COURSE DESCRIPTION CARD - SYLLABUS

Course name
Inorganic chemical technology - methods for inorganic matrix modification [S1IFar1>TCNmmmn]

Course

Field of study
Pharmaceutical Engineering

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
0

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Student has knowledge of general and inorganic chemistry, physical chemistry and apparatus of chemical industry, knows the basic methods, techniques and tools used in chemical analysis (core curriculum of I and II year of the studies). Student can obtain information from literature, databases and other sources, can interpret the obtained information to draw conclusions and formulate opinions in the area of general and inorganic chemistry. Student is able to apply that knowledge in practice, both during the implementation work and the further education. Student is able to interact and work in a group. Student is able to properly identify the priorities used to perform a specific task. Student understands the need for further education.

Course objective

Acquiring basic knowledge in the field of inorganic materials technology. Understanding the basic industrial processes and operations related to the technology of materials dedicated to pharmaceutical applications. Ability to select / select chemical raw materials and intermediates. Understanding the methods of obtaining and modifying inorganic products that may find potential application in pharmacy, and identifying them. Indication of the possibility of using products manufactured in inorganic technology processes. The ability to create modern methods for the synthesis of inorganic materials.

Course-related learning outcomes

Knowledge:
k_w1 - has stuctured general knowledge in the field of inorganic chemical technology as a field directly related to pharmaceutical engineering
k_w4 - has structured, theoretically founded general knowledge in inorganic chemistry and inorganic chemical technology enabling understanding, description and investigation of chemical phenomena and processes related to pharmaceutical engineering
k_w8 - knows the rules of environmental protection related to pharmaceutical technology and waste management, has the necessary knowledge about the risks associated with the implementation of chemical and pharmaceutical processes
k_w11 - knows the basics of kinetics, thermodynamics and catalysis of chemical processes
k_w13 - has knowledge of natural and synthetic raw materials, products and processes used in the pharmaceutical industry
k_w24 - has basic knowledge in the field of methods of searching for new substances used in pharmacy, including inorganic supports of farmaceutically active substances, and techniques used to characterize them with respect to physicochemical properties

Skills:
k_u1 - is able to obtain information from literature, databases and other sources related to inorganic chemical technology, also in a foreign language, integrate them, interpret and draw conclusions and formulate opinions
k_u2 - based on general knowledge, explains the basic phenomena associated with relevant processes, distinguishes between types of chemical reactions and has the ability to select them for chemical processes, can characterize various states of matter, structure of chemical compounds, using theories used to describe them, experimental methods and techniques
k_u3 - uses chemical and pharmaceutical terminology and chemical nomenclature correctly, also in a foreign language
k_u24 - has the ability to self-study

Social competences:
k_k1 - is ready to critically assess his knowledge, understands the need for further training, supplementing specialization knowledge and raising his professional, personal and social competences, understands the importance of knowledge in solving problems.
k_k2 - can interact and work in a group.
k_k3 - is aware of the importance of non-technical aspects and effects of engineering activities, including their impact on the environment and the associated responsibility for the decisions taken.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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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 e-

mail 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

• Basic processes and operations of inorganic technology
- adsorption of functional dyes on the surface of materials of biological origin
- immobilization of enzymes on the surface of selected materials of biological origin and inorganic supports
- spray drying of materials dedicated for pharmaceutical applications
• Methods for functionalizing the surface of inorganic materials used in pharmacy
- sol-gel process
- solvent method
• Methods of synthesis of inorganic materials used in pharmacy
- synthesis and characterization of hydroxyapatit

Teaching methods

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

Bibliography

Basic
1. K. Schmidt-Szałowski, J. Sentek, J. Raabe, E. Bobryk, Podstawy technologii chemicznej. Procesy w przemyśle nieorganicznym, Oficyna Wydawnicza Politechniki Warszawskiej Warszawa 2004
2. Jess Andreas, Chemical Technology: An Integral Textbook, Wiley 2012, ISBN13 (EAN): 9783527304462, ISBN10: 3527304460.
3. Moulijn Jacob A., Chemical Process Technology, Wiley-Blackwell 2013, ISBN13 (EAN): 9781444320251, ISBN10: 1444320254.
4. E.F. Vansant, P. van der Voort and K.C. Vrancken, Characterization and chemical modification of the silica surface, Elsevier, Amsterdam 1995
5. J.A. Rodriguez, M. Fernandez-Garcia, Synthesis, properties and applications of oxide nanomaterials, John Wiley & Sons, New Jersey 2007
6. A.W. Adamson, A.P., Gast, Physical chemistry of surface, John Wiley & Sons, Toronto 1997
7. Ch. Kumar, Nanostructured oxides, Wiley-VCH, Weinheim 2009
8. Katja A. Strohfeldt (2015) Essentials of Inorganic Chemistry: For Students of Pharmacy, Pharmaceutical Sciences and Medicinal Chemistry; Wiley
9. Costas, Demestos (2016) Pharmaceutical Nanotechnology: Fundamentals and Practical Applications, Springer
Additional
1. G. Wypych, Handbook of fillers, 3rd ed., ChemTec Publishing, Toronto 2010
2. M. Xantos, Functional fillers for plastics, Wiley-VCH, New York 2011
3. Padma V. Devarajan, Sanyog Jain, Targeted Drug Delivery : Concepts and Design, Springer 2015
4. Nelson Duran, Silvia S. Guterres, Ostwaldo L. Alves, Nanotoxicology: materials, methodology and assessments. Springer 2014
5. Vijay K. Thakur, Manju K. Thakur, Michael R. Kessler, Handbook of Composites from Renewable Materials, Wiley 2017
6. Hermann Ehrlich, Extreme Biomimetics, Springer 2017
7. Scott E. McNeil, Characterization of Nanoparticles Intended for Drug Delivery, Springer 2011

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	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)	25	1,00