

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Basics of biotechnology		Code
Field of study Technology of environmental protection	Profile of study (general academic, practical)	Year /Semester 3/6
Elective path/specialty -	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) full-time	
No. of hours Lecture: 30 Classes: 15 Laboratory: 60 Project/seminars: -		No. of credits 6
Status of the course in the study program (Basic, major, other)		(university-wide, from another field) University-wide
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 6 100% 6 100%
Responsible for subject / lecturer: prof. dr hab. Włodzimierz Grajek email: grajek@up.poznan.pl tel. +\$* 606391525 Faculty of Chemical technology ul. Piotrowo 3 60-965 Poznań		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	A student has basic theoretical systematic knowledge of environmental protection related to chemical wastes and chemical by-products, has basic knowledge of biology and microbiology
2	Skills	A student can find the necessary information on the Internet, databases and the library, he is able to analyze scientific text, speak English to the extent required to use the literature
3	Social competencies	A student understands the need to expand their competences, he is aware of eco-friendly
Assumptions and objectives of the course: Provide students with basic knowledge of environmental biotechnology. Extending knowledge of biological and microbiological aspects of environmental protection.		
Study outcomes and reference to the educational results for a field of study		
Knowledge: A student has knowledge of complex chemical bio-processing involving selection of raw materials, microorganisms, methods, techniques, and equipment for utilization of waste materials. - [K_W03] A student know the rules of environment protection using biological processes K_W05 A student has a structured, theoretically founded general knowledge of enzymology and industrial microbiology K_W07		
Skills: A student has the ability to obtain and critically evaluate information from literature, databases and other sources and to formulate on the basis of opinions and reports. - [K_U01] A student has the ability to team work and team leadership. - [K_U02] A student has the ability to prepare and to present speech on the environment protection using biological methods K_U05 A student has the ability to self-studying K_U06 A student use professional terminology on environmental biotechnology K_U08		
Social competencies:		

A student is aware of the need for lifelong learning and professional development. - [K_K01]
 A student is aware of the limitations of science and technology related to chemical technology, including environmental protection. - [K_K02]

Assessment methods of study outcomes

1. Knowledge: lectures, self-studying - Written exam. Exercises – multimedia presentation. Laboratory – tests
2. Skills: Lectures, self-studying – written exam, Exercises – public presentation , laboratory -presence, realization, tests
3. Social competencies: - written exam, tests, work in a student's group

Course description

The course covers the topics of Environmental biotechnology : definitions, the main areas of applications . Microorganisms and plants as a tool in cleaning up the environment . Methods of cultivation of microorganisms : batch, fed-batch, and continuous cultures, immobilized organisms . Enzymes in the environment : the basis of enzymatic catalysis , structure of enzymes, catalytic activity , catalysis conditions , the characteristics of the different classes of enzymes , enzymes and micro-organisms, the use of enzymes in cleaning up the environment . Biotechnological processes and their biological and molecular basis : activated sludge , trickling filters , anaerobic digestion . Composting of organic wastes : fermentation in a fixed bed , the base of microbiological and biochemical aspects of technological apparatus . Water and soil remediation . Effluent-free methods of industrial production - examples. The use of organic waste for the production of bioenergy. Removal of oil pollution . The use of biotechnological methods in environmental monitoring. The landfill and biogas production .

Basic bibliography:

Klimiuk E., Łebkowska M.. Biotechnologia w ochronie środowiska. Wydawnictwa Naukowe PWN, Warszawa, 2003
 Libudzisz Z., Kowal K., Żakowska Z. Mikrobiologia techniczna. Tom 1. Mikroorganizmy i środowiska ich występowania. Wydawnictwo Naukowe PWN, Warszawa 2007.
 Libudzisz Z., Kowal K., Żakowska Z. Mikrobiologia techniczna. Tom 2. Mikroorganizmy w biotechnologii, ochronie środowiska i produkcji żywności. Wydawnictwo Naukowe PWN, Warszawa 2008.
 Błaszczyk M.K. Mikrobiologia środowiskowa. Wydawnictwo Naukowe PWN, Warszawa 2010

Additional bibliography:

Abigail A. Salyers, Dixie D. Whitt, „Mikrobiologia” Wydawnictwo Naukowe PWN
 Jadwiga Baj , Z. Markiewicz, „Biologia molekularna bakterii”, Wydawnictwo Naukowe PWN
 Postgate J. Człowiek i drobnoustroje. Wydawnictwo Naukowe PWN, Warszawa, 1994
 Nicklin J., Graeme-Cook K., Paget T., Killington R. Mikrobiologia. Wydawnictwo Naukowe PWN, Warszawa 2000
 Bednarski W., Fiedurek J. Podstawy biotechnologii przemysłowej. WNT, Warszawa 2007
 Kunicki-Goldfinger W. Życie bakterii, Wydawnictwo Naukowe PWN
 Schlegel H.G. Mikrobiologia ogólna, Wydawnictwo Naukowe PWN

Result of average student's workload

Activity	Time (working hours)
Participation in lectures	30h
Participation I exercises	15h
Participation in laboratories	30h
Preparation for the laboratory exercises	20h
Self-studying, preparation to tests and exam	55h

Student's workload

Source of workload	hours	ECTS
Total workload	150	6
Contact hours	75	3
Practical activities	45	1,8