COURSE DESCRIPTION CARD - SYLLABUS

Course name
Technologia materiałów polimerowych (Technology of polymer materials)

Course

Field of study
Chemical Technology

Year/Semester
III/6

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
dr hab. inż. Sławomir Borysiak, prof. PP

Responsible for the course/lecturer:

Prerequisites

The student should have a basic knowledge of organic and general chemistry. Student should also be able to search information from literature, databases and other properly selected sources and be willing to cooperate as part of a team.

Course objective

Providing knowledge in the field of preparation, structure, properties and applications of polymers and polymeric materials. Mastering the skills of polymer synthesis, plastic processing and characteristics of their performance.

Course-related learning outcomes

Knowledge

1. The student has a systematic, theoretically founded general knowledge in the field of polymer chemistry, in particular their structure and methods of obtaining polymers [K_W08]

2. The student has the necessary knowledge in the field of synthetic and natural polymers as well as knows the technological methods for processing plastics [K_W09]

3. The student has the necessary knowledge in the field of research methods to identify and characterize the physicochemical properties of polymer materials [K_W11]

Skills

1. Student has the skills to search information from literature, databases and other sources related to polymeric materials [K_U01]

2. Student uses basic laboratory techniques in the synthesis of polymeric materials [K_U20]

3. Student is able to characterize the chemical, physical and mechanical properties of polymers and plastics [K_U22]

Social competences

1. The student understands the need for further training and improving their professional competences [K_K01]

2. The student is able to work in a group and cooperate during performing practical tasks [K_K03]

3. The student is aware of the importance of the effects of engineering activities related to the plastics industry, in particular the impact on the environment [K_K02]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:

Knowledge acquired in lecture is verified in the form of a written exam after completing the entire subject course (W + C + L), i.e. after the seventh semester. The exam consists of 5-10 open questions. Passing threshold: 50% of points. In addition, knowledge is verified after the end of the cycle of all lectures (after the sixth semester) in the form of a test. Exam issues will be sent to students via e-mail using the university e-mail system.

Programme content

1. Basic concepts in the polymers science (monomer, polymer, mer, degree of polymerization, functionality). Nomenclature of polymers. Polymer classification according to Flory and Carothers.

2. Properties and applications of selected polymers, eg. polyolefins, vinyl polymers, rubbers, polyesters, polyamides, polycarbonates, polyurethanes, epoxy and polyester resins, special polymers.

3. Chain polymerization - mechanism and types. Chain polymerization stages - initiation, propagation and termination. Radical, cationic, anionic polymerization, living polymerization. Polymerization kinetics, gel effect. Copolymerization and types of copolymers.

4. Industrial polymerization methods (bulk, suspension, in solution, emulsion, phase boundary).

5. Step polymerization. Polycondensation and types of polycondensation. Comparison of polymerization and polycondensation. Polycondensation reactions. Kinetics of the polycondensation process - Carothers equation. Polyaddition - mechanism, properties, examples of polymers obtained by polyaddition.

6. Industrial methods of polycondensation (in alloy, in solution, on the interface, in the solid phase).

7. Polymer structure - forms of polymer chains (linear, branched, crosslinked), I, II, III-order structures - sequence of mers, cis-trans isomerism, tacticity, conformational forms, aggregation states, morphology of polymers, degree of crystallinity. Crystalline and amorphous polymers - properties.

8. Molecular weight of polymers - types of molecular weights, polydispersion, influence of molecular weight on properties. Degradation, depolymerization and destruction.

9. Plastics - definitions, classifications. Blends and polymer composites. Plastomers, elastomers, thermoplastics, duroplasts. Physical states and characteristic temperatures of polymers, glass transition temperature.

10. Basic mechanical properties, viscoelasticity of polymers.

11. Basic methods of plastic processing - technological stages, extrusion, injection molding, pressing, thermoforming, calendering, spinning, rotomolding.

12. Recykling of plastic - material recykling, compounds recovery and energy recovery.

Teaching methods

1. Lecture: multimedia presentation

Bibliography

Basic

1. W. Szlezyngier, Tworzywa sztuczne, Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 1996

2. J. Pielichowski, A. Puszyński, Chemia polimerów, TEZA, Kraków 2004

3. J.F. Rabek, Współczesna wiedza o polimerach, PWN, Warszawa 2008

4. B. Łączyński, Tworzywa wielkocząsteczkowe: rodzaje i własności, WNT, Warszawa 1982.

Additional

1. K. Czaja, Poliolefiny, WNT, Warszawa 2005

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	30	1,2
Student's own work (literature studies, preparation for test, preparation for exam) [1]	45	1,8

[1] delete or add other activities as appropriate