# 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 chemiczna ogólna (General Chemical 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

20

Laboratory classes

20

Other (e.g. online)

Tutorials

0

Projects/seminars

0

## Number of credit points

5

## Lecturers

Responsible for the course/lecturer:

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Wydział Technologii Chemicznej

Instytut Technologii i Inżynierii Chemicznej

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Responsible for the course/lecturer:

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Instytut Technologii i Inżynierii Chemicznej

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## Prerequisites

A student has basic theoretical systematic knowledge of general and inorganic chemistry, organic and chemical technology.

A student has the ability to assess the technological suitability of raw material sources and the selection of the technological process in relation to the product quality requirements, as well as about the directions of development of the chemical industry in the country and in the world.

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. Selects methods and analytical techniques for process control and quality assessment of raw materials and products.

He can obtain information from the literature, databases, and other sources in English and to interpret the data obtained, draw conclusions and formulate and justify opinions.

A student understands the need for further education and improvement of his professional and personal competences, knows how to interact and work in a group, can think and act in a creative and entrepreneurial way.

## 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. Understanding the methods for obtaining of fillers and addivites and the possibilities of their using in polymers and other fields of technology. Ability to select chemical raw materials and semi-finished products used in polymer technology. Indication of the possibility of changing the surface properties of used fillers which improve their interaction with the polymer matrix.

## Course-related learning outcomes

### Knowledge

1. A student has knowledge of complex chemical processes involving selection of appropriate materials, raw materials, methods, techniques, apparatus and equipment for chemical processes and the characterization of the resulting products [K_W3].

2. A student has extended knowledge about the newest chemical technologies and problems of environmental protection resulting from chemical processes, he/she knows contemporary trends of development of industrial chemical processes [K_W6].

3. The graduate has well-established and expanded knowledge of chosen speciality [K_W11].

4. The graduate has extended knowledge of advanced devices and apparatus used in chemical technology [K_W13].

5. A student has knowledge of selected issues of modern chemical knowledge and aspects of copyright and industrial property [K_W14].

### Skills

1. The graduate can obtain the necessary information from literature, databases and other sources related to chemical sciences; correctly interprets them, draws conclusions, formulates and justifies opinions [K_U1].

2. A student is able to independently determine the directions of further education and implement self-education [K_U5].

3. The graduate is able to properly verify concepts of engineering solutions in relation to the state of knowledge in technology and chemical engineering [K_U11].

4. A student 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_U12].

5. A student is able to 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_U15].

6.The graduate has the ability to use the knowledge acquired under the specialty in professional activity [K_U23].

Social competences

1. The graduate understands the need for further training and raising their professional competences [K_K1].

2. The graduate is aware of the importance and understanding of non-technical aspects and effects of engineering activities, including its impact on the environment [K_K2].

3. A student observes all rules of teamwork; is aware of the responsibility for joint ventures and achievements in professional work [K_K4].

4.The graduate is able to think and act in a creative and entrepreneurial way [K_K6].

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. 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 - od 90.1%.

2. 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 lecture includes the following thematic topics:

1. Technological production of monomers.

2. Raw materials for the petrochemical industry.

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

4. The catalytic processes in the refinery and petrochemical industry. Gasoline reforming.

5. The dehydrogenation process in the refinery industry-industrial production of styrene.

6. Modern technologies for production of olefin, styrene,vinyl chloride and terephthalic acid.

7. Monomers, fillers and additives - definitions, division and application.

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

9. Methods of surface functionalization of inorganic materials to improve their adhesion with polymeric materials.

10. Inorganic pigments technology with particular emphasis on titanium dioxide production.

## 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, 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.

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, Wydawnictwo Politechniki Poznańskiej, Poznań 2017.

4. Laboratory materials.

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 125 | 5,0 |
| Classes requiring direct contact with the teacher | 60 | 2,4 |
| Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam) [1] | 65 | 2,6 |

[1] delete or add other activities as appropriate