



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Polymer technology

### Course

Field of study

Chemical and process engineering

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

3/6

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

30

Other (e.g. online)

Tutorials

Projects/seminars

### Number of credit points

5

### Lecturers

Responsible for the course/lecturer:

dr hab. inż. Arkadiusz Kloziński

Responsible for the course/lecturer:

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Wydział Technologii Chemicznej

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### Prerequisites

The student has knowledge of the basic issues of general chemistry, organic chemistry.

The student knows and applies good working techniques in the chemical laboratory, is able to operate research equipment. Is able to obtain information from literature, databases and other properly selected sources.

### Course objective

Obtaining basic knowledge about polymers, polymer materials, their preparation, applications, processing and properties.



## Course-related learning outcomes

### Knowledge

1. The student has knowledge in the field of polymer chemistry and technology that allows understanding and description of physical phenomena and processes associated with polymeric materials. [K\_W02]

### Skills

1. The student is able to plan and carry out simple experiments in the field of chemistry and technology of polymer materials, as well as interpret their results and draw conclusions. [K\_U08]

2. The student is able to identify the basic processes and unit operations in the field of chemistry and technology of polymer materials and formulate their specifications. [K\_U17]

### Social competences

1. The student understands the need for further training and improving their professional competences in the field of polymer chemistry. [K\_K01]

2. The student is aware of the importance and understanding of non-technical aspects and effects of engineering activities in the field of polymer chemistry, including its impact on the environment and the associated responsibility for decisions. [K\_K02]

3. The student is aware of the responsibility for their own work and readiness to submit to work in a team and take responsibility for jointly implemented tasks. [K\_K04]

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Knowledge evaluation based on a written exam.

2. Evaluation of knowledge from laboratory exercises based on oral and written answers.

3. Evaluation of the laboratory report.

## Programme content

Basic concepts in the science of polymers (monomer, polymer, mer, degree of polymerization), reactions leading to the preparation of polymers (chain and step polymerization). Knowledge of the structure of the most popular monomers and their polymers (properties and applications), such as polyolefins, vinyl polymers, rubbers, polyesters, polyamides, polyurethanes, epoxy and polyester resins, special polymers. Structure of polymers (linear, branched, crosslinked), thermoplastics and duroplastics and their properties, natural polymers. Plastic - concept, ingredients; Composites. Molecular weight of polymers and its types. Degradation, depolymerization and destruction. Polymer spatial structure, tacticity. Radical polymerization. Ionic polymerization (anionic and cationic). Coordination polymerization: types of catalysts, Ziegler-Natta catalysts, polymerization mechanism, process specificity (specific properties of polymers). Copolymerization. Industrial polymerization methods (bulk, suspension, in solvent, emulsion). Industrial polycondensation methods (in the alloy, in solution, on the interface, in the solid phase). Polyaddition, characteristics, examples. Crosslinking of polymers:



crosslinking methods, examples, vulcanization. Main chain shape: 1st, 2nd and 3rd order structure; polymer crystallinity. Physical states and characteristic temperatures of polymers. Basic mechanical properties, viscoelasticity of polymers. Basic methods of plastic processing, modification of polymers. Basics of polymer recycling.

Laboratory exercises include:

- Polymerization - block polymerization of methyl methacrylate.
- Polycondensation - synthesis of polyamide 6.10 at the interface.
- Synthesis of polyvinyl butyral.
- Polyaddition - obtaining polyurethane foam.
- Processing of polymeric materials - extrusion techniques.

### Teaching methods

1. Lecture: multimedia presentation, illustrated with examples on the board.
2. Laboratories - practical classes.

### Bibliography

Basic

1. J. Pielichowski, A. Puszyński „Chemia Polimerów” TEZA, Kraków, 2004
2. J. Pielichowski, A. Puszyński „Technologia tworzyw sztucznych”, WNT, Warszawa, 1994

Additional

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

### Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	65	3,5
Student's own work (literature studies, preparation for laboratory classes, preparation for exam) <sup>1</sup>	60	1,5

<sup>1</sup> delete or add other activities as appropriate