COURSE DESCRIPTION CARD - SYLLABUS

Course name
Polymers [S2TCh2E-KiN>Pol]

Course

Field of study
Chemical Technology

Year/Semester
1/1

Area of study (specialization)
Composites and Nanomaterials

Profile of study
general academic

Level of study
second-cycle

Course offered in
english

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

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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 basic issues related to the physicochemistry of polymers. 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. To familiarize students with selected aspects of the application of polymers in the industry.

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 stationary/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). The test takes place stationary or on the eKursy platform if online work is required. Evaluation 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%
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:
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 and miscibility of polymers. Engineering and performance polymers. Thermal properties of polymers (thermal transitions, DSC measurements). Mechanical properties of polymers (tensile properties, stress-strain failure, viscoelasticity, rheological models). Polymer solutions: viscosity of polymer solutions, dependence of viscosity on molecular weight, thermodynamics of the dissolution process, solubility parameters, phase diagrams of polymer solutions. To Familiarie students with the production technologies of the most important polymers.To familiarize students with selected aspects of the application of polymers in the industry.
The laboratory covers the following issues:
1. Radical copolymerization of styrene with maleic anhydride
2. Depolymerization of polymers
3. Thermal transitions in polymers measured by differential scanning calorimetry (DSC)

Teaching methods

Lecture: informative lecture with multimedia presentation.
Laboratory classes: performing experiments and became familiar with research equipment and chemical reagents used, teaching materials for the laboratory in pdf files, in case of online teaching - 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	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00