University of Gdańsk

Subject card

Subject name and code	Spectroscopic Methods for Determining Chemical Structures, PG_00188917		
Field of study	Spektroskopowe metody wyznaczania struktur chemicznych (Wykład)		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2027/2028
Education level	Bachelor's studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	2.0
Learning profile	academic	Assessment form	exam
Conducting unit	Laboratory of Structural Research of Biopolymers -> Department of Organic Chemistry -> Faculty of Chemistry -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Emilia Sikorska	
	Teachers		

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	15	5.0	30.0	50

Subject objectives	Students will be introduced to the principles governing the interaction of electromagnetic radiation with matter, as well as the theoretical foundations of spectroscopic methods. Particular emphasis will be placed on the practical application of these techniques in chemical analysis, structural studies, and compound identification. The lectures will also focus on developing skills in spectral interpretation, a key component of both laboratory work and research.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[AKRL3_W02] The graduate knows and understands, at an advanced level, the analytical methods used in forensic laboratories, in particular spectroscopic, chromatographic and electroanalytical methods.	The student understands advanced spectroscopic methods used in forensic laboratories and can evaluate their respective advantages and limitations.	[SW4] test/egzamin - ustny lub pisemny [SW1] wypowiedź ustna/rozmowa/ dyskusja
[AKRL3_K01] The graduate is ready to critically evaluate their own knowledge, understand its importance for solving cognitive and practical problems, and to seek expert opinions when necessary.	The student is prepared to critically evaluate their own knowledge and recognizes the importance of continual learning, particularly when interpreting chemical data in a forensic context. They can identify situations that require expert consultation and assess the reliability of information sources.	[SK1] wypowiedź ustna/rozmowa/ dyskusja [SK4] test/egzamin - ustny lub pisemny
[AKRL3_W03] The graduate knows and understands the structure and chemical properties of compounds relevant in forensic examinations.	The student understands the structure and chemical properties of compounds relevant to forensic research, such as drugs, explosives, dyes, toxins, and biological traces, and can explain how spectroscopic methods enable their identification and differentiation in evidence.	[SW4] test/egzamin - ustny lub pisemny [SW1] wypowiedź ustna/rozmowa/ dyskusja

Subject contents

The properties of electromagnetic radiation and the mechanisms of its interaction with molecular systems, including absorption, scattering, and emission, will be discussed. A review of key spectroscopic techniques, such as UV/VIS, IR, Raman, fluorescence, NMR, and MS, will be presented, highlighting their strengths, limitations, and areas of application. Emphasis will be placed on the complementarity of these methods, which enables the acquisition of more comprehensive information about the compounds under study. The lecture will cover the use of spectroscopy for molecular structure identification. Combined approaches, such as integrating spectroscopic methods with chromatography and microscopy, will also be discussed, as they facilitate the analysis of complex matrices and microscale samples. Additionally, examples of the application of spectroscopic methods in forensics will be provided (e.g. the analysis of biological traces, the identification of drugs, explosives, and dyes, as well as the examination of documents and counterfeit items). The role of spectroscopy as a rapid, selective, and non-destructive analytical tool in forensic laboratories will be emphasized.

Prerequisites and co-requisites

Completed basic course in organic chemistry

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
100	51.0%	100.0%

Recommended reading

Basic literature

1. Collectively edited W. Zieliński i A. Rajca: Spectroscopic methods and their application in the identification of organic compounds, WNT Warszawa 1995, 2000.

2. R.M. Silverstein, F.X. Webster, D.J. Kiemle: Spectroscopic identification of organic compounds, PWN Warszawa 2007.

3. B. Wojtkowiak, Martial Chabanel: Molecular spectroscopy, PWN Warszawa 1984.

4. Z. Kęcki: Basics of molecular spectroscopy, PWN Warszawa 1998.

5. W. Danikiewicz: Mass Spectrometry: Basics and Applications, PWN Warszawa 2020.

	Supplementary literature	1. H. Barańska, A. Łabudzińska, J. Terpiński: Laser Raman Spectrometry, Analytical Applications, PWN, Warszawa 1981. 2. A. S. Płaziak: Mass spectrometry of organic compounds, Adam Mickiewicz University Scientific Publishing House Poznań 1997. 3. R.A.W. Johnstone, M.E. Rose: Mass spectrometry, PWN Warszawa 2001. 5. S. Paszyc. Basics of photochemistry, PWN Warszawa 1992. 6. I.Z. Siemion: Biostereochemistry, PWN Warszawa 1985. 7. K. Wüthrich: NMR in biological research: peptides and proteins, North-Holland, Amsterdam 1976. 8. Scientific publications. 9. Internet: independent research, verified by the instructor.
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

Document generated electronically. Does not require a seal or signature.