

FACULTY OF CHEMISTRY					
SUBJECT CARD					
Name of subject in Polish:	Ochrona środowiska w technologii chemicznej				
Name of subject in English:	Environmental protection in chemical technology				
Main field of study:	Chemical Technology				
Specialization:	Technology of Fine Chemicals				
Profile:	academic				
Level and form of studies:	2nd level, full-time				
Kind of subject:	obligatory				
Subject code:	TCC024006				
Group of courses:	NO				
	Lecture	Practice	Laboratory	Project	Seminar
Number of hours of organized classes at University (ZZU)	15		30		
Number of hours of total student workload (CNPS)	60		60		
Form of credit	Crediting with grade		Crediting with grade		
Group of courses mark (X) final course	X		X		
Number of ECTS points	2		2		
including number of ECTS points for practical(P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	0,5		1		
PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES					
1. Course of general chemistry 2. Completed courses for basic inorganic and organic technologies 3. Completed basic course on chemical engineering 4. Ability for teamwork					
SUBJECT OBJECTIVES					
C1 Presentation of backgrounds for environmental management and protection C2 Presentation of problems related to pollution of atmosphere, water and soil, and methods for their prevention/mitigation C3 Presentation of international legislation, environment policy in EU and Poland, European directives in environment protection C4 Principles of environment protection, rules of sustainable development, administration of natural resources					

SUBJECT LEARNING OUTCOMES		
relating to knowledge:		
PEK_W01 student knows the concepts of environment protection		
PEK_W02 student recognizes the sources of atmosphere, water and soil contaminations		
PEK_W03 student is familiar with new techniques for environment protection		
PEK_W04 student knows problems related to sustainable development of chemical industry		
relating to skills:		
PEK_U01 student knows the rules of risk management in chemicals trading		
PEK_U02 student is familiar with separation processes and material selection		
PEK_U03 student recognizes integrated and hybrid processes and can design them		
PEK_U04 student can point the best method for separation of substances from streams		
relating to social competences:		
PEK_K01 student can work in team and solve the problems collectively		
PROGRAMME CONTENT		
Lectures		Number of hours
Wy1	Introduction Definitions and terms used in environment protection engineering. Natural resources and rational their exploitation, Renewable resources, EU policy in environment protection.	2
Wy2	REACH directive: European policy in relation to REACH document (directive 1907/2006) dealing with registration of chemicals, their evaluation, authorization and restriction, Procedures for component registration, Procedures of documents specification, Procedures of authorization and Restriction	2
Wy3	Atmosphere conservation. Air pollutants, Characterization of sources of air pollution, Warming effect, Methods of air protection ,	2
Wy4	Water conservation. Shortage of water, Water pollutants, Industrial waste water and municipal sewage, Quality of water, Surface and brackish water, Methods of water protection, Integrated systems	2
Wy5	Soil conservation . Soil pollutants, Quality of soil, Hazard for soil degradation, Methods of re-cultivation.	2
Wy6	Waste management. Definition, Waste classification, Methods for disposal and utilization of wastes, Industrial and municipal wastes, Dangerous wastes,	2
Wy7	Chemical industry and its impact to environment. Zero-discharge technologies, Clean and cleaning technologies, Concept of zero discharge technologies, Trends in development in new technologies.	2
Wy8	Summary and colloquium	1
	Total hours	15
Laboratory		Number of hours
La1	Introduction to laboratory: rules	2
La2	Diffusion dialysis in recovery of acids from hydrometallurgy wastes	4
La3	Membrane methods in removal of organic pollutants from water	4
La4	Adsorption for removal of organic pollutants from water	4
La5	Ion exchange processes in water treatment	4
La6	Endocrine disruptors removal by active carbons	4
La7	Micellar enhanced ultrafiltration in water treatment processes	4
La8	Hybrid systems in removal of oxyanions from aqueous systems	4
	Total hours	30

TEACHING TOOLS USED		
N1. Multimedia presentation N2. Manual for practice N3. Reporting		
EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation (F – forming (during semester), P – concluding (at semester end))	Learning outcomes number	Way of evaluating learning outcomes achievement
P (lecture)	PEK_W01-PEK_W04	Colloquium
F1	PEK_K01 PEK_W03 PEK_U01	Report + quiz
F2	PEK_K01 PEK_W03 PEK_U01	Report+ quiz
F3	PEK_K01 PEK_W03 PEK_U02	Report+ quiz
F4	PEK_K01 PEK_W03 PEK_U02	Report+ quiz
F5	PEK_K01 PEK_W03 PEK_U02	Report+ quiz
F6	PEK_K01 PEK_W03 PEK_U03	Report+ quiz
F7	PEK_K01 PEK_W03 PEK_U03	Report+ quiz
P (laboratory)= (F1+F2+F3+F4+F5+F6+F7)/7		
PRIMARY AND SECONDARY LITERATURE		
<u>PRIMARY LITERATURE:</u>		
[1] Angelo Basile, Advances in Membrane Technologies for Water Treatment, (Elsevier, Amsterdam, 2015)		
[2] Donald K Anton and Dinah L Shelton, Environmental Protection and Human Rights (Cambridge University Press, New York, 2011) 986		
[3] Monzer Fanun, The Role of Colloidal Systems in Environmental Protection, (Elsevier, Amsterdam, 2014)		
[4] Mariachiara Alberton and Francesco Palermo, Environmental Protection in Multi-Layered Systems, (Nijhoff Pub., 2012)		
<u>SECONDARY LITERATURE:</u>		
[1] Nidal Hilal, Mohamed Khayet, Chris Wright, Membrane modification, CRC Press, Boca Raton, 2012		
[2] Angelo Basile, Fausto Gallucci, Membranes for Membrane Reactors, Willey, 2011		
[3] Marek Bryjak, Nalan Kabay, Bernabe Rivas, Jochen Bundschuh, Innovative Materials and Processes for Water Treatment, CRC Press, Amsterdam, 2015		
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)		
Prof. Dr. Marek Bryjak (marek.bryjak@pwr.edu.pl) (Lecture)		
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