COURSE DESCRIPTION CARD - SYLLABUS

Course name

Polymers and Polymer Composites

Course

Field of study

Chemical Technology

Area of study (specialization)

Composites and Nanomaterials

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/1

Profile of study

general academic

Course offered in

English

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

Piotr Gajewski, Eng, PhD

Faculty of Chemical Technology

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Responsible for the course/lecturer:

Prerequisites

Student should have knowledge of the basic principles of general chemistry, organic chemistry, physical chemistry, polymer chemistry and polymer technology. Knows and applies the techniques of good work in the chemical laboratory, can use basic laboratory equipment. Is able to obtain information from literature, databases and other properly selected sources.

Course objective

Obtaining knowledge about polymers, polymer materials, their preparation, methods of production, properties and applications.
To familiarize students with the chemistry of chain and step polymerization processes, chemical reactions of polymers, as well as obtain skills related to the methods of synthesis, modification, degradation of polymers and polymer composites. To familiarize students with the properties, applications and basic methods of plastics analysis.

Course-related learning outcomes

Knowledge

Student has expanded and in-depth knowledge in the field of polymer chemistry and other related areas of science, allowing to formulate and solve complex tasks related to polymer technology (K_W2). Student has expanded knowledge in the field of kinetics, thermodynamics, catalysis of polymerization processes (K_W4). Student has a well-established and expanded knowledge of methods and mechanisms of synthesis and modification of polymers. (K_W11). Student has an established knowledge of health and safety in the polymer chemistry laboratory (lists and applies health and safety regulations) (K_W10).

Skills

Student has the ability to obtain and critically evaluate information from literature and other sources (K_U1). He works in a group to prepare and perform experiments in the laboratory (K_U2). Student has the ability of presenting the results of laboratory exercises in concise and proper manner (K_U6). Student has the ability of analysing and interpreting of the results of experiments from the area of polymer chemistry and technology (K_U21). Can use English in professional contacts (K_U3). Student knows and observes the safety rules related to the performed work (K_U19).

Social competences

Student is conscious of limitations of science and technology in the area of polymer chemistry and technology, including environment protection (K_K2). Student is conscious of limitation of his knowledge and understands the need of further continuous education in area of polymer chemistry and technology (K_K1). Students can work in a team and are aware of their responsibility for their work and responsibility for the results of the teamwork (K_K4).

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture. Stationary: A written form (consisting of 2 - 4 open and 20-30 closed questions) from the area of polymer chemistry presented during the lectures (student obtains a pass by achieving at least 51% of

points). Online form: A test consisting of 40 - 50 questions (including >50% closed questions) from the area of polymer chemistry presented during the lectures (student obtains a pass by achieving at least 51% of points) on the eKursy platform.

Laboratory classes. Stationary form. Establishing a final grade on the basis of partial grades obtained during the semester: oral answers or written tests from the material included in the exercises and the given theoretical issues; the presence and performance of all laboratory exercises provided for in the study program; activity in the classroom and the way of exercise performance; grades from reports prepared after each exercise. Online form: Establishing a final grade on the basis of partial grades obtained during the semester; an oral answer and / or a written test (test, 10-20 closed questions) from the material contained in the exercises, instructional videos, and the theoretical issues provided, conducted in "live view" mode with the web camera on, in direct contact with the teacher via the platform eKursy; online presence and completion of all laboratory exercises provided in the study

Programme content

The lecture covers the following topics:

Classification of polymer materials. Chain polymerization: thermodynamics, mechanism and types, copolymerization. Polycondensation: mechanism and types. Polymer blends. Special and engineering polymers. Polymer structure and properties: morflology, thermal and mechanical properties.

The laboratory covers the following issues:
Basic concepts (linear, branched and crosslinked polymers, molecular weight, tacticity). Basic characteristics of chain polymerization reaction: types, mechanisms, examples of polymers. Copolymerization and copolymers. Basic characteristics of step polymerization; mechanism, examples of polymers. Polymer morphology. Classification of polymeric materials (thermoplastics, thermosets, elastomers, thermoplastic elastomers). Polymer blends. Engineering and performance polymers. Thermal properties of polymers (thermal transitions, DSC measurements). Mechanical properties of polymers (tensile properties, stress-strain failure, viscoelasticity, rheological models).

The laboratory covers the following issues:

1. Preparation of polymer composites by photopolymerization

2. Depolymerization of polymers

3. Manufacturing of composites with natural fibers

Teaching methods

Lecture: informative lecture with multimedia presentation.

Laboratory classes: performing experiments and getting acquainted with research equipment and chemical reagents used in their conduct, teaching materials for the laboratory in pdf files, tutorial videos on the eKursy platform.

Bibliography

Basic

1. G. Odian, Principles of Polymerization, 4th ed., Wiley, 2004.
2. H.R. Allcock, F.W. Lampe Contemporary Polymer Chemistry, 2nd ed., Prentice Hall, 1990.
3. L.H. Sperling Introduction to Physical Polymer Science, 4th ed., Wiley, 2006.
4. Handbook of Plastics Technologies, C.A. Harper. Ed., The McGraw-Hill Companies, 2006, e-book

Additional

1. S. Fakirov Fudamentals of Polymer Science for Engineers, Wiley, 2017
2. M. Rubinstein, R. H. Colby Polymer Physics, Oxford, 2003
3. R. A. Pethrick Polymer Science and Technology for Scientists and Enginineers, Whittless Publishing, 2010
4. J. W. Nicholson The Chemistry of Polymers, 5th ed., Royal Society of Chemistry, 2017

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	3,0
Classes requiring direct contact with the teacher	30	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	30	1,0

[1] delete or add other activities as appropriate