FACULTY OF CHEMISTRY

SUBJECT CARD

Name of subject in English:	Specialty polymers – physicochemistry and technology
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:	TCC024015
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)	90		90		
Form of crediting	Exam		crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	3		3		
including number of ECTS points for practical (P) classes			3		
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 inorganic, organic and physical chemistry from 1st level of studies.
2. Basic knowledge in the area of polymers and plastics.
3. Basic laboratory skills and ability for teamwork

SUBJECT OBJECTIVES

C1 To provide students with a general knowledge of polymerization reactions as well as relation between materials structure and their physicochemical properties.
C2 To acquaint students with possibilities of post-synthetic modifications of polymers used to introduce new functionalities to materials designed for special purposes.
C3 To familiarize students with main classification of specialty polymers and their potential in every aspects of modern life and industry.
C4 Widening the knowledge about the latest achievements in specialty polymers field.
C5 To acquaint students with practical aspects of polymerization (selected methods, polymerization mixture composition, reaction parameters), polymer modification possibilities and overall preparation procedures of final polymeric material to designed purposes.

SUBJECT LEARNING OUTCOMES

related to knowledge:

Student, who has completed the course:
PEK_W01 has gained knowledge of structure and techniques of various polymers synthesis and modification
PEK_W02 knows relations between polymers structure, properties and applications of those materials
PEK_W03 is familiar with main groups of specialty polymers and their application in the industry

and medicine

related to skills:

Student, who has completed the course:

PEK_U01 is familiar with basic polymerization techniques and possibilities of chemical modification of polymer for introducing new functionalities to material

PEK_U02 can evaluate the basic parameters of synthesis influencing polymer structure and morphology

PEK_U03 is able to select and apply basic methods of polymer synthesis to obtain materials having designed properties

PEK_U04 is able to prepare a final report describing performed block of experiments and obtained results summarized by detailed analysis of properties in relation to polymer structure and synthesis method

PROGRAMME CONTENT

Lectures		**Number of hours**
Lec 1	Specialty polymers – definition, basic knowledge of polymers, types of polymerizations	2
Lec 2	Irregularities in polymerization reactions, including fine chemicals industry	2
Lec 3	Special types of polymerizations (ROMP, ATRP etc.), polymers topology	2
Lec 4	Crosslinked polymers – obtaining, shaping of their structure	2
Lec 5	Thermoplastics, thermosets, elastomers in fine chemicals	2
Lec 6	„Polymeric" Nobel Prizes, conducting polymers, applications	2
Lec 7	Thermosensitive specialty polymers and their applications to separation science	2
Lec 8	Temperature swing sorption, grafted polymers	2
Lec 9	Molecularly imprinted polymers, application to separation science and catalysis	2
Lec 10	Polymeric carriers for biomolecules. Properties of such polymers and requirements towards carrier-enzyme systems	2
Lec 11	Polymeric catalysts for organic chemistry and industrial applications	2
Lec 12	Synthetic polymers for solid phase syntheses, polymeric scavengers	2
Lec 13	Ion-exchangers and their applications (ion-exchange, catalysis)	2
Lec 14	Polymeric fibres, membranes for separation processes (also hybrid materials)	2
Lec 15	Polymers for ion-exchange chromatography, separation of amino acids	2
	Total hours	**30**
Laboratory		**Number of hours**
Lab 1	Preparation of chelation resin – synthesis of basic polymers differing in morphology	6
Lab 2	Preparation of chelation resin – incorporation of chelation ligands by chemical modification of obtained polymers	6
Lab 3	Preparation of chelation resin – analysis of sorption properties of final materials	6
Lab 4	Synthesis of stimuli-sensitive hydrogels	6

Lab 5	Investigation on stimuli-responsive properties of various hydrogels	6
	Total hours	**30**

TEACHING TOOLS USED

N1. Lectures with multimedia presentations
N2. Performing experiments with different laboratory equipment and instruments
N3. Preparation of report including analysis and interpretation of obtained results

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_W01-W03	Regular attendance
F2	PEK_U01-U04	2 graded summary reports
F3	PEK_U01-U04	Final test
P1 (lecture)	PEK_W01-W03	Written exam
P2 (laboratory) Grade = (F2 + F3)/2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] M. Chanda, S.K. Roy, "Industrial Polymers, Specialty Polymers, and Their Applications", Boca Raton etc., CRC Press/Taylor & Francis Group, 2009.
[2] F. Mohammad (Ed), "Specialty Polymers: Materials And Applications", I. K. International Pvt Ltd, Anshan Ltd, Tunbridge Wells, 2007.
[3] L.H. Sperling, "Introduction to Physical Polymer Science", 4th ed., Hoboken, NJ, John Wiley & Sons, 2006.
[4] F. Billmayer, "Textbook of Polymer Science", 3rd ed., New York [etc.], John Wiley & Sons, 1984.

SECONDARY LITERATURE:

[1] K. Dorfner (Ed.), "Ion exchangers", Walter de Gruyter, New York, 1991 (or later reprints).
[2] M. Komiyama, T. Takeuchi, T. Mukawa, H. Asanuma, „Molecular Imprinting: From Fundamentals to Applications", Weinheim, Wiley-VCH 2003.
[3] R. M. Ottenbrite, K. Park, T. Okano (Eds.), "Biomedical Applications of Hydrogels Handbook", Springer Science & Business Media New York, 2010.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

Prof. dr hab. inż. Andrzej Trochimczuk, andrzej.trochimczuk@pwr.edu.pl (lecture)
Dr inż. Anna Jakubiak-Marcinkowska, anna.jakubiak@pwr.edu.pl (laboratory)