Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

Faculty of Chemical Technology and Engineering

Field of study	Chemical Engineering		
Mode of study	stationary	*Level*	first cycle
Graduate's qualification	inżynier		
Area(s) of study	nauki techniczne		
Educational profile	general academic		
Module			
Course unit	**Environmental Engineering**		
Code	ChEn_1A_S_C25		
Field of specialisation			
Administering faculty	Institute of Inorganic Chemical Technology and Environmental Engineering		
ECTS	4,0	*ECTS (forms)*	4,0
Form of course credit	credits	*Language*	english
Electives		*Elective group*	

Form of instruction	*Code*	*Semester*	*Hours*	*ECTS*	*Weight*	*Credit*
lecture	W	7	30	1,5	0,40	credits
lecturing course	A	7	15	1,0	0,30	credits
laboratory course	L	7	30	1,5	0,30	credits

Leading teacher	Markowska-Szczupak Agata (Agata.Markowska@zut.edu.pl)
Other teachers	Dzięcioł Małgorzata (Malgorzata.Dzieciol@zut.edu.pl), Friedrich Małgorzata (Malgorzata.Bojarska@zut.edu.pl), Markowska-Szczupak Agata (Agata.Markowska@zut.edu.pl), Wodnicka Alicja (Alicja.Wodnicka@zut.edu.pl)

Prerequisites	
W-1	Background in chemical engineering at university level is required.
W-2	Principles of microbiology applied to the design and operation of engineered environmental systems: treatment of wastewater, bioremediation, energy conversion.
W-3	Actively engaging in classroom discussions, classroom activities, and laboratory investigations.

Module/course unit objectives	
C-1	Student will be able to: characterize popular environmental pollutants and indicate sources of its emission; explain principles of operation of devices and technologies used in environment protection; collect, organize and present data from literature; Student will be aware of the harmful influence of pollution on the environment.
C-2	Students will obtain knowledges on basic principles on technologies of decontamination of persistent organic pollutants (dangerous contaminants of the environment) mainly by means of the biological approaches using degradation ability of microorganisms, fungi, and plants, i.e. using bioremediation, mycoremediation, and phytoremediation technologies, as well as physico-chemical technologies, nanotechnologies, and other innovative technologies. Knowledges on basic principles of bioremediation technologies as the alternative of physico-chemical methods are being emphasized.
C-3	Knowledge and skills associated with the technology used in contaminants removal from air, water and wastewater.

Course content divided into various forms of instruction		*Number of hours*
T-W-1	Air pollutants. Sources of emission. Global problems of air protection. Monitoring of air pollutants. Strategies to reduce the environmental impact.Methods of gas emission control (absorption, adsorption, thermal and catalytic combustion, condensation).	4
T-W-2	Methods of particulate matter removal. Types of dust collectors (settling chambers, inertial dust collectors, wet scrubbers, fabric filters, electrostatic precipitators).	3
T-W-3	Sources of water contaminants. Characteristic, classification and composition of effluents. Technologies for removal of contaminants from water (conventional treatment systems: primary and secondary treatment, advanced treatment processes)	3
T-W-4	Replacement of chemicals & chemical processes conversion of plant biomass to fermentable sugars, conversion of sugars to biotechnological products eg ethanol, biopolymers etc. Biomining and acid mine drainage.	2
T-W-5	Principles, methods, advantages, and limitations of bioremediation processes. Bioremediation of heavy and toxic metals. Nanotechnologies used for removal of contaminants.	4
T-W-6	Requirements to the microorganisms used in decontamination processes. Isolation and adaptation of microorganisms with degradation ability. Biological wastewater processing. Biological processes for nitrogen and phosphorus removal.	4
T-W-7	Odour nuisance of emission sources. Odour abatement of industrial gases. Methods of odour emission and odour concentratin measurement.	4
T-W-8	Pollution dispersion modeling in the atmosphere. Odour air quality forecasting. Standards of odour air quality. Odour sampling methods. Determination of odour in ambient air.	4
T-W-9	Odour sampling methods. Determination of odour in ambient air.	2

Course content divided into various forms of instruction		*Number of hours*
T-A-1	Methods of emission control.	5
T-A-2	Methods of clean-up of municipal and industrial effluents.	5
T-A-3	Determination of odour emission rate. Determination of odour abatement efficiency. Determination od precision and accuracy using reference material. Relationship between odour concentration and odour intensity. Odour dispersion modeling in the atmosphere. Assessing the impact of odour nuisance of installations on the environment.	5
T-L-1	Elimination of iron from water.	4
T-L-2	The use of activated carbon for the removal of oxidizable compounds from water.	4
T-L-3	Elimination of phosphorus from water by precipitation method.	4
T-L-4	Determination of nitrogen dioxide in air by spectrophotometric method.	4
T-L-5	Determination of odour concentration by dynamic olfactometry: yes/no method and forced choice method. Determination of individual odour threshold.	4
T-L-6	Odour panel selection and panel screening.Determination of odour intensity and hedonic tone. Olfactometry field.	4
T-L-7	Biodegradability evaluation of polymers	3
T-L-8	Microbial contamination detection in water.	3

Student workload - forms of activity		*Number of hours*
A-W-1	participation in classes	30
A-W-2	consultations	3
A-W-3	individual learning and preparing to written test	12
A-A-1	participation in seminar classes	15
A-A-2	studying literature	5
A-A-3	preparing of presentation	10
A-L-1	participation in laboratory classes	30
A-L-2	consultations	3
A-L-3	preparing of written reports	12

Teaching methods / tools	
M-1	lectures with presentations
M-2	discussion during lectures and seminar
M-3	laboratory classes
M-4	seminar
M-5	private study, working through the course as presented in lectures, tutorials and learning materials

Evaluation methods (F - progressive, P - final)		
S-1	F	evaluation of attendence at laboratory classes and working in the laboratory
S-2	F	evaluation of knowledge and engagement in discussion during seminar
S-3	P	written test - grade from lectures
S-4	P	evaluation of written reports from laboratory
S-5	P	evaluation of presentations during seminar

Designed learning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to the learning outcomes defined for the particular areas of education	Reference to learning outcomes leading to the degree of "inżynier"	Course objectives	Course content	Teaching methods	Evaluation methods
Knowledge							
ChEn_1A_C25_W01 Student has knowledge about environmental pollutants, processes, devices and technologies used in environmental protection.	ChEn_1A_W05 ChEn_1A_W20	P6S_WG_TA11		C-1 C-2	T-A-1 T-L-8 T-A-2 T-W-1 T-A-3 T-W-2 T-L-1 T-W-3 T-L-2 T-W-4 T-L-3 T-W-5 T-L-4 T-W-6 T-L-5 T-W-7 T-L-6 T-W-8 T-L-7 T-W-9	M-1 M-3 M-5	S-3 S-4 S-5
Skills							
ChEn_1A_C25_U01 Student is able to collect and interpret data from laboratory experiments and literature, prepare written experimental reports and present results of literature study using audiovisual ways.	ChEn_1A_U01 ChEn_1A_U03 ChEn_1A_U05 ChEn_1A_U08 ChEn_1A_U16	P6S_UO P6S_UU P6S_UW_TA11 P6S_UW_TA14	P6S_UW_IA11 P6S_UW_IA14	C-1 C-2 C-3	T-A-1 T-L-4 T-A-2 T-L-5 T-A-3 T-L-6 T-L-1 T-L-7 T-L-2 T-L-8 T-L-3	M-2 M-3 M-4 M-5	S-2 S-4 S-5
Other social / personal competences							

ChEn_1A_C25_K01 Student is able to perform all tasks on time, cooperate and work in group.	ChEn_1A_K01 ChEn_1A_K03 ChEn_1A_K04 ChEn_1A_K05	P6S_KK P6S_KO P6S_KR		C-1 C-2 C-3	T-A-1 T-L-8 T-A-2 T-W-1 T-A-3 T-W-2 T-L-1 T-W-3 T-L-2 T-W-4 T-L-3 T-W-5 T-L-4 T-W-6 T-L-5 T-W-7 T-L-6 T-W-8 T-L-7 T-W-9	M-1 M-2 M-3 M-4 M-5	S-1 S-2 S-3 S-4 S-5

Required reading

1. Evans G. M., Furlong J.Cans G. M., Furlong J.C, Environmental Biotechnology.Theory and Application, Wiley,, 2003, 2nd
2. Scrag A., Environmental Biotechnology, Oxford: Oxford University Press, Oxford, 2005, 2nd, 447 p. ISBN 0-19-926867-3
3. Basak N.N., Environmental Engineering, Tata McGraw-Hill Education, 2003, pp.295
4. Manahan S.E., Environmental Science and Technology, CRC Taylor & Francis, Boca Raton, London, New York, 2007

Supplementary reading

1. Environmental Engineering Journals Published by Elsevier, 2011
2. Smith J. M., Introduction to Chemical Engineering Thermodynamics, MCGRAW-HILL Higher Education, 2005, 2nd, pp. 817
3. Gaur R.C., Basic Environmental Engineering, New Age International (P) Limited, Publishers, 2007, pp.220
4. Crittenden J.C.R., Trussell R.,Hand D.W. et al., Water Treatment: Principles and Design, Wiley, 2012
5. Singh A., Ward O.P., Applied Bioremediation and Phytoremediation, Springer, 2004, http://www.springer.com/gp/book/9783540210207