COURSE DESCRIPTION CARD - SYLLABUS

Course name
Advanced drying techniques of materials and biomaterials [S2IChiP1-IBiB>ZTSMiB]

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

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
15

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

The student should know the basics of simultaneous heat and mass transfer. The student should know the basics of engineering graphics. The student should know the basic chemical apparatus. The student should use English. The student should be able to implement self-education. The student should understand the need for further self-learning and learning of other people (students).

Course objective

Mastering knowledge of advanced drying techniques for various materials. Based on this knowledge, acquiring the ability to choose the right drying technique suitable for both the dried material and matched to the technological lines. Knowledge of the use of renewable energy in drying processes.

Course-related learning outcomes

Knowledge:
1. student has knowledge of transport phenomena during the drying process. - [k_w02, k_w12]

2. student has knowledge of advanced drying techniques for various materials. - [k_w04, k_w12]
3. student has knowledge of new development trends in drying techniques. - [k_w04, k_w07, k_w12]
4. student has knowledge of pro-ecological solutions in drying techniques. - [k_w09, k_w12]

Skills:
1. student has the ability to select the appropriate drying technique for various dried materials. - [k_u13, k_u14, k_u20]
2. student has the ability to use renewable energy sources in the drying technique. - [k_u12]
3. student has the ability to use energy and drying medium recycling in the drying technique. - [k_u12, k_u13]
4. student has the ability to design and conduct experimental drying tests. - [k_u18]
5. the student has the ability to use specialized english. - [k_u03]

Social competences:
1. the student understands the need for self-education and raising their professional competences. - [k_k01]
2. the student is aware of compliance with the principles of engineering ethics in a broad sense. - [k_k02, k_k05]
3. student is able to interact and work in a group, taking on different roles in it. - [k_k03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
The skills acquired during the project classes are verified on the basis of the project made in teams and oral answers to questions about the project.
The lectures end with a written test concerning the mastery and understanding of the entire material and the ability to draw conclusions from this knowledge. The test consists of 3-4 open issues.
If it is necessary to take a remote exam, it will be conducted in the form of an oral exam on the above issues.

Programme content

The course covers advanced drying techniques for various materials. The impact of applied techniques and drying conditions on the process kinetics and quality of obtained products is discussed. Particular attention is paid to the use of renewable energy and the recycling of energy and drying agent in drying techniques.
In particular, the following are discussed:
basic definitions, drying history, energy consumption during the process, humidity contained in the material, moist air thermodynamics;
division of drying techniques, drying kinetics,
solar drying as a technique using renewable energy;
individual advanced drying techniques with an indication of their current development (drying of a layer of material, drum, fluidization, fountain, jet, spray, using inert particles, contact, cylindrical, plate, vacuum, radiation, dielectric, microwave and using ultrasound drying).

Teaching methods

lecture, project

Bibliography

Basic
1. Handbook of Industrial Drying, pod. red. Mujumdar A.S, wyd. 3, CRC Press 2006
2. Kudra T., Mujumdar A.S., Advanced Drying Technologies, wyd. 2, CRC Press 2009
3. Strumiłło, Cz., Podstawy teorii i techniki suszenia, wyd. 2, WNT 1983
4. Vandt Land C.M., 2012, Drying in the Process Industry, John Wiley & Sons Inc., Hoboken, New Jersey
5. Musielak G. Zaawansowane techniki suszenia, Wyd. Politechniki Poznańskiej, Poznań 2013
Additional
1. Kowalski S.J., Rajewska K., Rybicki A., Fizyczne podstawy suszenia mikrofalowego, Wyd. PP 2005
2. Oetjen G-W., Haseley P., Freeze-Drying, wyd. 2, WILEY-VCH Verlag 2004

3. Brosnan D.A., Robinson G.C., Introduction to Drying of Ceramics with laboratory Exercises, The American Ceramic Society 2003
4. Biskupski M., Łysiak J., Strutyńska K., Tkaczyk R., 1972, Suszarnie zbożowe i urządzenia do aktywnego wietrzenia. WNT Warszawa
5. Spray Drying Technology, ed. Woo M.W., Mujumdar A.S., Daud W.R.W.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00