STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Polymers and Polymeric Materials	

Field of study	Profile of study (general academic, practical)	Year /Semester
Technology of Environment Protection	**general academic**	**3 / 5**
Elective path/specialty	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **30** Classes: **-** Laboratory: **60** Project/seminars: **-**	**6**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
major	**university-wide**

Education areas and fields of science and art	ECTS distribution (number and %)
Technical sciences Technical Sciences	**6 100%** **6 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Knowledge of the basic principles of general and organic chemistry
2	**Skills**	Student knows and applies good practices of laboratory work, is able to operate the scientific equipment. He or she is able to search for information in scientific literature, databases and other properly chosen sources.
3	**Social competencies**	He or she is conscious of the effects of engineering activity

Assumptions and objectives of the course:

Gaining of basic knowledge about polymers, polymeric materials, their production, properties and applications.

Study outcomes and reference to the educational results for a field of study

Knowledge:

Student has a basic knowledge of polymer chemistry and polymeric materials technology.

K_W03, K_W06

Skills:

Student has the ability of analyzing and interpreting of the results of experiments from the area of polymer technology.

Student has the ability of presenting the results of laboratory exercises in concise and proper manner

Student is able to apply basic laboratory techniques for synthesis and processing of polymers

K_U01, K_U02, K-U11

Social competencies:

Student is conscious of limitations of science and technology in the area of polymer chemistry, including environment protection.

Student is conscious of limitation of his knowledge and understands the need of further continuous education in area of polymer chemistry.

Students can work in a team and are aware of their responsibility for their work and responsibility for the results of the teamwork

K_K01, K_K02, K_K04

Assessment methods of study outcomes

Written exam from the lecture subjects, evaluation of laboratory exercises and reports.

Course description

Basic information about polymers (monomer, polymer, repeat unit, polymerization degree), reactions used in production of polymers (chain- and step-growth polymerization)

Popular monomers and polymers therefrom (properties, applications): polyolefines, vinyl polymers, rubbers, polyesters, polyamides, polyurethanes, epoxide resins, specialty polymers.

Structure of polymers (linear, branched, cross-linked), thermoplastic and duroplastic polymers and their properties, naturally occurring polymers.

Polymeric materials – definition, ingredients, composites.

Molecular weight of polymers, types of molecular weight.

Degradation, depolymerisation and destruction of polymers.

Structure of polymers, tacticity.

Radical polymerization, initiation, propagation, termination, molecular weight control..

Kinetics of radical polymerization, autoacceleration.,

Ionic polymerization. Mechanism, living polymerization.

Coordination polymerization, Ziegler-Natta catalysts, mechanism of polymerization.

Copolymerization; reactivity coefficients, types of copolymers.

Industrial methods of polymer synthesis (mass, emulsion, solution, suspension polymerization).

Polycondensation – types of polycondensation, comparison of radical polymerization and polycondensation, features of the process, equilibrium and non-equilibrium polycondensation, Carothers equation.

Industrial methods of polycondensation.

Polyaddition, features and examples.

Crosslinking of polymers, , methods of crosslinking, vulcanization.

Polymeric chain structure, , crystallinity of polymers

Physical states and characteristic temperatures of polymers.

Mechanical propertiers of polymers, viscoelasticity.

Basic methods of polimer processing, modification of polymers.

Principles of polimer recycling.

Basic bibliography:

. J. Pielichowski, A. Puszyński „Chemia Polimerów” TEZA, Kraków, 2004

2. J. Pielichowski, A. Puszyński „Technologia tworzyw sztucznych”, WNT, Warszawa, 1994

Additional bibliography:

1. . Praca zbiorowa pod red. Z. Floriańczyka i S. Penczka „Chemia polimerów” tom I i II, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1995 i 1997.

2. W. Szlezyngier „Tworzywa sztuczne” Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 1996.

Result of average student's workload	
Activity	**Time (working hours)**
1. lecture	30
2. preparation for laboratory	15
3. laboratory	60
4. exam preparation, exam	30
5. reports preparation	15

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	150	6
Contact hours	90	3.5
Practical activities	45	2.5