COURSE DESCRIPTION CARD - SYLLABUS

Course name
Physicochemical methods in the identification of chemical compounds [S1TOZ1>MFwIZC]

Course

Field of study
Circular System Technologies

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

dr hab. inż. Beata Strzemiecka
beata.strzemiecka@put.poznan.pl

Lecturers

Prerequisites

Knowledge in the field of physical chemistry, organic chemistry, basics of analytical chemistry, basics of chemical apparatus, mathematics, the ability to solve elementary problems in general and instrumental chemistry based on the acquired knowledge, the ability to obtain information from indicated sources in Polish and a foreign language, understand the need for training, understanding the need to expand one"s competences, willingness to cooperate within the team

Course objective

Provide students with basic knowledge of techniques and methods of analysis as well as the characteristics of various chemical compounds with different physical states and purity. Acquainting students with UV, IR, NMR and MS spectroscopic methods, methods of studying the surface of solids (IGC, ATR-FTIR, XPS, ToF-SIMS, ICP), imaging methods (SEM, TEM, AFM), methods of thermal analysis (TG, DSC), particle size tests. During the laboratory classes, students will learn how to properly prepare samples for testing with various techniques and perform measurements using various instrumental techniques (UV, IR, IGC). They will interpret the spectra and the results of the imaging methods. Familiarizing students with good practices when conducting physicochemical analyzes.

Course-related learning outcomes

Knowledge:
k_w11, p6s_wg - has knowledge of techniques, methods of identification and characterization of main and by-products in circular system technologies

Skills:
k_u01, p6s_uw - can obtain information from literature, databases and other sources related to circular system technologies, also in a foreign language, integrate them, interpret them, draw conclusions and formulate opinions
k_u03, p6s_uw - plans, selects equipment and scientific apparatus, performs research and analyzes the results and draws conclusions
k_u04, p6s_uu - has the ability to self-educate, is able to use source information in polish and a foreign language in accordance with the principles of ethics, reads with understanding, conducts analyzes, syntheses, summaries, critical assessments and correct conclusions
k_u05, p6s_uw, p6s_uk - correctly uses in the discussion and properly uses nomenclature and terminology in the field of circular economy, chemistry, technology and chemical engineering, environmental protection and related disciplines, also in a foreign language
k_u08, ps6_uo - can plan and organize work individually and in a team
k_u09, ps6_uo - can interact with other people as part of work on circular system technology and of an interdisciplinary nature
k_u10, p6s_uw - selects methods of process control and quality assessment of raw materials, products and waste
k_u13, p6s_uw - selects analytical methods suitable for the qualitative and quantitative determination of chemical compounds
k_u15, p6s_uw - based on the acquired knowledge, can develop an independent or team project/report on the work performed and make its multimedia presentation

Social competences:
k_k01, p6s_kr - behaves professionally in every situation, takes responsibility for decisions made in connection with professional duties, acts in accordance with moral principles and the principles of professional ethics
k_k02, p6s_kr - shows independence and inventiveness in individual work, and effectively works in a team, playing various roles in it; objectively assesses the effects of his own work and that of team members
k_k04, p6s_kr, p6s_kk - cares about the safety of his own and others" work, applies appropriate procedures and rules in emergencies
k_k05, p6s_kk - objectively assesses the level of his knowledge and skills, understands the importance of improving professional and personal competences adequately to changing social conditions and the progress of science
k_k07, p6s_kk - shows care and full responsibility for the specialist equipment entrusted to him for testing
k_k08, p6s_kk, p6s_ko, p6s_kr - participates in discussions and is able to conduct discussions, is open to different opinions and ready to assertively express feelings and critical comments

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: evaluation work
Laboratories: oral and written test before each class, exercise reports

Programme content

Techniques and methods of analysis as well as the characteristics of various chemical compounds.

Course topics

The lecture includes familiarizing students with the following content:
1. Spectroscopic techniques (IR, Raman, UV-VIS, NMR, MS).
2. Techniques for examining the surface of solids (XPS, IGC, ToF SIMS, ICP).
3. Imaging techniques (SEM, TEM, AFM).

During the laboratories, students become familiar with the IR technique (two classes), UV and NMR techniques. They learn how to properly prepare samples to perform spectra using particular techniques, as well as how to prepare the spectrum itself and how to interpret it. Before taking spectra using particular techniques, students pass a test of theoretical knowledge regarding a given technique.

Teaching methods

Lecture, discussion, practical exercises

Bibliography

Basic
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3. A. Voelkel, K. Bielicka-Daszkiewicz, K. Milczewska (Ed.) "Applications of chromatographic techniques", PP Publishing House, Poznań 2005, in Polish.
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8. R.W. Kelsall, I.W. Hamley, M. Geoghegan: Nanotechnologie, Warszawa: Wydawnictwo Naukowe PWN, 2008. ISBN 978-83-01-15537-7.
9. Klein, Tobias; Buhr, Egbert; Frase, Carl G. (2012). TSEM: A Review of Scanning Electron Microscopy in Transmission Mode and Its Applications. Advances in Imaging and Electron Physics. 171. pp. 297–356. doi:10.1016/B978-0-12-394297-5.00006-4. ISBN 9780123942975.
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Additional
1. L.A. Kazicyna, N.B. Kupletska, "Spectroscopic methods for determining the structure of organic compounds", PWN, Warsaw, 1989, in Polish.
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Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	65	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	35	1,50