

FACULTY OF CHEMISTRY					
SUBJECT CARD					
Name of subject in Polish:	Materiały wykorzystywane w procesach i operacjach chemicznych				
Name of subject in English:	Materials used in chemical unit operation				
Main field of study (if applicable):	Chemical and Process Engineering				
Specialization (if applicable):					
Profile:	academic				
Level and form of studies:	2nd level, , full-time				
Kind of subject:	optional				
Subject code	ICC020009				
Group of courses:	NO				
	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
Number of hours of total student workload (CNPS)	60				
Form of crediting	crediting with grade				
For group of courses mark final course with (X)					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1				
PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES					
1. Basic knowledge on chem technology					
2. Knowledge on material science					
SUBJECT OBJECTIVES					
C1 Introduction to material science with special emphasis to modern technology					
C2 Presentation of place for materials in unit operation processes					
SUBJECT LEARNING OUTCOMES					
Relating to knowledge:					
PEU_W01 – students know materials used in industry					
PEU_W02 – students are able to assess usability of materials in a particular technology					
Relating to skills:					
PEU_U01 – students can shape and solve the problems					
Relating to social competences:					
PEU_K01 students understand a need to transfer their knowledge on engineering achievements to communities					
PROGRAM CONTENT					
Lectures					Number of hours
Lec 1	Unit processes in chemical technology, materials used in chemical technology, classification				2
Lec 2	Plastics, kind of polymers, crosslinking, polymer is solution, in gel and in solid state, polymer crystallinity				2
Lec 3	Phase transition, glass temperature, polymer blends and composites, stability				2
Lec 4	Separation, polymer membranes, preparation of membranes, modification of membranes				2
Lec 5	Polymer sorbents, specialty sorbents, monodispersive sorbents, porous				2

	structure, sorbent swelling, sorbents for hybrid processes	
Lec 6	Ion exchange and chelating resins, SIR, core-shell resins	2
Lec 7	Molecularly imprinted polymers, surface and bulk imprinting, natural sorbents	2
Lec 8	Constructive polymers, chemical and mechanical resistivity, tests	2
Lec 9	Carbon materials, activated carbon, porosity, sorption properties, sorbents and catalyst carriers	2
Lec 10	Polymer carbon composites for such separation processes as ED, RO, NF, CDI or EDI	2
Lec 11	Materials not prone for fouling, surface hydrophilization, super-hydrophilic and super-hydrophobic surfaces, polyelectrolytes, L-b-L structures	2
Lec 12	Surface modification by layer deposition, plasma modification, surface grafting, ATRP method in surface alteration	2
Lec 13	Inorganic materials, nanospheres, zeolites and perovskites, molecular sieves, sorbents and carriers, surface modification	2
Lec 14	Metals, protective and passive layers, electrochemical protection, surface pre-treatment	2
Lec 12	Summary	30
TEACHING TOOLS USED		
N1. Lecture with PPT presentations		
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	PEU-W01, W02 PEU-U01 PEU-K01	examination
C=F1		
PRIMARY AND SECONDARY LITERATURE		
PRIMARY LITERATURE:		
[1] [1] F.W.Billmeyer, Textbook of polymer science, J.Wiley New York, 1984 [2] J.F.Rabek, Współczesna wiedza o polimerach, PWN Warszawa, 2013 [3] S.Penczek, Z.Florianczyk, Chemia polimerow Tom I-III, Warszawa, 1995-98 [4] K.Li, Ceramic Membranes for Separation and Reaction, J.Wiley, 2007 [5] N.Hilal, Membrane modification, CRC Press 2012		
SECONDARY LITERATURE:		
[1] [1] E.Hoek, Encyclopedia of Membrane Science and Technology, J.Wiley, 2013 [2] A.Basile, Membrane for Membrane reactors, Elsevier, 2013		
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)		
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