

**DOCTORAL SCHOOL OF WROCLAW UNIVERSITY OF SCIENCE AND
TECHNOLOGY**

SUPERVISOR DECLARING COURSE: Dr hab inż Katarzyna Matczyszyn
DEPARTMENT: Chemistry
SCIENTIFIC DISCIPLINE: Chemical Sciences

COURSE CARD

Course name in Polish: Najnowsze kierunki badań w naukach chemicznych

Course name in English: The latest research directions in chemical sciences.

Course language: English

The course is intended for all PhD students: NO - chemical sciences

- ~~1) BASIC COURSE~~
- ~~2) SPECIALIST COURSE~~
- ~~3) SEMINAR~~
- ~~4) HUMANISTIC COURSE~~
- ~~5) LANGUAGE~~
- ~~6) RESEARCH SKILLS~~

Subject code: NCQ100259W

* delete as applicable

	Lecture	Foreign language course	Seminar	Mixed forms
Number of hours of organized classes in university (ZZU)	30			
Grading	Exam	Exam	Oral presentation	Exam, inspection, evaluation classes

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic tools of mathematical analysis (derivatives, differential equations)
2. Biological and chemical fundamentals
3. Principles of organic chemistry
4. Knowledge on specific English language terms and nomenclature

COURSE OBJECTIVES

- C1 Systemizing the knowledge about organic chemistry, physical chemistry and biotechnology
- C2 Reminder and expansion of the knowledge on thermodynamic description of the equilibrium (chemical reactions and other processes)
- C3 Reminder and expansion of the knowledge on the description of chemical reactions rates
- C4 To provide students with knowledge about the application of biological macromolecules as elements of nanotechnology applied in medicine
- C5 To provide students with knowledge about the application of microbes for the synthesis of nanoparticles

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C6 To provide a systematic background of modern organic chemistry, in particular, reactivity of organic compounds.

C7 To provide advanced knowledge on correlation between the structure and reaction mechanisms.

PROGRAM CONTENTS

Form of classes - lecture		Number of hours
1	Fermi-Dirac, Bose-Einstein and Maxwell-Boltzmann distributions. Equation of state.	2
2	The functions of state. First and second law of thermodynamics.	2
3	Thermodynamic theory of equilibrium.	2
4	Formal kinetics of chemical reactions.	2
5	Transition-state theory in kinetics	2
6	Fundamentals about biological systems	2
7	Enzymes as diagnostic markers	2
8	RNA and DNA in nanotechnology	2
9	Antibodies as diagnostic markers	2
10	Theranostics based upon nanotechnology	2
11	Chemical bonding, localized and delocalized. Bonding weaker than covalent.	2
12	Stereochemistry. Optical activity and chirality. Stereoisomerism. Conformation.	2
13	Carbocations, carbanions and free radicals. Carbenes and nitrenes. Structure and reactivity.	2
14	Types of reactions and mechanisms. Thermodynamic and kinetic requirements and control. Methods of determining mechanisms. Acids and bases.	2
15	Correlation of structure and medium with reactivity. Resonance and field, steric effects. Effect of medium on reactivity.	2
Total hours		30

TEACHING TOOLS USED

N1. Traditional academic lecture
N2. Multimedial presentation
N3.

ACHIEVED SUBJECT LEARNING OUTCOMES

Type of learning outcome	Code of learning outcome	Assessment of learning outcome
Knowledge	P8S_WG	competently cites other authors in published and prepared for publication articles in peer-reviewed scientific journals, in peer-reviewed

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		materials from international scientific conferences, in book editions
Knowledge	P8S_WK	has knowledge at an advanced level of basic nature for the field related to the area of scientific research, including the latest methods of research and verification of the results achieved
Skills	P8S_UW	knows how to creatively interpret the obtained results and look for their application use
Skills	P8S_UW	has scientific and technological skills related to the methodology and methodology of conducting scientific research and the critical evaluation of the obtained results

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

Krzysztof Pigoń, Zdzisław Ruziewicz „Physical Chemistry”
„ Modern Industrial Microbiology and Biotechnology” Second Edition, Okafor Nduka; 2018, ISBN13 (EAN): 9781138550186
March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, 8th Edition, Wiley, 2019.

SECONDARY LITERATURE:

Carey, F. A., Sundberg, R. J. Advanced Organic Chemistry. Part A: Structure and Mechanisms, Springer, 2007.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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