COURSE DESCRIPTION CARD - SYLLABUS

Course name
Advanced analytical methods [S1Bioinf1>ZMA]

Course

Field of study
Bioinformatics

Year/Semester
4/7

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
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

basic knowledge of chemistry, chemical analysis

Course objective

Provide students with basic knowledge of techniques and methods of analysis and the characteristics of biomolecules. Acquainting students with UV, IR, NMR and MS spectroscopic methods, as well as combined techniques: GC-MS, GC-MS/MS, GC/GC-MS, GC-IR, HPLC-MS, HPLC-MS/MS, HPLC- UV, NMR 2D and 3D. To acquaint students with the methods of testing the surface of solids (IGC, ATR-FTIR, XPS, ToF-SIMS, ICP), imaging methods (SEM, TEM, AFM), thermal analysis methods (TG, DSC), and particle size testing. During the laboratory classes students will learn how to properly prepare samples for testing with various techniques and perform measurements using various instrumental techniques (IGC, HPLC-UV, IR, GC, GC-MS). They will interpret the spectra and other obtained results (e.g. chromatograms, surface activity of pharmaceuticals). To acquaint students with good practices when conducting qualitative and quantitative analysis and physicochemical analysis of the surface of solids.

Course-related learning outcomes

Knowledge:

K_W19 - techniques and methods for the identification of biomolecules and biologically active compounds

Skills:
K_U01 - obtain information from literature, databases and other properly selected sources, also in English
K_U02 - integrate and interpret the information obtained, as well as draw conclusions and formulate and justify your opinions
K_U04 - use analytical methods for quantitative and qualitative determination of biochemical compounds, evaluate their suitability
K_U10 - use a language adequate to the undertaken scientific discussions in communication with various environments
K_U12 - use English at B2 level in the field of technical and natural sciences, in particular computer science and biology
K_U16 - independently acquire knowledge and improve their qualifications
K_U17 - start working in the enterprise, individually and in a team, plan and organize individual and team work, follow the safety rules related to this work

Social competences:
K_K01 - lifelong learning and improving one"s competences
K_K02 - cooperation and work in a group, assuming different roles in it
K_K04 - identifying and resolving ethical dilemmas related to the performance of the profession
K_K05 - taking responsibility for the decisions made
K_K06 - taking responsibility for the safety of their own work and that of others; taking appropriate actions in emergency situations
K_K07 - thinking and acting in an entrepreneurial way
K_K08 - fulfilling the social role of a university graduate

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

none

Course topics

During the lecture, students will become familiar with the following techniques for analyzing chemical compounds:
1. Spectroscopic techniques (IR, Raman, UV-VIS, NMR, MS)
2. Chromatographic techniques with particular emphasis on combined techniques (GC-MS, HPLC-MS, GC-FTIR, HPLC-FTIR)
3. Techniques for testing the surface of solids (XPS, IGC, ToF SIMS, ICP).
4. Imaging techniques (SEM, TEM, AFM).
During laboratory classes, students perform IR, UV and NMR spectra and perform analysis using liquid and gas chromatography techniques.

Teaching methods

lecture, discussion, practical exercises

Bibliography

Basic
1. Robert M.Silverstein, Francis X. Webster, David J. Kiemle "Spectroscopic methods for the identification of organic compounds", Polish Scientific Publishers PWN 2007, in Polish or in English.
2. The essence of chromatography, C.F. Poole, Elsevier, Amsterdam, 2003

Additional
1. B. Strzemiecka, A. Voelkel, J. Donate-Robles,J.M. Martín-Martínez, Assessment of the surface chemistry of carbon blacks by TGA-MS, XPS and inverse gas chromatography using statistical chemometric analysis, Applied Surface Science, 316 (2014) 315-323.
2. B. Strzemiecka, A. Voelkel, J. Zięba-Palus, T. Lachowicz, Assessment of the chemical changes during storage ofphenol-formaldehyde resins pyrolysis gas chromatography mass spectrometry, inverse gas chromatography and Fourier transform infra red methods, 1359 (2014) 255-261.
3. A.Voelkel, B. Strzemiecka, K. Adamska, K. Milczewska, Inverse gas chromatography as a source of physicochemical data, J. Chromatogr. A, 1216 (2009) 1551-1566.
4. A.Voelkel, H. Grajek, B. Strzemiecka, K. Adamska, New Essential Events in Modern Applications of Inverse Gas Chromatography, Analytical Separation Science, First Edition by J.L. Anderson, A. Berthod, V.P. Esteves, A.M. Stalcup, Wiley VCH Verlag GmbH & Co., KGaA, 2015, chapter 8, pp. 979-997.
5. "Introduction to Electron Microscopy" (PDF). FEI Company. p. 15. Retrieved 12 December 2012.
6. witryna internetowa: https://science.howstuffworks.com/scanning-electron-microscope2.html

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