, rhizoplane, plant tissues; 3. Methods of studying the diversity and abundance of microorganisms; 4. Detection of biofilm-forming strains; 5. Diversity indicators determined by the CLPP technique (physiological "fingerprint" tests determining the ability of substrate consumption by environmental microorganisms (Biolog EcoPlate) and isolates (Biologist FF); 6. Screening methods for determining: the degradation of carbon and nitrogen sources (cellulose, chitin, starch, fats, urea, protein), ammonification, oxidation and reduction of nitrogen compounds; 7. Cultivable and viable but nonculturable (VBCN) environmental microorganisms: representativeness of culturable bacteria - % of culturable bacteria in different groups/types; 8. The composition of air microorganisms; microorganisms of enclosed spaces; air sampling procedures for bioaerosol monitoring: sedimentation and impaction methods.
Bibliography	<ol style="list-style-type: none"> 1. Patra J.K., Vishnuprasad C.N., Das G., (Eds.). Microbial Biotechnology Vol 1, Applications in Agriculture and Environment 2017 2. Kundu R., Narula R., Paul R., Mukherjee S., (Eds.). Environmental Biotechnology For Soil and Wastewater Implications on Ecosystems 2019 3. Długoński J., (Ed.). Microbial biotechnology in the laboratory and practice 2021
Learning outcomes	<p>KNOWLEDGE</p> <p>W1. student is able to describe the processes (technologies) used in environmental biotechnology (e.g. bioremediation, biogas and compost production) the techniques practiced in the use of renewable and waste resources (K_W01)</p> <p>W2. know complex mechanisms applied in biomonitoring (biosensors) for the determination of environmental pollution (K_W07)</p> <p>W3. understanding technologies for beneficial microorganisms inocula used as biofertilizers or other</p>

	<p>preparations as limiting the use chemical plant protection products according to the rules of sustainable development (K_W11)</p> <p>SKILLS</p> <p>U1. operate basic laboratory equipment, simple experiments (measurements, observations with application of methods) and preparing correct conclusions (K_U03, K_U06, K_U07)</p> <p>U2. use basic biotechnology, microbiology and ecology terms in scientific statements, discussions (K_U13)</p> <p>SOCIAL COMPETENCES</p> <p>K1. presenting a pro-environmental perspective based on the developed knowledge about mechanisms supporting sustainable development (K_K01, K_K06, K_K07)</p> <p>K2. understanding the needs of systematic updating the knowledge and considering alternative solutions for its practical applications (K_K04)</p>
Practice	-
Teaching methods	<p>Lecture: multimedia presentation, lecture</p> <p>Laboratory: experiments and assays, observation, multimedia presentation, discussion</p>