COURSE DESCRIPTION CARD - SYLLABUS

Course name
Polymer technology [S1IChiP1>TPo]

Course

Field of study
Chemical and Process Engineering

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

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:

Learning outcomes presented above are verified as follows:
Lecture: Stationary: written exam/test (20-30 questions). Online: final test using the test module on the eKursy platform (20-30 questions).
Laboratory classes: Stationary form - oral answer or written test from the material contained in the exercises and the given theoretical issues; presence and realization of all laboratory exercises provided in the study program; grade from reports prepared after each exercise. A final grade will be given based on the average grades of the oral/written answers and reports for each exercise, divided by the number of exercises performed. Online form - oral answer and/or written test from the material contained in the exercises, tutorial videos and the theoretical issues provided, conducted in the "live view" mode with the webcam turned on via eMeeting or Zoom platform during a direct conversation with the teacher and/or using the test module on the eKursy platform; online presence and completion of all laboratory exercises provided in the study program; grade from the reports prepared after each exercise and sent via the eKursy platform or by e-mail using the university"s e-mail system. A final grade will be given based on the average grade of the oral/written answers and reports for each exercise, divided by the number of exercises performed. Grade criteria: 3 - 50.1%-60.0%; 3.5 - 60.1%-70%; 4 - 70.1%-80.0%; 4.5 - 80.1%-90%; 5 - from 90.1%.

Programme content

Issues relating to basic knowledge of polymers, polymeric materials, their production, applications, processing and properties.

Course topics

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	5,00
Classes requiring direct contact with the teacher	65	3,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	1,50