FACULTY OF CHEMISTRY

SUBJECT CARD

Name of subject in Polish: Synteza „inteligentnych" polimerów
Name of subject in English: Fabrication of "smart" polymers
Main field of study (if applicable): Chemical and process engineering
Specialization (if applicable): Chemical Nanoengineering
Profile: academic
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: ICC025003
Group of courses: NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	crediting with grade		crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	2		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	1		0.5		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of organic and inorganic chemistry from 1st level of studies.
2. 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 familiarize students with main classes of smart polymers and their potential in various aspects of modern life and industry.
C3 Widening the knowledge about the latest achievements in smart polymers field.
C4 To acquaint students with some practical aspects of polymerization (selected methods, polymerization mixture composition, reaction parameters, preparation procedures) important for fabrication of polymers with designed purposes.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

Student, who has completed the course:
PEK_W01 has gained knowledge of structure and techniques of various polymers synthesis for special applications
PEK_W02 knows relations between polymers structure, properties and applications of those materials and can design polymerization process for fabrication of final products
PEK_W03 is familiar with main groups of smart polymers and their application in various fields

relating to skills:

PEK_U01 is able to select and apply basic methods of polymer synthesis to obtain materials having designed properties
PEK_U02 can evaluate the basic parameters of synthesis influencing polymer structure and morphology

PEK_U03 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	Polymers – definition, basic knowledge of polymers, types of polymerizations	2
Lec 2	Irregularities in polymerization reactions, random character of polymerizations	2
Lec 3	Special types of polymerizations (ROMP, ATRP etc.), polymers topology, controlling polymerization kinetics, controlling polymers' composition and physical properties. Part I	2
Lec 4	Special types of polymerizations (ROMP, ATRP etc.), polymers topology, controlling polymerization kinetics, controlling polymers' composition and physical properties. Part II	2
Lec 5	Physical means of controlling the properties of polymers and "plastics"	2
Lec 6	Thermosensitive polymers and their applications	2
Lec 7	Temperature swing sorption, grafted polymers.	2
Lec 8	Organizing the polymer architecture around template - Molecularly Imprinted Polymers (MIP)	2
Lec 9	Application of MIPs to separation science and catalysis	2
Lec 10	Polymeric carriers for biomolecules	2
Lec 11	Properties of such polymers and requirements towards carrier-enzyme system	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
Lec15	Polymers for ion-exchange chromatography, separation of aminoacids	2
	Total hours	30
Laboratory		**Number of hours**
Lab 1	Synthesis of stimuli-responsive hydrogels.	5
Lab 2	Internal phase emulsion polymerization (HIPE) as a method used for formation of polymeric materials with unique porous structures.	5
Lab 3	Basic characterization of obtained materials.	5
	Total hours	15
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 EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01-U03	2 graded summary reports

F2	PEK_U01-U02	Final colloquium
P1 (lecture)	PEK_W01-W03	Written test (minimum examination pass mark is 53 %)
P2 (laboratory)	Grade = (F1 + F2)/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.
[5] K. Dorfner (Ed.), "Ion exchangers", Walter de Gruyter, New York, 1991 (or later reprints).
[6] M. Komiyama, T. Takeuchi, T. Mukawa, H. Asanuma, „Molecular Imprinting: From Fundamentals to Applications", Weinheim, Wiley-VCH 2003.

SECONDARY LITERATURE:

[1] R.M. Ottenbrite, K. Park, T. Okano (Eds.), "Biomedical Applications of Hydrogels Handbook", Springer Science & Business Media New York, 2010.
[2] R. Barbucci (Ed.), "Hydrogels. Biological Properties and Applications", Springer-Verlag Italia, Milan 2009.
[3] N.R. Cameron, D.C. Sherrington, "High internal phase emulsions (HIPEs) — Structure, properties and use in polymer preparation", in: Biopolymers Liquid Crystalline Polymers Phase Emulsion, Advances in Polymer Science, vol 126, Springer, Berlin, Heidelberg 1996.

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

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