COURSE DESCRIPTION CARD - SYLLABUS

Course name
Composites

Course

Field of study
Chemical and process engineering

Year/Semester
2/3

Area of study (specialization)
Bioprocesses and biomaterials engineering

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	15	
Tutorials	Projects/seminars	

Number of credit points

6

Lecturers

Responsible for the course/lecturer:
Mariola Sądej, PhD, MSc

Responsible for the course/lecturer:
Jakub Zdarta, PhD, MSc

Prerequisites

Knowledge of basic chemistry, organic chemistry and inorganic chemistry as well as knowledge and skills in the field of chemical technology and polymer technology.

Course objective

To get a theoretical and practical knowledge about the production and properties of polymeric and inorganic composites, as well as use of organic and inorganic fillers. Understanding of the basic industrial processes and operations related to the prudction technology and the characteristics of composite materials. Ability to select raw materials and precursors for synthesis of a desired systems. Strengthening knowledge through practical exercises.

Course-related learning outcomes

Knowledge

K_W04. The student has knowledge about complex chemical processes, including the appropriate selection of materials, raw materials, apparatus and equipment for the implementation of chemical processes and characterization of the products obtained.

K_W07. The student has knowledge of the novel chemical and material technologies, including technologies of advanced materials and nanomaterials, knows the current trends in the development of chemical industrial processes

K_W08. The student knows modern methods of testing the structure and properties of materials, necessary to characterize raw materials and products of the chemical and related industries.

Skills

K_U02. The student has the ability to work in a team and lead a team.

K_U06. The student has the ability to present research results in the form of a report, dissertation or presentation.

K_U11. The student has the ability to adapt knowledge in chemistry and related fields to solve technological problems and to plan new industrial processes, not only chemical

K_U18. The student is able to critically evaluate the results of experimental research and determine the direction of further research leading to solving problems in the field of chemical engineering, process equipment and industrial technologies.

Social competences

K_K01. The student understands the need for lifelong learning; can inspire and organize the learning process of others; is aware of the importance and non-technical aspects and effects of engineering activities, including its impact on the environment, and the associated responsibility for the decisions taken.

K_K03. The student is able to interact and work in a group, taking on different roles.

K_K07. The student is aware of the social role of a technical university graduate, and in particular understands the need to formulate and convey to the public, in particular through the mass media, information and opinions on the achievements of technology and other aspects of engineering activities; endeavors to provide such information in a manner that is universally understandable and gives reasons for different points of view.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Final exam related to the content of the lecture. Reports after laboratory exercises.

Programme content

Lectures include:

Inorganic matrix composites: general information on inorganic composite materials; review of methods of obtaining of inorganic composite systems; surface functionalization of composite oxide materials; physicochemical, dispersion and morphological characteristics of composite oxide systems and their derivatives; oxide composites with defined properties for use in various processes; directions of use of advanced powder substances.

Polymer matrix composites: basic information on polymer composites - definition and components as well as used precursors; methods of strengthening polymers; preparation and types of composites and their characteristics; methods of synthesis of polymer composites; nanocomposites; differences in the structure and properties of composites and nanocomposites; physical, chemical and mechanical properties of (nano) composites, their processing and recycling; application of (nano) polymer composites with particular emphasis on composites in medicine and dentistry; basic information about development trends in the field of synthesis of composite materials.

Laboratory exercises include:

Inorganic matrix composites: preparation of composite oxide materials, physicochemical and dispersion characteristics of composite oxide systems and their derivatives, methods of surface functionalization of hybrid oxide materials, colorimetric characteristization of pigment systems, determination of sorption properties of oxide systems.

Polymer-based composites: curing dental composites, obtaining and testing the physicochemical and mechanical properties of composite materials used in medicine; identification of composite materials and fillers used.

Teaching methods

Lectures, laboratory excercises.

Bibliography

Basic

1. A. Boczkowska, J. Kapuściński, Z. Lindemann, D. Witemberg-Perzyk, S. Wojciechowski, Kompozyty, Oficyna Wydawnicza Politechniki Warszawskiej, 2003.

2. G. Wypych, Handbook of fillers, ChemTec Publishing, 2010.

3. G. Wilde, Nanostructured Materials, Elsevier, 2009.

4. E.F. Vansant, P. Van Der Voort, K.C. Vrancken, Characterization and Chemical Modification of the Silica Surface, Elsevier, 1997.

Additional

1. Research artciles related to the topic of course.

2. A. Jess, Chemical Technology: An Integral Textbook, Wiley VCH, 2012.

3. J.A. Moulijn, Chemical Process Technology, Wiley VCH, 2013.

Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,0
Classes requiring direct contact with the teacher	90	4,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam) [1]	60	2,0

[1] delete or add other activities as appropriate