COURSE DESCRIPTION CARD - SYLLABUS

Course name
Spectroscopic Methods for Natural Products

Course

Field of study
Pharmaceutical Engineering
Area of study (specialization)
-
Level of study
First-cycle studies
Form of study
full-time

Year/Semester
2/4
Profile of study
general academic
Course offered in
polish
Requirements
compulsory

Number of hours

Lecture
15
Laboratory classes
15
Other (e.g. online)
0
Tutorials
0
Projects/seminars
0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:
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Prerequisites

A student approaching this course should possess the basic knowledge and skill set required for the application of basic laboratory techniques in the fields of biochemistry, general chemistry and organic chemistry. The student should be capable of extracting information from the literature, databases and other sources, interpreting the extracted information and formulating conclusions and opinions. The student should be ready to work as a member of a group.

Course objective

Endowing the students with basic knowledge related to the application of spectroscopic techniques - including mass spectrometry and NMR spectroscopy - in the field of natural products analysis.

Course-related learning outcomes

Knowledge

The student has theoretically founded general knowledge in the field of spectroscopic methods enabling understanding, description and analysis of natural products (K_W4).

The student has knowledge about basic techniques, research methods used in the analysis of natural products, knows classical and instrumental methods used in the qualitative and quantitative assessment of natural products (K_W7).

The student has knowledge regarding the basic principles and terminology used in mass spectrometry and NMR spectroscopy (K_W9).

Skills

The student understands literature in the field of spectroscopic methods in Polish language; reads and understands simple scientific and technical articles in a foreign language, is able to obtain information from literature, databases and other sources, also in a foreign language; integrates, interprets and draws conclusions and forms opinions (K_U1).

The student uses correct terminology and nomenclature regarding spectroscopic methods, also in a foreign language (K_U3).

The student uses basic techniques, research equipment and apparatus useful in the analysis of natural products by spectroscopic methods (K_U8).

The student selects and applies appropriate analytical methods and techniques in qualitative and quantitative analysis of natural products by spectroscopic methods. The student has the skills necessary for the practical experimental application of the possessed knowledge regarding mass spectrometry using a variety of materials and aparature and is able to interpret the results. The student possesses the skill set required for the unsupervised interpretation of NMR spectra of simple organic compounds using 1D and 2D, homo and heteronuclear techniques (K_U11).

Social competences

The student is ready to critically assess his/her knowledge, understands the need for further education,

and raising his professional, personal and social competences, understands the importance of knowledge in solving problems and is ready to consult experts (K_K1).

The student is ready to show respect and care for the good of all people among whom he works (K_K4)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the lecture is verified by two 45-minute colloquiums carried out during the 4th and 8th lectures. Each test consists of 10-15 questions (test and open-ended), scored differently. Passing threshold: 50% of points. The credit issues on the basis of which the questions are developed will be sent to students by e-mail using the university's e-mail system, and the necessary lecture materials will be placed on the e-course on the PUT e-learning platform. The skills acquired during laboratory classes are verified on the basis of reports, oral answers during classes and in special cases in the form of a final test, consisting of 5-7 tasks with different points depending on their difficulty. Passing threshold: 50% of points.

Programme content

The basic construction principles of a mass spectrometer. Different ionization techniques. Ion sources and their potential applications. Types of analysers encountered in mass spectrometers. Resolution, sensitivity and accuracy of mass measurements. Tandem mass spectrometry. Mass spectrometry applied to the analysis of various natural products. Coupled systems: LC-MS/MS, GC-MS/MS. Combination of sample preparation methods with final analysis.

Physical principles behind NMR spectroscopy. NMR spectral parameters: chemical shift, scalar coupling, nuclear Overhauser effect. The effect of dynamic processes on NMR spectra. Technical aspects of NMR spectroscopy: the construction of an NMR spectrometer, acquisition and processing of experimental data. Selected experimental aspects of NMR spectroscopy. Interpretation of 2D homo- and heteronuclear NMR spectra. Practical aspectr of the acquisition of 2D NMR spectra. Molecular structure determination using NMR.

Teaching methods

1. Lecture: illustrated by a slide show and examples presented on the drawing board

2. Laboratories: mass spectrometry laboratory - work with real samples (preparation of real samples and their determination, interpretation and calculations of the final content of determined analytes, NMR laboratory - demonstration practical exercises.

Bibliography

Basic

1. R. Jonston, Spektrometria mas. Podręcznik dla chemików i biochemików; Wyd.: PWN, 2001

2. Piotr Suder, J. Silbering, Spektrometria mas, Wyd. Wydawnictwo Uniwersytetu Jagiellońskiego

3. A. Kraj, A. Dabik, J. Silbering, Proteomika i metabolomika, Red. A. Kraj, A. Drabik, wyd. Wydawnictwa Uniwersytetu Warszawskiego

4. Silverstein R., Kiemle D. , Webster F., Spektroskopowe metody identyfikacji związków organicznych, PWN, Warszawa 2007

5. Praca zbiorowa pod redakcją W. Zielińskiego, A. Rajcy, Metody spektroskopowe i ich zastosowanie do identyfikacji związków organicznych, Wydanie II, WNT Warszawa 2000.

6. E de Hoffmann, J. Charette, V. Stroobant, Spektrometria mas, WNT, Warszawa 1998.

7. R. Kasprzykowska, A. S. Kołodziejczyk, E. Jankowska, K. Stachowiak, Preparatyka i analiza związków naturalnych, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2014.

Additional

1. J. H. Gross, Mass spectrometry J. H. Gross; Wyd. Springer 2011

2. Claridge T. D. W. , High-resolution NMR Techniques in Organic Chemistry, Elsevier Science, Second edition 2009

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests) [1]	30	1,0

[1] delete or add other activities as appropriate