

FACULTY OF CHEMISTRY					
SUBJECT CARD					
Name of subject in English:	Separation of heterogeneous systems				
Main field of study (if applicable):	Chemical and Process engineering				
Specialization (if applicable):					
Profile:	academic				
Level and form of studies:	1 st level, full-time				
Kind of subject:	obligatory				
Subject code:	ICC013011				
Group of courses:	NO				
	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)			30	30	
Number of hours of total student workload (CNPS)			60	60	
Form of crediting			crediting with grade	crediting with grade	
For group of courses mark (X) final course					
Number of ECTS points			2	2	
including number of ECTS points for practical (P) classes			2	2	
including number of ECTS points for direct teacher-student contact (BK) classes			1	1	
PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES					
1. Basic knowledge of principles of chemical engineering.					
SUBJECT OBJECTIVES					
C1 To provide student's knowledge about the principles of unit pressure processes used in chemical engineering					
C2 To provide student student's knowledge about various kinds of heterogenic systems					
C3 To provide student's knowledge about construction of apparatuses used in separation processes					
C4 To provide student's knowledge about basic equations which describe rate of separation in various separation apparatuses					
C5 To provide student's knowledge about choosing the right separation process according to the defined application					
C^ To provide student's knowledge about using filtration, centrifugal, flotation and ultra-filtration separators					
SUBJECT LEARNING OUTCOMES					
related to skills:					
PEK_U01 student can apply and use proper methods for separation of chosen heterogenic systems					
PEK_U02 student is able to calculate constants from the equations related to the rate of specific separation process and indicate the parameters that can increase process efficiency					
PEK_U03 student can plan and organize both his individual and team work					
related to social competences:					
PEK_K01 student understands the significance of obtained knowledge both theoretical and practical and is ready to use his skills in practice					
PEK_K02 student can work in a team in the conducting the experiments and their results analysis (with computer)					

PROGRAMME CONTENT		
Laboratory		Number of hours
La 1	Separation of suspension in low and high pressure with use of filtration	6
La 2	Flotation	6
La 3	Filtration with disk filtration and filtration press	6
La 4	Separation of emulsion in centrifugal device	6
La 5	Ultrafiltration	6
	Sum	30
Project		Number of hours
P 1	Choice of project subject, discussion	2
P 2	Presentation of whole process in which designed device is going to be – problem description	2
P 3	Presentation of concept of solution	2
P 4	Analysis of mechanism of separation process	2
P 5	Presentation of ideal solution with assumption that all problems were solved	2
P 6	Presentation of initial process parameters	2
P 7	Determination of key parameters, bottlenecks	2
P 8	Process balance, naming the flows, process scale definition	2
P 9	Analysis of resource need, efficiency of production	2
P 10	Graphic designed device presentation	2
P 11	Mechanical durability, materials, weight of device	2
P 12	Measurements locations, their type and placing	2
P 13	Economical analysis	2
P 14,15	Presentation of final project – discussion on the strong and weak points of chosen solution	4
	Sum	30
TEACHING TOOLS USED		
N1. Laboratory		
N2. Multimedia presentation		
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
F2-F6 (laboratory)	PEK_U01 – PEK_U03	Points for each experiment – test + laboratory report (max. 5 points each)
F7 (project)	PEK_W01-05; PEK_U01-03	Presentation and preparation of final project
P (laboratory) = (F2+F3+F4+F5+F6) P = 3.0 if points sum is 60-67,9% 3.5 if points sum is 68-75,9% 4.0 if points sum is 76-83,9%		

4.5 if points sum is 84-89,9% 5.0 if points sum is 90-98% 5.5 if points sum is >98% P(project) = F7=10 pkt. 9.5 - 10 pkt. + very good 9.0 – 9.4 pkt. very good 8.0 – 8.9 pkt. + good 7.0 – 7.9 pkt. good 6.0 – 6.9 pkt. + adequate 5.0 - 5.9 pkt. adequate		
PRIMARY AND SECONDARY LITERATURE		
<u>PRIMARY LITERATURE:</u>		
[1] Koch R., Noworyta A., Procesy mechaniczne w inżynierii chemicznej, WNT Wa-wa 1995 [2] Pikoń J., Aparatura chemiczna, PWN, Warszawa 1978 [3] Lewicki P., Inżyniera procesowa i aparatura przemysłu spożywczego, Wydawnictwo Naukowe PWN, 2017		
<u>SECONDARY LITERATURE:</u>		
[1] Seider W. D., Lewin D. R., Seader J. D., Widagdo S., Gani R., Ng K- Ming. ,Product and Process Design Principles: Synthesis, Analysis and Evaluation, 4th Edition, Wiley, 2016 [2] Selecki A., Gawroński R., Podstawy projektowania wybranych procesów rozdzielania mieszanin, WNT 1992		
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)		
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