COURSE DESCRIPTION CARD - SYLLABUS

Course name
Advanced analytical methods [S2Bioinf1>ZMA]

Course

Field of study
Bioinformatics

Year/Semester
1/1

Area of study (specialization)
–

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
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

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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_W04 - methods, techniques and tools used in the process of solving complex bioinformatics tasks, mainly of engineering nature

Skills:
K_U01 - fluently use and integrate information from literature and electronic sources, in Polish and English, interpret and critically evaluate them
K_U02 - draw conclusions, clearly formulate and fully justify opinions based on data from various sources
K_U03 - carry out advanced measurements and laboratory experiments, and interpret their results
K_U09 - prepare a presentation of research results in Polish and English, and discuss the results with a scientific community
K_U11 - use English at the B2+ level in technical and natural sciences, particularly in computer science and biology
K_U17 - gain knowledge independently and plan his/her professional career
K_U18 - take up a job in an enterprise, individually and as a team, plan and organize individual and team work, follow safety rules related to this work

Social competences:
K_K01 - learn throughout life, inspire and organize the learning process of others
K_K02 - cooperate and work in a group, assuming various roles
K_K04 - identify and resolve ethical dilemmas related to occupational performance
K_K05 - take responsibility for decisions made
K_K06 - take responsibility for assessing threats resulting from applied research techniques and for creating safe working conditions
K_K09 - display a creative attitude in professional and social life
K_K10 - be aware of fulfilling a 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

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).

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