COURSE DESCRIPTION CARD - SYLLABUS

Course name
Technology of monomers, fillers and additives [N2TCh2-TCO>TM,NiŚP]

Course

Field of study
Chemical Technology

Year/Semester
1/1

Area of study (specialization)
General Chemical Technology

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
20

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

none

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 - Stationary form - the knowledge acquired during the lecture is verified in the form of a written exam after the completed cycle of lectures (thematic topics: 1-6 - I part of the exam, thematic topics: 7-10 - II part of the exam). The condition for passing the course is obtaining a positive grade for each part of the lecture. The exam of each thematic topics consists of 3-5 open questions. Online form - the knowledge acquired during the lecture of thematic topics is verified in the form of a written exam after the completed cycle of lectures via the eKursy platform. The exam includes 3-5 open questions (for each part) that students answer in the "live view" mode with the webcam turned on via the eMeeting or Zoom platforms, or 10-20 opened and closed test questions (single and multiple choice) for each part, to which students answer using the test module on the eKursy platform. Grade 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%.
2. Laboratory: Stationary form - oral answer or written test (3-5 questions) from the material contained in the exercises and the given theoretical issues; presence and realization of all laboratory exercises provided in the study program; grade from reports prepared after each exercise. A final grade will be given based on the average grades of the oral/written answers and reports for each exercise, divided by the number of exercises performed. Online form - oral answer and/or written test (10-20 closed, multiple choice test questions) from the material contained in the exercises, tutorial videos and the theoretical issues provided, conducted in the "live view" mode with the webcam turned on via eMeeting or Zoom platform during a direct conversation with the teacher and/or using the test module on the eKursy platform; online presence and completion of all laboratory exercises provided in the study program; grade from the reports prepared after each exercise and sent via the eKursy platform or by

email using the university's e-mail system. A final grade will be given based on the average grade of the oral/written answers and reports for each exercise, divided by the number of exercises performed. Grade 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%.

Programme content

Issues in monomer, filler and auxiliary agent technology.

Course topics

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, tutorial videos on the eKursy platform.

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	5,00
Classes requiring direct contact with the teacher	44	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	81	3,00