Nazwa jednostki prowadzącej kierunek: **Faculty of Chemistry - Opole University**		
Undergraduate studies	Field of study: **Chemistry/Biology/Biotechnology**	Special interest: **Ecological chemistry, environmental chemistry and biotechnology**
Course code:	Course title: **Ecological and Environmental Biotechnology**	
Year of study: 3rd bachelor; Sem. 6 or 1st MSc; Sem. 2	Liczby godzin i formy zajęć: **W, K, L, S** The number of hours and the form of classes **15 Lect., 15 S, 30 Lab. (15 W, 15 K, 30 L)**	**Number of credit allocated : 4 ECTS**
Jednostka organizacyjna prowadząca przedmiot: **Department of Analytical and Ecological Chemistry**		

Name lecturer:
Lecture: Jacek Lipok
Seminar: Jacek Lipok
Laboratory (Practice): ***Dorota Wieczorek, Hanna Studnik, Jacek Lipok***

Prerequisites:
basic undergraduate courses in: biochemistry, organic chemistry, biology

Assessment procedures and performance criteria:
For passing grade student must carry out a project (in written form), where he/she in a rational way, and based on the knowledge from the theoretical part of the course, should propose the solution of a given environmental problem. Moreover this project must be orally present for the other students. Student must also discuss and critically evaluate the projects presented by other participants of this course. All experiments have to be done in order to finish the laboratory.

Objective of the course:
This course gives an understanding of how human activity affects the functioning of various ecosystems as well as it gives an overview of how biotechnological processes can be applied in conservation of natural resources including biodiversity, in the context of sustainability. The aim of this course is also to allow the students an understanding of some aspects of bioremediation of environmental pollutants on cell and molecular level and give them basic practical skills in operating of such processes.

Course contents:
Lecture & seminary:
Ecology - basic concepts and principles: The Earth – geological variability; concepts of ecosystem; functioning of ecosystems: on the border of worlds – biotic and abiotic components of cybernetic system, energy transfer, trophic and behavioral interactions (chains and web), production and decomposition in a system, limiting factors, homeostasis; development and evolution of ecosystems.
Ecosystems (freshwater, marine, estuarine and terrestrial) as habitats of biota. Natural and anthropogenic ecosystems.
Basics of Ecotoxicology: toxicants in environment: natural toxins vs xenobiotics; factors affecting toxicity and environmental distribution of toxicants; absorption and bioaccumulation of xenobiotics; environmental fate of toxicants; detoxification processes: natural and implemented by human.
Biotechnology – the union of science and practise. Basics of biochemistry, enzymology and microbiology in respect to biotechnological purposes. Microorganisms (bacteria, cyanobacteria, fungi) - naturally talented bioengineers and genetically improved bioremediators. Role of microorganisms in natural and artificial systems; microbes in the web of environmental interactions. Microbial activity in bioremediation and biodegradation of environmental wastes and xenobiotics. Biological treatment of wastewater: aerobic and anaerobic system. Biogas production from wastewater, solid waste and energy crops. Plants possessing phytoremediation capabilities – physiological adaptations and improvements. Genetically modified plants (GMP) for special biotechnological purposes. Phytoremediation of heavy and noble

metals from the soil. Phytoremediation of organic pollutants - mechanism(s) of detoxification of organic pollutants by plants organism. Advantages and limitations in biotechnological management of environmental resources.

Laboratory:

1. Basic Microbiology and Cell Culturing: aseptic techniques - sterilization, media preparation, isolation of pure culture, growth curve
2. Biodiversity of microorganisms - Microorganisms form natural and polluted environments: soil, water, air
3. Biotransformation - analysis of product
4. Biodegradation - microbial degradation of textile dyes/pesticides/hydrocarbons or oils
5. Bioremediation – phytoremediation and biosparging

Effects of education (expected learning outcomes and competences to be acquired):

The students should understand the importance of the presence of natural toxicant(s) or xenobiotic(s) in appropriate ecosystem and rationally predict the consequences of such disturbance(s). The students should also be ready to suggest possible solution/remediation method leading to limitation of such environmental problem basing on the theoretical and practical knowledge regarding biotechnology.

Recommended literature: information will be given during the course in dependence on the availability of data bases

Contact: Jacek.Lipok@uni.opole.pl