COURSE DESCRIPTION CARD - SYLLABUS

Course name
Engineering of nanoporous materials [S2TCh2E-KiN>IMN]

Course

Field of study
Chemical Technology

Year/Semester
1/2

Area of study (specialization)
Composites and Nanomaterials

Profile of study
general academic

Level of study
second-cycle

Course offered in
english

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

A student starting this subject should have the knowledge of the subjects included in the programme of the first-cycle studies, i.e. a basic knowledge in the field of mathematics, physics and chemistry, chemical technology and chemical engineering in order to understand and interpret physical phenomena as well as processes occurring in porous materials. A student should also have the ability to obtain information from different sources, self-study, work individually and in a team, as well as to plan and carry out experiments including interpretation of results and conclusions.

Course objective

The aim of the course is to give students the basic knowledge of engineering of different porous materials with a focus on nanoporous materials in the field of structure and properties study, functional features and possibilities of practical application of various porous bodies.

Course-related learning outcomes

Knowledge:
1. A student demonstrates a basic knowledge of the characteristics, structure parameters, classification and application of porous materials (including nanomaterials) as well as is able to analyse and determine

their various properties.
K_W7
2. A student has knowledge of the different methods used in determination of porous materials (including nanoporous materials), understands phenomena, processes and related laws with porous media and can name them correctly.
K_W4, K_W11
3. A student is familiar with basic functioning of control-measurement systems and apparatus used in the study of porous materials.
K_W13

Skills:
1. A student is able to analyse porous materials (including nanomaterials) by using adequate techniques and apparatus, and also has raporting ability.
K_U6, K_U18, K_U23
2. A student is able to choose the right way to solve simple engineering tasks related to chemical and process engineering of porous materials.
K_U12

Social competences:
1. A student is aware of the need for lifelong learning and continuous professional development.
K_K1
2. A student is aware of the responsibility for teamwork tasks.
K_K4

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Stationary classes: knowledge acquired during the lectures is verified on the basis of a written exam consisting of closed and open tasks differently scored. Passing threshold: 51 % of points. Knowledge and skills acquired during the laboratory classes are verified on the basis of short tests. Passing threshold: 51 % of points.
On-line classes: knowledge acquired during the on-line lectures is verified on the basis of the on-line final test consisting of closed and open tasks differently scored. Passing threshold: 51 % of points. Knowledge and skills acquired during the on-line laboratory classes are verified on the basis of short on-line tests. Passing threshold: 51 % of points.
In both cases, the points are converted into the final grade:
5.0 90-100 %
4.5 81-89 %
4.0 71-80 %
3.5 61-70 %
3.0 51-60 %
2.0 < 51 %

Programme content

The issue of the course includes the fundamental understanding of structure-property relations of nanostructures in terms of specific properties, applications and design. The scope of the subject involves issues related to the structure of different porous materials, methods of structure testing and determination (including apparatus), saturation processes, sorption and desorption isotherms, extraction of substances from porous materials, the issue of specific surface area, permeability, diffusion, heat transfer in porous media, capillary phenomena, filtration as well as classification and practical application of porous bodies (including nanoporous materials).

Teaching methods

1. Lecture: a multimedia presentation illustrated with examples given on the blackboard by the teacher.
2. Laboratory classes: performing of tasks given by the teacher - practical exercises based on theoretical base for the exercises.

Bibliography

Basic:
1. Engineering of porous materials, Banaszak, J., Poznan University of Technology: Poznan, 2005 (in Polish).
2. Engineering of porous materials, Kowalski, S.J., Poznan University of Technology: Poznan, 2004 (in Polish).
3. Handbook of porous media, Second Edition, Kambiz, V., CRC Press: Boca Raton, 2005.
4. Mechanics and Physics of Porous Solids, Coussy,O., John Wiley & Sons: Chichaster, 2010.
5. The physics of flow through porous media, Scheidegger, A.E., University of Toronto Press, 1974.

Additional:
1. Nanoporous Materials: Science and Engineering, Lu, G.Q., Zhao, X.S., World Scientific: Singapore, 2004.
2. Mass movement in porous bodies, Aksielrud, G.A., Altszuler, M.A., WNT: Warsaw, 1987 (in Polish).
3. Mechanical properties of matter, Cottrell, A.H., PWN: Warsaw, 1970 (in Polish).

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	50	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	50	2,00