COURSE DESCRIPTION CARD - SYLLABUS

Course name

Technologia monomerów, napełniaczy i środków pomocniczych (Technology of monomers, fillers and additives)

Course

Field of study

Technologia Chemiczna (Chemical Technology)

Year/Semester

I/1

Area of study (specialization)

Technologia Polimerów (Polymer Technology)

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

Polish

Form of study

part-time

Requirements

compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	30	
Tutorials	**Projects/seminars**	
0	0	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

Łukasz Klapiszewski, Ph.D. D.Sc. Eng.

e-mail: lukasz.klapiszewski@put.poznan.pl

tel. +48 61 665 37 48

Faculty of Chemical Technology

Instituite of Chemical Technology and Engineering

Berdychowo 4, PL-60965 Poznan

Responsible for the course/lecturer:

Monika Rojewska, Ph.D. Eng.

e-mail: monika.rojewska@put.poznan.pl

tel. +48 61 665 36 26

Faculty of Chemical Technology

Instituite of Chemical Technology and Engineering

Berdychowo 4, PL-60965 Poznan

Prerequisites

Structured and systematic knowledge in the field of general and inorganic chemistry, organic chemistry and chemical technology, and apparatus of the chemical industry (the curriculum of the full-time first cycle studies). Ability to solve elementary engineering problems based on knowledge. Ability to obtain information from the indicated sources in Polish and a foreign language. Understanding the need for further education, understanding the need to expand their competences, readiness to cooperate within a team.

Course objective

Obtaining theoretical and practical knowledge in the field of technology of monomers, fillers and additives. Understanding the basic sources and industrial processes for producing monomers in the petrochemical industry. Ability to select chemical raw materials and semi-finished products used in polymer technology. Understanding the basic industrial processes and unit operations related to the technology of obtaining and modifying of inorganic polymer fillers. Understanding the methods of obtaining inorganic and inorganic-organic products, including hybrid products with defined structural and morphological properties.

Course-related learning outcomes

Knowledge

K_W2 - has expanded and in-depth knowledge in chemistry and other related areas of science, allowing to formulate and solve complex tasks related to chemical technology

K_W3 - has knowledge of complex chemical processes, including the appropriate selection of materials, raw materials, methods, techniques, apparatus and equipment for carrying out chemical processes and characterizing the products obtained

K_W6 - has expanded knowledge of the latest chemical and material technologies, including advanced materials and nanomaterials technologies, knows current trends in the development of chemical industrial processes

K_W7 - knows modern methods of testing the structure and properties of materials, necessary to characterize raw materials and products of the chemical and related industries

K_W11 - has a well-established and expanded knowledge of the selected specialty

K_W13 - has extended knowledge of advanced devices and apparatus used in chemical technology

K_W14 - has knowledge of selected issues of modern chemical knowledge and aspects of copyright and industrial property

Skills

K_U1 - has the ability to obtain and critically evaluate information from literature, databases and other sources, and formulate opinions and reports on this basis

K_U2 - has the ability to work in a team and lead a team

K_U5 - can independently determine the directions of further education and implement self-education

K_U11 - is able to properly verify the concepts of engineering solutions in relation to the state of knowledge in technology and chemical engineering

K_U12 - has the ability to adapt knowledge of chemistry and related fields to solve problems in the field of chemical technology and planning new industrial processes

K_U15 - can critically analyze industrial chemical processes and introduce modifications and improvements in this area, using the acquired knowledge, including knowledge about the latest achievements of science and technology

K_U16 - has the ability to assess the technological suitability of raw materials and the selection of the technological process in relation to the quality requirements of the product

K_U23 - has the ability to use the knowledge acquired under the specialty in professional activity

Social competences

K_K1 - is aware of the need for lifelong learning and professional development

K_K2 - is aware of the limitations of science and technology related to chemical technology, including environmental protection

K_K4 - observes all rules of teamwork; is aware of the responsibility for joint ventures and achievements in professional work

K_K6 - can think and act in a creative and entrepreneurial way

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture - written/oral exam graded on the basis of a precent system (0-100%): 3 - 50.1%-70.0%; 4 - 70.1%-90.0%; 5 - min. 90.1%.

Laboratory - reports from laboratory exercises, oral/written answer, solving scientific problems, criterion: 3 - basic theoretical and practical knowledge, preparation skills concerning reports from laboratories, basic participation in theoretical and practical classes without additional involvement; 4 - practical preparation supported by theoretical knowledge, the ability to formulate the right conclusions from the data obtained during the laboratory, active participation in classes supported by the desire to acquire additional practical and theoretical knowledge; 5 - complete preparation for classes, the ability to draw conclusions at an advanced level, and also posed defense, preparation of project assumptions at a high substantive level and their presentation, precise execution of entrusted tasks, independent search additional theoretical knowledge, coordination of work in a research team, an ambitious approach to the subject matter.

Programme content

The lecures consist of two parts:

1. The first part of lectures (Monomer Technology) cover the following topics:

1.1. Raw materials for the petrochemical industry. Trends in petrochemical technology.

1.2. Thermal processes in the refinery and petrochemical industry. Olefin pyrolysis as a source of ethylene, propylene, C4 fraction and pyrolysis gasoline.

1.3. The catalytic processes in the refinery and petrochemical industry. Gasoline reforming as a source of benzene, toluene and xylenes.

1.4. Hydrogen sources. The hydrogenation and dehydrogenation process in the refinery industry.

1.4.1. Industrial production of cyclohexane.

1.4.2. Industrial production of styrene.

1.5. The role of dehydration processes for the technology obtaining monomers: ethylene, styrene, gasoline and olefins (Cenpes, Halcon, MTO, MTG).

1.6. Modern technologies for production of vinyl chloride and terephthalic acid.

2. The second part of lectures - The technology of fillers and additives.

2.1. Monomers, fillers and additives - definitions, classification and their use.

2.2. Silicon fillers - division, methods of preparation, change of hydrophilic-hydrophobic properties and their application.

2.3. Surface modification of inorganic systems.

2.4. Organic and inorganic pigments, with a particular focus on titanium dioxide production.

2.5. Types and mechanisms of action of flame retardant materials and aspects of their use.

Teaching methods

Lecture: multimedia presentation.

Laboratory - teaching materials for the laboratory in pdf files, practical exercises.

Bibliography

Basic

1. G. Wypych, Handbook of fillers, 3rd ed., ChemTec Publishing, Toronto 2010.

2. M. Xantos, Functional fillers for plastics, Wiley-VCH, New York 2010.

3. E.F. Vansant, P. van der Voort and K.C. Vrancken, Characterization and chemical modification of the silica surface, Elsevier, Amsterdam 1995.

4. J.A. Rodriguez, M. Fernandez-Garcia, Synthesis, properties and applications of oxide nanomaterials, John Wiley & Sons, New Jersey 2007.

5. A.W. Adamson, A.P., Gast, Physical chemistry of surface, John Wiley & Sons, Toronto 1997.

6. Ch. Kumar, Nanostructured oxides, Wiley-VCH, Weinheim 2009.

7. E. Grzywa, J.Molenda Technologia podstawowych syntez organicznych: Surowce do syntez Tom I, WNT, Warszawa 2015.

8. E. Grzywa, J.Molenda Technologia podstawowych syntez organicznych: Surowce do syntez Tom II, WNT, Warszawa 2015.

Additional

1. J. Szarawara, J. Piotrowski, Podstawy teoretyczne technologii chemicznej, WNT, Warszawa 2010.

2. G. Ertl, H. Knözinger, F. Schüth, J. Weitkamp, Handbook of heterogeneous catalysis, WILEY-VCH, Weinheim 2008.

3. K. Alejski, I. Miesiąc, K. Prochaska, M. Regel-Rosocka, A. Sobczyńska, J. Staniewski, K. Staszak, M. Staszak, M. Wiśniewski, Podstawy technologii chemicznej i inżynieria reaktorów. Część I i II. Pod redakcją M. Wiśniewskiego i K. Alejskiego, Wyd. Politechniki Poznańskiej, Poznań 2017.

4. Materiały laboratoryjne (opracowania ćwiczeń).

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,0
Classes requiring direct contact with the teacher	60	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam) [1]	30	1,0

[1] delete or add other activities as appropriate