Wrocław University of Science and Technology
Doctoral School

COURSE CARD

1. Basic information

Course name in English:	Advanced Organic Chemistry	
Course name in Polish:	Zaawansowana Chemia Organiczna	
Number of hours:	30	
Type of course:	Elective course	
Form of course:	lecture	
Code of course:		
Course leader:	*Dr hab. inż. Rafał kowalczyk*	
Faculty of the course leader:	W3 Faculty of Chemistry	
Email address of the course leader:	rafal.kowaczyk@pwr.edu.pl	
Scientific discipline(s) assigned to the course (doctoral students representing the marked disciplines can participate in the course):	Architecture and urban planning	☐
	Automation, electronic, and electrical engineering	☐
	Information and communication technology	☐
	Biomedical engineering	☐
	Chemical engineering	☐
	Civil engineering and transport	☐
	Mechanical engineering	☐
	Environmental engineering, mining, and energy	☐
	Mathematics	☐
	Chemical sciences	☒
	Physical sciences	☐
	Management and quality studies	☐

2. Objectives

C1 The relationship of the electronic structure of organic compounds, carbocations, carbenes, radicals and carbanions with their properties and reactivity in the light of the theory of molecular orbitals and VBO
C2 Acidity, basicity, nucleophilicity and electrophilicity as structural factors of an organic compound that determine the course of a reaction
C3 How to determine reaction mechanism?
C4 Indication the postulates of the transition state theory in terms of optimization of the reaction course
C5 Presentation of the basic methods of modifications of the reactivity of organic compounds by means of changing the reaction medium or reaction conditions (temperature, concentration)
C6 The relationship between the transition state and the possibility of catalysis. Introduction to electrophilic and nucleophilic catalysis, general and specific acid and base catalysis
C7 Demonstration how the reaction mechanism interferes with a reaction medium and concentration factors and the subsequent impact on the course of reactions important for modern organic synthesis

3. Content

Detailed information about the course content, including topics and form of classes.

No.	Topic	Number of hours	Form of classes
1	New look into the bonding in organic chemistry	4	lecture
2	Structure of the molecule determines the stability and the reactivity	2	lecture
3	Acids and bases, nucleophiles and electrophiles	2	lecture
4	Molecular orbitals and HSAB theory. Klopman-Salem equation	2	lecture
5	Bonds weaker than covalent as an extra-stabilizing interaction	2	lecture
6	Transition state theory	2	lecture
7	Catalysis as the only way to chemistry 2.0	4	lecture
8	Mechanisms of the crucial reactions applied in the modern organic synthesis	10	lecture
9			Select form
10			Select form
11			Select form
12			Select form
13			Select form
14			Select form
15			Select form

4. Prerequisites

List of prerequisites relating to knowledge, skills and other competences for course participants.

1. Physical Chemistry (basic level)
2. Organic Chemistry (medium level)

5. Learning outcomes

List of learning outcomes at level 8 of the Polish Qualifications Framework assigned to the course (mark the learning outcomes in the last column).

Symbol	Learning outcome	
	KNOWLEDGE. Doctoral student knows and understands:	
SzD_W3	the main trends in the development of the scientific or artistic disciplines covered in the curricula;	☒
SzD_W4	research methodology;	☒
SzD_W5	the rules for the dissemination of scientific results, including in open access mode;	☐
SzD_W6	the fundamental dilemmas of modern civilization;	☐
SzD_W7	the legal and ethical conditions of scientific activity;	☐

SzD_W8	the economic and other relevant conditions of scientific activity;	☐
SzD_W9	basic principles of knowledge transfer to the economic and social spheres and commercialisation of results of scientific activity and know-how related to these results.	☐
	SKILLS. Doctoral student is able to:	
SzD_U2	use knowledge from different fields of science or art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, in particular: - define the purpose and subject of scientific research, formulate a research hypothesis, - develop research methods, techniques and tools, and use them creatively, - draw conclusions on the basis of scientific research; critically analyse and evaluate the results of scientific research, expertise and other creative work and their contribution to knowledge development; transfer the results of scientific activities to the economic and social spheres;	☒
SzD_U3	communicate on specialised topics to the extent that they enable an active participation in the international scientific community;	☒
SzD_U4	disseminate research results, including in popular forms;	☐
SzD_U5	initiate debates and participate in a scientific discourse;	☒
SzD_U6	be able to speak a foreign language at B2 level of the Common European Framework of Reference for Languages to a level that enables them to participate in the international scientific and professional environment;	☐
SzD_U7	plan and implement an individual or collective research or creative activity, including in an international environment;	☐
SzD_U8	independently plan and act for one's own development and inspire and organize the development of others;	☐
SzD_U9	plan classes or groups of classes and implement them using modern methods and tools.	☐
	SOCIAL COMPETENCES. Doctoral student is ready to:	
SzD_K3	fulfilling the social obligations of researchers and creators, initiate public interest activities, thinking and acting in an entrepreneurial way;	☒
SzD_K4	maintaining and developing the ethos of research and creative environments, including: - carrying out scientific activities in an independent manner, - respecting the principle of public ownership of research results, taking into account the principles of intellectual property protection.	☐

6. Evaluation

Short description of the method(s) used to evaluate the learning outcomes assigned to the course, e.g., exam, test, report, presentation, etc.

Evaluation of the learning outcomes: exam

7. Teaching methods

Short description of the teaching methods used during the course, e.g., multimedia presentation, discussion, literature studies, developing written documents, own work, etc.

lecture with multimedia presentation, discussion, literature studies

8. Literature

List of primary and secondary literature used to prepare the course and including additional knowledge for participants, e.g., books, textbooks, research papers, standards, web pages, etc.

Primary literature
[1] F. A. Carey, R. J. Sundberg, Advanced Organic Chemistry, Springer, 2007
[2] M. B. Smith, March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, 7th Edition, Wiley, 2013
[3] E. V. Anslyn, D. A. Dougherty, Modern Physical Organic Chemistry, University Science Books, 2006
Secondary literature
J. Clayden, N. Greeves, S. Warren, P. Wothers, Organic Chemistry, Oxford University Press, 2001

9. Other remarks

Additional remarks, comments, (e.g., language of the course)

Lecture in English