

FACULTY OF CHEMISTRY					
SUBJECT CARD					
Name of subject in English:	Sustainable energy and fuels				
Main field of study (if applicable):	Chemical technology				
Specialization (if applicable):	Technology of Fine Chemicals				
Profile:	academic				
Level and form of studies:	2nd level, full-time				
Kind of subject:	obligatory				
Subject code:	TCC024028				
Group of courses:	NO				
	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			30	
Number of hours of total student workload (CNPS)	30			60	
Form of crediting	crediting with grade			crediting with grade	
For group of courses mark (X) final course					
Number of ECTS points	1			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. General knowledge on chemical technology.					
SUBJECT OBJECTIVES					
C1 To provide students with a general knowledge of sustainable development concepts.					
C2 To provide student with a knowledge on sustainable chemical technologies and sustainability related to energy and fuel production technologies.					
SUBJECT LEARNING OUTCOMES					
related to knowledge:					
PEK_W01 student knows the principles of sustainable development and understands the need for their use.					
PEK_W02 student knows modern, sustainable technologies of fuel and energy production.					
PEK_W03 student knows and understands the principles of the selection of catalysts and parameters for the processes of sustainable fuel and energy production, as well as the principles of control and reduction of pollutant emissions.					
related to skills:					
PEK_U01 student can apply the principles of sustainable development in the design of fuel and energy production technologies.					
PEK_U02 student is able to analyze and critically evaluate selected technologies of receiving specialty chemicals, energy and fuels in terms of their compliance with goals of sustainable development.					
related to social competences:					
PEK_K01 student understands the need to inform the public about the need to achieve the goals of sustainable development in technologies for the production of chemicals, fuels, energy and environmental protection.					
PEK_K02 student is able to work in a group, performing various roles including group leader.					
PEK_K03 student is aware of the social role of the engineer.					

PEK_K04 student is ready to critically evaluate his/her knowledge and received content.		
PROGRAMME CONTENT		
Lectures		Number of hours
Lec 1	Introduction to sustainable development – definitions, rules, models	2
Lec 2	Development of technologies of fuel and energy production	2
Lec 3	Biorefineries – integrated sustainable chemical technologies	2
Lec 4	Bioalcohols, biodiesel, biogas as sustainable fuels	2
Lec 5	Advanced materials and catalysts in sustainable technologies of fuels and energy production	2
Lec 6	Environmental sustainability, Zero emission concept, Cleaner Production concept, Smart City	2
Lec 7	The challenges of sustainable development	2
Lec 8	Test	1
	Total hours	15
Project		Number of hours
Proj 1	Project rules, rules of <i>design thinking</i> and <i>action learning</i> as work methods	6
Proj 2	Case studies – sustainable chemicals, fuels, energy and catalysts	12
Proj 3	Smart City – Smart University – energy conservation and environment protection	4
Proj 4	Final project	8
	Total hours	30
TEACHING TOOLS USED		
N1. Presentation.		
N2. Project1: <i>Design thinking</i> method.		
N3. Project 2: <i>Action learning</i> method.		
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
F1	PEK_U01 – PEK_U02 PEK_K01, PEK_K02	Projects (2x20%)
F2	PEK_U01 – PEK_U02 PEK_K01, PEK_K02	Final project (40%)
F3	PEK_U01 – PEK_U03 PEK_K03, PEK_K04	Presentation (20%)
P (project) 50-60% 3,0 (dostateczny) 60-70% 3,5 (dostateczny plus) 70-80% 4,0 (dobry) 80-90% 4,5 (dobry plus) >90% 5,0 (bardzo dobry)		
P (lecture)	PEK_W01 – PEK_W03 PEK_K03	Test
50-60% 3,0 (dostateczny) 60-70% 3,5 (dostateczny plus) 70-80% 4,0 (dobry)		

80-90%	4,5 (dobry plus)
>90%	5,0 (bardzo dobry)
PRIMARY AND SECONDARY LITERATURE	
<u>PRIMARY LITERATURE:</u>	
[1]	Sustainable Energy Technologies Options and Prospects, ed. by K. Hanjalic, R. Van de Krol, A. Lekic, Springer 2008
[2]	Vincenzo Piemonte, Marcello De Falco, Angelo Basile, Sustainable Development in Chemical Engineering: Innovative Technologies, Wiley 2013, ISBN: 978-1-119-95352-4
[3]	N.D. Kaushika, K.S. Reddy, Kshitij Kaushik, Sustainable Energy and the Environment: A Clean Technology Approach, Springer 2016
[4]	Developments in Sustainable Chemical and Bioprocess Technology, ed. by Ravindra Pogaku, Awang Bono, Christopher Chu, Springer 2013
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)	
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