

*Course name* Bioremediation *Code* VII.12 *Credit points* 3

*Language of instruction* **English**

*Programme* Intelligent Energy (IE), Biotechnology for Environmental Protection (BI)

*Type of studies* MSc studies

*Unit running the programme* Faculty of Environmental Protection and Engineering  
Institute of Environmental Engineering

*Course coordinator and academic teachers* Krystyna Malińska, PhD.  
Magdalena Zabochnicka-Świątek, PhD.

*Form of classes and number of hours*

Semester	Lec.	Tut.	Lab.	Proj.	Sem.	Credit points
VII	15	15				3

*Learning outcomes* Understanding of the relations between the transport and fate of the contaminants in the environment and biological processes for conversion of contaminants to minimize the contamination of the environment.

*Prerequisites* Earth science, plant science, microbiology, chemistry, waste management,

*Course description* **LECTURES:**  
Contamination of the environment. Persistent Organic Pollutants. Petroleum hydrocarbons. Heavy metals. Pesticides. Natural attenuation. Monitored natural attenuation. Enhanced natural attenuation. Microbial metabolism, growth and kinetics. Biological conversion processes. Biodegradation. Bioaccumulation. Soil microorganisms. Bioremediation technologies for soil, water and air decontamination. Pump and treat.  
**TUTORIALS:**  
Volume, mass and concentration relationships. Practical design calculations for bioremediation of soil and water with petroleum hydrocarbons, heavy metals and pesticides. Biodegradation. Phytoremediation. Biosorption. Global applications of bioremediation technologies (case studies).

*Form of assessment* Exam

*Basic reference materials*

1. Alvarez P.J.J., Ullman W.A. 2006. *Bioremediation and natural attenuation. Process Fundamentals and mathematical models*. Wiley-Interscience
2. Kuo J., 1999. *Practical design calculations for groundwater and soil remediation*. Lewis Publishers
3. King B.R., Long G.M., Sheldon J.K. 1997. *Practical environmental bioremediation*. Lewis Publishers
4. Schnoor J. 1997. *Phytoremediation*. Technology Evaluation Report, GWARTAC
5. Baker A.V., Bryson G.M. *Bioremediation of heavy metals and organic toxicants by composting*. The Scientific World Journal (2002) 2, 407-420

*Other reference materials*

For Polish-speaking students:

1. Surygała J. 2000. *Zanieczyszczenia naftowe w gruncie*. Oficyna Wydawnicza Politechniki Wrocławskiej
2. Klimuk E., Łebkowska M. 2003. *Biotechnologia w ochronie środowiska*. Wydawnictwo Naukowe PWN
3. Zieliński S. 2000. *Skażenia chemiczne w środowisku*, Oficyna Wydawnicza Politechniki Wrocławskiej
4. Malina G. *Biodegradacja węglowodorów ropopochodnych w gruncie strefy aeracji przez mikroorganizmy autochtoniczne. Cz. I. Podstawy teoretyczne biodegradacji aerobowej*. Gospodarka surowcami mineralnymi, Tom 12 (1996), Zeszyt 3
5. Malina G. *Biodegradacja węglowodorów ropopochodnych w gruncie strefy aeracji przez mikroorganizmy autochtoniczne. Cz. II. Badania laboratoryjne biodegradacji toluenu i dekanu*. Gospodarka surowcami mineralnymi, Tom 12 (1996), Zeszyt 3

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Average student workload (teaching hours + individ.)	
Remarks:	
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