

Nazwa w jęz. angielskim: Characterization of chemical structures

Dane dotyczące zajęć:  
Information on course:

Jednostka oferująca: Wydział Chemiczny // dr hab. inż. Nikodem Kuźnik, prof. PŚ  
Course offered by: Faculty of Chemistry // dr hab. inż. Nikodem Kuźnik, prof. PŚ

<b>Język wykładowy:</b>
angielski
<b>Language:</b>
English
<b>Strona WWW: Course homepage:</b>
<b>Skrócony opis:</b>
<b>Short description:</b>
To teach fundamentals of most important instrumental techniques destined to determination of structure of chemical compounds and properties of materials
<b>Opis:</b>
<b>Description:</b>
<b>Lectures (30 h/sem):</b> - detailed programme's content: Backgrounds of nuclear magnetic resonance (NMR), scheme of spectrometer system, techniques <sup>1</sup> H and <sup>13</sup> C NMR. Qualitative and quantitative analysis. Exemplary NMR spectra. <sup>19</sup> F and <sup>31</sup> P NMR spectra. NMR of polymers. Mass spectrometry (MS): scheme of apparatus, ionization techniques, ion fragmentation. Exemplary solving of MS spectra. Chromatography – theoretical background. Gaseous chromatography (GC), high performance liquid chromatography (HPLC, UPLC), thin layer chromatography (TLC). Apparatus construction, theoretical backgrounds, selection of analysis conditions. IR and UV-Vis spectroscopy. Theoretical backgrounds, examples of spectrum analysis. DSC/DMTA techniques in the study of polymeric materials, XPS, SERS, ellipsometry, contact angle measurements, STM, AFM, SEM, TEM - applications for the study of nano-materials. X-ray diffraction on single crystals. Discussion of the phenomenon and application in the study of the structure of crystal bodies. Elements of quantitative and qualitative analysis of polycrystals. - teaching methods, including distance learning: The lecture is performed in the form of an interactive presentation. - form and criteria for semester completion, including retake tests, as well as conditions for admission to the examination: The material from the lecture is the basis for preparation for laboratory classes. Completing the material presented in the lectures is therefore done in the laboratory. - course organisation and rules of participation in the course, with an indication whether a student's attendance is obligatory Lectures are performed according to the schedule published during the first lecture and on the Remote Education Platform. In accordance with the study regulations, lectures are open and not obligatory.
<b>Laboratory (45 h/sem):</b> - detailed programme's content:

Qualitative and quantitative <sup>1</sup>H NMR analysis. Interpretation of <sup>1</sup>H and <sup>13</sup>C NMR spectra. Mass spectrometry (MS): sample preparation, analysis, interpretation of fragmentation spectra. GC, HPLC and UPLC chromatography. Discussion of the technique, sample preparation, chromatogram analysis. IR and UV-Vis spectroscopy. Sample preparation, analysis, interpretation of spectra. DSC / DMTA techniques in the study of polymeric materials. Examination of material surfaces using spectroscopic (XPS, SERS) and microscopic (STM) techniques - chemical composition and morphology analysis. Sample preparation, measurement, interpretation of obtained results. Structural x-ray analysis - sample preparation, stages of measurement, structure analysis. - teaching methods, including distance learning: Practical laboratory - getting acquainted with the technique by visiting the laboratory, preparing samples for analysis, taking measurements and analyzing the results obtained. - form and criteria for semester completion, including retake tests, as well as conditions for admission to the examination:

The semester completion is based on partial credits from laboratory classes. Positive grades from all laboratory

classes are required to pass the course. There are three deadlines for passing laboratory classes.

- course organisation and rules of participation in the course, with an indication whether a student's attendance is obligatory

Laboratory classes are conducted according to the schedule published during the first lecture and on the Remote Education Platform. In accordance with the study regulations, laboratory classes are compulsory.

Number of course hours regardless of a teaching mode 75 h/3 ECTS

Student's work: preparation for a course 30 h/1 ECTS

Student's work: interpretation of results 30 h/1 ECTS

Total hours: 135 h

#### **Number of ECTS credits allocated to a course 5**

Summary indexes:

- number of course hours and ECTS credits at the course with a direct participation of academic teachers or other persons running the

course and supervising students; 75/3

- number of course hours and ECTS credits at the course related to the scientific activity conducted at the Silesian University of

Technology in a discipline or in disciplines to which a field of study is assigned - in the case of studies with a general academic profile; 75/3

- number of course hours and ECTS credits at the course developing practical skills- in the case of practical studies; 0

- number of course hours conducted by academic teachers employed by the Silesian University of Technology as their primary workplace.75

#### **Literatura:**

#### **Bibliography:**

1. R. S. Macomber, A complete introduction to modern NMR spectroscopy, New York : John Wiley & Sons, 1998
2. R. M. Silverstein, F. X. Webster, D. J. Kiemle, D. L. Bryce, Spectrometric Identification of Organic Compounds, New York : John Wiley & Sons
3. B. Schrader, Infrared and Raman spectroscopy: methods and applications, Weinheim: VCH Verlagsgesellschaft, 1995.
4. H. Gunther, NMR spectroscopy : basic principles, concepts, and applications in chemistry, Chichester : John Wiley & Sons, 1998.
5. M. F. Ladd, R. A. Palmer, Structure determination by X-ray crystallography, New York : Plenum Press, 1994
6. G. Schomburg, Gas chromatography : a practical course, Weinheim : VCH, 1990.
7. Kromidas, HPLC made to measure : a practical handbook for optimization, Weinheim : Wiley-VCH, 2006.

#### **Efekty uczenia się:**

**Learning outcomes:**

Knowledge: a student knows and understands

K2A\_W08 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; knows the rules of organization of the chemical products market (REACH).

Skills: a student can

K2A\_U03 Student is able to speak English fluently.

K2A\_U01 Student has the ability to acquire and critically evaluate information from literature, databases and other sources and to form opinions and reports on this basis.

K2A\_U06 Student has the ability to present research results in the form of a report, dissertation or presentation.

Social competences: a student is prepared to

K2A\_K06 Student is aware of the need for lifelong learning and professional development.

**Metody i kryteria oceniania:****Assessment methods and assessment criteria:**

The final grade is the arithmetic average of the laboratory grades. Lectures are substantive preparation for laboratory classes, therefore this knowledge is verified at the stage of the laboratory test.

**Przynależność do grup przedmiotów w cyklach:****Element of course groups in various terms:**

Opis grupy przedmiotów Course group description	Cykl pocz. First term	Cykl kon. Last term
przedmioty obieralne studia stacjonarne i niestacjonarne stopień studiów – dowolny kierunek studiów – dowolny, semestr dowolny  elective courses full-time and part-time studies degree - any field of study - any semester - any	2023/2024	