Załącznik nr 1 do zarządzenia nr 11 Rektora UW z dnia 19 lutego 2010 r.
w sprawie opisu przedmiotu w Uniwersyteckim Katalogu Przedmiotów zamieszczonym
w Uniwersyteckim Systemie Obsługi Studiów (USOS)
i zgodnym ze standardami Europejskiego Systemu Transferu i Akumulacji Punktów (ECTS)

Formularz opisu przedmiotu (formularz sylabusa) – dotyczy studiów I i II stopnia

A. Informacje ogólne (wypełnia koordynator przedmiotu z wyjątkiem pól *Kod przedmiotu*, *Przyporządkowanie do grupy przedmiotów*).

Nazwa pola	
Course title	Chemistry and technology of polymers
Faculty/Institute	Faculty of Chemistry /Department of Chemical Technology
Programme for which the course is offered	
Course ID	
Erasmus code	13303
Course group	
Didactic cycle	3 L
Type/form of class	Lecture 30 h/semester
Brief course description	Characteristics of polymer materials. Basic terms in polymer chemistry: molecular weight, molecular weight distribution, microstructure of polymer chain in solvent and in solid-state, polymer vs. polymer material. Mechanism of polymerization including phenol formaldehyde resin, epoxy and polyester resins. Popular large-scale methods of polymer production. Physical and chemical methods of polymer modifications. Reinforcing of polymers (fiber, powders and polymers). Processing of thermoplastic polymers, thermo- and chemo setting resins: Waste polymer environmental pollution (eco-balance, polymer environmental stress). Recycling of polymer materials: material recycling, monomer recycling, energy recycling.
Full course description	Topics of the lecture: 1. Introduction Polymer definition (homopolymer, copolymer, terpolymer) Molecular weight and molecular weight distribution Microstructure of polymer chain in solvent and in solid state, polymer and polimer material 2. Mechanisms of polymerization Main mechanisms of polyreactions 3. Reactivity of vinyl monomers in polymerization reaction 3.1. Step and chain growth 3.1.1. Radical polymerization (Initiation, Propagation, Termination, Transfer reaction, Inhibition and retardation, kinetic equations) 3.1.2. Copolymerization kinetics models 3.1.2.1. Terminal model 3.1.2.2. Penultimate model 3.1.3. Characteristics of controlled/living radical polymerization 3.1.4. Other polymerization models 3.2. Ionic polymerization (active centers, polymerization conditions,kinetics of reaction 3.2.1. Cationic polymerization 3.2.2. Anionic polymerization 3.3. Coordination polymerization 3.3.1. Main catalysts 3.3.2. Stereoregular polymers 3.4. Polycondensation 3.5. Polyaddition 4. Industrial polymerization methods 4.1. Bulk polymerization in bulk 4.2. Solvent polymerization 4.3. Suspension and emulsion polymerization 4.4. Other methods of polymerization 5. Examples of basic polimer technologies 5.1. Polyethylene, characteristics of PE types 5.1.1. HDPE: blown film extrusion, injection, pipes 5.1.2. LLDPE: film 5.1.3. LDPE::film, extrusion with coating 5.1.4. Ziegler catalysts in PE synthesis 5.2. Polypropylene 5.2.1. Ziegler-Natta catalysts in PP synthesis 5.3. Polystyrene

		5.3.1. Polymerization methods (In bulk, suspension and emulsion) 5.3.2. PS types 5.3.3. Copolymers with styrene 5.4. Poly(vinyl chloride) 6. Reological characteristics of polymers. 7. Chemical modification of polymers 7.1. Grafting of polymers 7.2. Crosslinking of polymers 8. Pysical modification of polymers. 8.1. Blending of polymers 8.2. Reinforcing of polymers (fibers, fillers, powders, polymers). 9. Processing of polymers 9.1. Thermoplastic processing 9.2. Chemosetting of polymers 9.3. Thermoplastic processing 9.4. Thermoplastic processing 10. Enviromental pollution with waste-polymers 10.1. Balanse of enviromental stress 10.2. Eco-balance 11. Recykling materiałów polimerowych 11.1. material recycling 11.2. monomer recycling 11.3. energy recycling 12. Biodegradable polymers 12.1. Conditions for biodegradability 12.2. Biodegradable polymers from 12.2.1. Non-renovable sources 12.2.2. Renovable sources
Prerquisites	Formal prerquisites	obtained a credit for a class/course In general chemistry and In organic chemistry
	other prerquisites	Before the course the student should: – demonstrate basic knowledge of polymer chemistry, – demonstrate skills in scientific literature search and study – demonstrate understanding principles of research work in chemistry
Learning outcomes		After the course the student should: – demonstrate skills in forecasting possible methods of synthesis for given polymers – is able to determine conditions for planned synthesis of given polymer - - - demonstrate skills in analysis of applicability of a given polymer and its relations with the method of synthesis - demonstrated understanding for necessity of recycling of polymer materials and use biodegradable polymers
ECTS credits		3 weeks of work (and presence at the lecture) is sufficient to get 3 ECTS points
Assessment methods and criteria		Exam
Type of examination		Skills required to pass the exam: Skills sufficient to pass the exam. To proof the acquired skills the student is obligated to answer questions connected to the main topics of the lecture. Passing the exam means to get > 50% of max. number of points There are approximately 6 open questions of varying difficulty expressed in points of a settled scale (scale 0-20 pts).
Type of course		According to the program of the study the lecture is an optional course in the Ist year of the 2nd level (M) specially for those who use polymer materials or/and polymer chemistry methods during specialization
Mode of delivery		Multimedia aided lecture. Stimulation to active participation (questions, discussion, digressions to research and scientific problems)
Language of instruction		Polish
Bibliography		Supplementary bibliography: - „Chemia polimerów", tom I,II,III, praca zbiorowa pod red. Z. Florjańczyka i S. Penczka, Oficyna Wyd. Pol. Warszawskiej, 1995-98. - J. Pielichowski i A. Puszyński Technologia tworzyw sztucznych",WNT, Warszawa 2003. - Nicholson J. W., Chemia polimerów WNT, Warszawa 1996. - G. Odian, Principles of Polymerization, John Wiley & Sons, 2004 - G. Moad, D.H. Solomon, The Chemistry of Free Radical Polymerization
Work placement(s)		Lecture room
Course coordinator		dr hab. Inż. Andrzej Kaim
Academic teachers		dr hab. Inż. Andrzej Kaim
Remarks		

B. Informacje szczegółowe (wypełnia prowadzący zajęcia, z wyjątkiem pól: *Limit miejsc w grupie, Terminy odbywania zajęć*, *Miejsce odbywania zajęć* – pola te prowadzący zajęcia wypełnia w porozumieniu z administracją).

Nazwa pola	
Name of the academic teacher	**Andrzej Kaim**
Academic degree	**PhD, Ing.**
Form of the class	lecture
Learning outcomes	After the course the student should: – demonstrate skills in forecasting possible methods of synthesis for given polymers – is able to determine conditions for planned synthesis of given polymer - - - demonstrate skills in analysis of applicability of a given polymer and its relations with the method of synthesis
Assessment methods and criteria for this course	Passing the exam means to get > 50% of max. number of points There are approximately 6 open questions of varying difficulty expressed in points of a settled scale (scale 0-20 pts).
Type of examination	Witten exam
A list of topics	1. Introduction Polymer definition (homopolymer, copolymer, terpolymer) Molecular weight and molecular weight distribution Microstructure of polymer chain in solvent and in solid state, polymer and polimer material 2. Mechanisms of polymerization Main mechanisms of polyreactions 3. Reactivity of vinyl monomers in polymerization reaction 3.1. Step and chain growth 3.1.1. Radical polymerization (Initiation, Propagation, Termination, Transfer reaction, Inhibition and retardation, kinetic equations) 3.1.2. Copolymerization kinetics models 3.1.2.1. Terminal model 3.1.2.2. Penultimate model 3.1.3. Characteristics of controlled/living radical polymerization 3.1.4. Other polymerization models 3.2. Ionic polymerization (active centers, polymerization conditions,kinetics of reaction 3.2.1. Cationic polymerization 3.2.2. Anionic polymerization 3.3. Coordination polymerization 3.3.1. Main catalysts 3.3.2. Stereoregular polymers 3.4. Polycondensation 3.5. Polyaddition 4. Industrial polymerization methods 4.1. Bulk polymerization in bulk 4.2. Solvent polymerization 4.3. Suspension and emulsion polymerization 4.4. Other methods of polymerization 5. Examples of basic polimer technologies 5.1. Polyethylene, characteristics of PE types 5.1.1. HDPE: blown film extrusion, injection, pipes 5.1.2. LLDPE: film 5.1.3. LDPE::film, extrusion with coating 5.1.4. Ziegler catalysts in PE synthesis 5.2. Polypropylene 5.2.1. Ziegler-Natta catalysts in PP synthesis 5.3. Polystyrene 5.3.1. Polymerization methods (In bulk, suspension and emulsion) 5.3.2. PS types 5.3.3. Copolymers with styrene 5.4. Poly(vinyl chloride) 6. Reological characteristics of polymers. 7. Chemical modification of polymers 7.1. Grafting of polymers 7.2. Crosslinking of polymers 8. Pysical modification of polymers. 8.1. Blending of polymers 8.2. Reinforcing of polymers (fibers, fillers, powders, polymers). 9. Processing of polymers 9.1. Thermoplastic processing 9.2. Chemosetting of polymers 9.3. Thermoplastic processing

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Learning activities and teaching methods	Multimedia aided lecture. Stimulation to active participation (questions, discussion, digressions to research and scientific problems)
Bibliography	Supplementary bibliography: - „Chemia polimerów", tom I,II,III, praca zbiorowa pod red. Z. Florjańczyka i S. Penczka, Oficyna Wyd. Pol. Warszawskiej, 1995-98. - J. Pielichowski i A. Puszyński Technologia tworzyw sztucznych",WNT, Warszawa 2003. - Nicholson J. W., Chemia polimerów WNT, Warszawa 1996. - G. Odian, Principles of Polymerization, John Wiley & Sons, 2004 - G. Moad, D.H. Solomon, The Chemistry of Free Radical Polymerization
Limit of places available	
Time	
Place	