



UNIWERSYTET
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Organic chemistry

Educational subject description sheet

Basic information

Study programme Chemistry	Didactic cycle 2023/24
Speciality -	Subject code 02CHSS.21P.00977.23
Organizational unit Faculty of Chemistry	Lecture languages English
Study level Second-cycle programme	Course type Obligatory
Study form Full-time	Block Basic subjects
Education profile General academic	
Subject coordinator	Anna Przybył, Michał Antoszczak, Jakub Grajewski
Lecturer	Anna Przybył, Michał Antoszczak, Jakub Grajewski
Period Semester 1	Activities and hours • Lecture: 20, Exam; including sub-activities: ◦ Synchronous lecture: 20 • Classes: 15, Graded credit • Laboratories: 40, Graded credit
	Number of ECTS points 7

Goals

Code	Goal
C1	Transfer of knowledge in the field of advanced organic chemistry with modern methods of synthesis, spectroscopic analysis and application of this knowledge in experimental projects.
C2	Transfer of knowledge in the field of stereochemistry, conformational analysis, stereoselective reaction, asymmetric synthesis, chemoselectivity (selective reaction, protection and deprotection) and formation of carbon-carbon and carbon-heteroatom bonds.
C3	Developing the ability to conduct retrosynthetic analysis and planning the synthesis of complex compounds.
C4	Developing skills in determining reaction mechanisms, the ability to plan multi-stage organic synthesis.
C5	Developing skills to use spectroscopic methods to determine the structure of organic compounds.
C6	Transfer of knowledge on the use of organometallic compounds in organic synthesis.
C7	Transfer of knowledge of organic reactions using organophosphorus, sulphur, boron, silicon and tin compounds.
C8	Getting acquainted with the rules of health and safety in laboratory of organic Chemistry and development of habits in this field.
C9	Developing skills in writing scientific work and use the literature sources, preparation of laboratory documentation and work reports.
C10	Developing communication and teamwork skills.

Entry requirements

No prerequisites required.

Subject learning outcomes

Code	Outcomes in terms of	Learning outcomes	Examination methods
Knowledge - Student:			
W1	knows selected notions from advanced organic chemistry.	CHS_K2_W01, CHS_K2_W02, CHS_K2_W05, CHS_K2_W06	Written exam, Written colloquium, Test, Project, Report
W2	knows the synthetic principles of chosen name reactions and is able to critically analyse reaction mechanisms.	CHS_K2_W01, CHS_K2_W02, CHS_K2_W03, CHS_K2_W05	Written exam, Written colloquium, Test, Project, Report
W3	knows the rules of spectroscopic analysis and interpret the results of spectral analyses of organic compounds, proposes an appropriate method to study various aspects of the compound structures.	CHS_K2_W01, CHS_K2_W02, CHS_K2_W03, CHS_K2_W04, CHS_K2_W05	Written exam, Written colloquium, Test, Project, Report
Skills - Student:			

Code	Outcomes in terms of	Learning outcomes	Examination methods
U1	plans to synthesize the organic compounds, also in several stages, uses of the specific compounds and reagents in asymmetric and selective organic synthesis.	CHS_K2_U01, CHS_K2_U03, CHS_K2_U08, CHS_K2_U09, CHS_K2_U10, CHS_K2_U11, CHS_K2_U12, CHS_K2_U13	Written exam, Written colloquium, Test, Project, Report
U2	interprets the results of spectral analyses of organic compounds, applies the appropriate spectroscopic techniques (IR, UV-Vis, EI-MS and NMR) for the identification and characterization of organic compounds, proposes an appropriate method to study various aspects of the compound structures.	CHS_K2_U01, CHS_K2_U02, CHS_K2_U07, CHS_K2_U08, CHS_K2_U09, CHS_K2_U10, CHS_K2_U11, CHS_K2_U12, CHS_K2_U13	Written exam, Written colloquium, Test, Project, Report
U3	is able to plan rationally syntheses of complex compounds and to discuss selected topics in organic chemistry, plans and conduct the experimental work according to given procedure, timeframe and look after tidiness and safety of working area and evaluates the work contribution of themselves and other group members.	CHS_K2_U01, CHS_K2_U02, CHS_K2_U03, CHS_K2_U06, CHS_K2_U07, CHS_K2_U08, CHS_K2_U09, CHS_K2_U10, CHS_K2_U11, CHS_K2_U12, CHS_K2_U13, CHS_K2_U15	Written exam, Written colloquium, Test, Project, Report
U4	writes reports on the conducted experiment, describes the properties and performs spectroscopic analyzes of the obtained compound.	CHS_K2_U01, CHS_K2_U02, CHS_K2_U07, CHS_K2_U08, CHS_K2_U09, CHS_K2_U10, CHS_K2_U12, CHS_K2_U13, CHS_K2_U14	Project, Report
Social competences - Student:			
K1	is ready to identify and evaluate cognitive and practical problems in the field of chemical research.	CHS_K2_K01, CHS_K2_K02	Written exam, Written colloquium, Test, Project, Report
K2	is ready to work in a group by applying safety rules and promote and observe professional ethics in their own and others' activities.	CHS_K2_K04	Project, Report

Study content

No.	Course content	Subject learning outcomes	Activities
1.	Introduction to the modern organic synthesis with strategies for analyzing organic reactions and electron pushing mechanisms.	W1, W2, U1	Lecture, Classes, Laboratories, Synchronous lecture

No.	Course content	Subject learning outcomes	Activities
2.	Chemistry of Carbonyl Compounds - formation and reactions of enols and enolates.	W1, W2, U1	Lecture, Classes, Laboratories, Synchronous lecture
3.	Retrosynthetic analysis.	W1, W2, U1	Lecture, Classes, Synchronous lecture
4.	Review of spectroscopic methods and interpretation and analysis of organic compounds using UV-Vis, FTIR, MS and NMR methods.	W3, U2, U3, U4, K1	Lecture, Classes, Laboratories, Synchronous lecture
5.	Stereochemistry and conformational analysis. Asymmetric synthesis.	W1, W2, U1, U2, U3	Lecture, Classes, Laboratories, Synchronous lecture
6.	Selective reduction and oxidation reactions.	W1, W2, U1, U3, U4	Lecture, Classes, Laboratories, Synchronous lecture
7.	Applications of phosphorus, sulphur and silicon chemistry: stereo- and regioselective synthesis of alkenes.	W1, W2, U1	Lecture, Classes, Synchronous lecture
8.	Pericyclic reactions: cycloadditions and rearrangements.	W1, W2, U1, U3	Lecture, Classes, Laboratories, Synchronous lecture
9.	Organometallic reagents in controlling reactivity, regioselectivity and stereoselectivity.	W1, W2, U1, U3	Lecture, Classes, Laboratories, Synchronous lecture
10.	Design of the synthesis of compounds, experimental synthesis of the planned products, interpretation of spectroscopic data and correct analysis with verification of the obtained compounds	W1, W2, W3, U1, U2, U3, U4, K1, K2	Lecture, Classes, Laboratories, Synchronous lecture
11.	safety rules of work in the laboratory of organic chemistry.	K2	Laboratories

Additional information

Activities	Teaching and learning methods and activities
Lecture	Lecture with a multimedia presentation of selected issues, Discussion, Problem-based learning, Demonstration and observation, Audio and/or video demonstrations
Classes	Discussion, Case study, Problem-based learning, Classes method, Work in groups
Laboratories	Discussion, Solving tasks (e.g. computational, artistic, practical), Laboratory method, Research method (scientific inquiry), Work in groups

Activities	Credit conditions
Lecture	<p>The exam will be in written form. The final mark will base on points obtained on a written exam as well as on points collected on laboratories.</p> <p>Grading scale with applied percentage distribution:</p> <ul style="list-style-type: none"> • excellent (5,0): achievement by the student of the assumed learning outcomes of at least 92% • very good (4,5): achievement by the student of the assumed learning outcomes of at least 84% to 91.9% • good (4,0): achievement by the student of the assumed learning outcomes of at least 76% to 83.9% • satisfactory (3,5): achievement by the student of the assumed learning outcomes of at least 68% to 75.9% • sufficient (3,0): achievement by the student of the assumed learning outcomes in range 60.0% - 67.9% • fail (2,0): failure to achieve the assumed learning outcomes by the student – below 60.0%
Classes	<p><u>The condition for classification is attendance at a minimum of 60% of classes.</u></p> <p>Written colloquiums and tests are required to pass the classes.</p> <p>Grading scale with applied percentage distribution:</p> <ul style="list-style-type: none"> • excellent (5,0): achievement by the student of the assumed learning outcomes of at least 92% • very good (4,5): achievement by the student of the assumed learning outcomes of at least 84% to 91.9% • good (4,0): achievement by the student of the assumed learning outcomes of at least 76% to 83.9% • satisfactory (3,5): achievement by the student of the assumed learning outcomes of at least 68% to 75.9% • sufficient (3,0): achievement by the student of the assumed learning outcomes in range 60.0% - 67.9% • fail (2,0): failure to achieve the assumed learning outcomes by the student – below 60.0%
Laboratories	<p><u>The condition for classification is attendance at a minimum of 60% of classes.</u></p> <p>Written colloquiums, projects as well as reports are required to pass the laboratory.</p> <p>Grading scale with applied percentage distribution:</p> <ul style="list-style-type: none"> • excellent (5,0): achievement by the student of the assumed learning outcomes of at least 92% • very good (4,5): achievement by the student of the assumed learning outcomes of at least 84% to 91.9% • good (4,0): achievement by the student of the assumed learning outcomes of at least 76% to 83.9% • satisfactory (3,5): achievement by the student of the assumed learning outcomes of at least 68% to 75.9% • sufficient (3,0): achievement by the student of the assumed learning outcomes in range 60.0% - 67.9% • fail (2,0): failure to achieve the assumed learning outcomes by the student – below 60.0%

Literature

Obligatory

1. J. Clayden, N. Greeves, S. Warren, P. Wothers: Organic Chemistry. Second edition. Oxford University Press 2012

Optional

1. F. A. Carey, R. J. Sundberg Advanced Organic Chemistry Part B – Reactions and Synthesis. 4th ed., Kluwer Academic Publishers, 2002 (selected paragraphs).
2. J. March: Advanced Organic Chemistry, Reactions, Mechanisms and Structure. 6th ed., Wiley-VCH, 2007 (selected paragraphs).
3. L.D. Field, S. Sternhell, J.R. Kalman: Organic Structures from Spectra. IV (2008)/ V (2013) edition., Wiley.
4. A.K.Przybył, J. Grajewski, M. Antoszczak, J. Kurek; Organic chemistry in laboratory (2020); ISBN: 978-83-62783-12-0 <https://www.wbc.poznan.pl/dlibra/publication/573678/edition/486299/content>
5. The articles in the scientific journals recommended by lecturer and teaching staff.

Calculation of ECTS points

Activities	Activity hours*
Lecture	20
Classes	15
Laboratories	40
Preparation for classes	45
Reading the indicated literature	5
Report preparation	15
Preparation for the exam	60
Preparation of a project	10
Student workload	Hours 210
Number of ECTS points	ECTS 7

* academic hour = 45 minutes

Efekty uczenia się dla kierunku

Kod	Treść
CHS_K2_K01	The graduate is ready to identify and evaluate cognitive and practical problems in the field of chemical research
CHS_K2_K02	The graduate is ready to evaluate the collected information critically
CHS_K2_K04	The graduate is ready to appreciating, promoting and adhering to professional ethics in their own and others' activities
CHS_K2_U01	The graduate can use chemical terminology consistent with IUPAC recommendations
CHS_K2_U02	The graduate can analyze the physicochemical properties of substances based on the selection of appropriate methods and tools
CHS_K2_U03	The graduate can carry out chemical processes including the selection of reagents and purification of products
CHS_K2_U06	The graduate can use analytical and instrumental techniques to describe the qualitative and quantitative interpretation of chemical phenomena
CHS_K2_U07	The graduate can prepare a final report on conducted research projects and conduct a critical analysis of experiments
CHS_K2_U08	The graduate can find and use information obtained from databases and literature resources in order to plan and carry out a research project
CHS_K2_U09	The graduate can use information and communication techniques in order to deepen his knowledge and communication in specialist circles of recipients
CHS_K2_U10	The graduate can use English at the B2 + level of the European System for the Description of Language Education in the field of chemistry and the discipline in which conducts research
CHS_K2_U11	The graduate can present a complex chemical or physicochemical problem and propose a solution
CHS_K2_U12	The graduate can draw conclusion properly and evaluate critically on the basis of data from self-conducted chemical or physicochemical experiments and literature resources
CHS_K2_U13	The graduate can deepens his specialistic knowledge to the extent necessary to solve and interpret the undertaken problem correctly
CHS_K2_U14	The graduate can express in an accessible way the acquired knowledge, conduct a debate and present the results of scientific projects in chemistry
CHS_K2_U15	The graduate can work in a group, performing various roles, including a leader
CHS_K2_W01	The graduate knows and understands selected advanced issues in the field of chemistry
CHS_K2_W02	The graduate knows and understands concepts and relationships allowing for a quantitative description of complex physico-chemical phenomena
CHS_K2_W03	The graduate knows and understands mechanisms of advanced chemical reactions and indicates their interrelationship and importance in science
CHS_K2_W04	The graduate knows and understands physico-chemical properties of chemical compounds and materials depending on their structure / composition
CHS_K2_W05	The graduate knows and understands advanced chemical synthesis processes
CHS_K2_W06	The graduate knows and understands the use of chemicals of key importance for the progress of science