DESCRIPTION OF THE COURSE OF STUDY

Course code	**0532-2CHEM-C05-CF**	
Name of the course in	Polish	**Chemia fizyczna**
	English	**Physical Chemistry**

1. LOCATION OF THE COURSE OF STUDY WITHIN THE SYSTEM OF STUDIES

1.1. Field of study	**Physical Chemistry**
1.2. Mode of study	**Full-time studies**
1.3. Level of study	**First-cycle studies**
1.4. Profile of study*	**General academic**
1.5. Person/s preparing the course description	**prof. dr hab. Piotr Słomkiewicz, dr Katarzyna Jedynak**
1.6. Contact	**piotr.słomkiewicz@ujk.edu.pl katarzyna.jedynak@ujk.edu.pl**

2. GENERAL CHARACTERISTICS OF THE COURSE OF STUDY

2.1. Language of instruction	**English**
2.2. Prerequisites*	**mathematics, physics, basics of chemistry**

3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

3.1. Form of classes		**Lectures, laboratory exerices**
3.2. Place of classes		**Classes in the teaching room of the UJK**
3.3. Form of assessment		**Lecture - exam, laboratory exercises - credit with grade**
3.4. Teaching methods		**Lecture, discussion, demonstration, independent experiments, project**
3.5. Bibliography	**Required reading**	1. P.W. Atkins, Physical Chemistry, Oxford University Press, 2022 2. Finn Miller, Physical Chemistry, Willford Press 2017 3. Langdon Jamie, Physical Chemistry and Its Applications, Willford Press 2017
	Further reading	Hofmann Andreas, Physical Chemistry Essentials, Springer International Publishing AG 2018

4. OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES

4.1. Course objectives ***(including form of classes)***

LECTURE

Teaching the student basic issues of physical chemistry

Understanding the relationship between physicochemical laws and specific problems

SEMINAR

Ability to apply basic calculation methods to typical physical chemistry problems

Acquiring the ability to independently solve physicochemical tasks and problems

EXERCISES

The student can perform laboratory tasks independently and correctly prepare measurement results

Principles of operation and operation of basic physicochemical equipment

Ability to analyze the results obtained during measurements

4.2. Detailed syllabus ***(including form of classes)***

Lecture:

1. States of matter and properties of gases.
2. Description of the states of matter. Equation of state. Gas mixtures and partial pressures. Gas kinetic theory. Real gases.
3. Thermodynamics; first rule.
4. The law of conservation of energy. Internal energy. Enthalpy.
5. Thermodynamics; second rule.
6. Entropy. Free enthalpy. Reactions at equilibrium.
7. Phase equilibria.
8. Phase diagrams of pure substances. Properties of non-electrolyte solutions. Phase diagrams of two-component systems.
9. Chemical balance.
10. Interpretation of equilibrium states. Acids and bases. Solubility balance.

11. Electrochemistry.
12. Galvanic cells. Applications reduction potential.
13. Chemical kinetics.
14. Empirical chemical kinetics. Justification of kinetic equations. Explosive reactions.
15. Chemical bonding.
16. Theory of valence bonds. Molecular orbitals. Band theory of solids.

Seminar:
Calculation methods used in typical tasks in the field of physical chemistry: calculation of thermodynamic functions and thermal effects of transformations, including chemical transformations (Hess's law and Kirchoff's law), thermodynamic description of the state of chemical equilibrium and phase equilibrium, parameters affecting the state of equilibrium, phenomena occurring at the phase boundary , determining the rate of a chemical reaction, the order of the reaction, the influence of temperature on the rate of a chemical reaction, description of electrode phenomena, calculation of EMF.

Laboratory exercises:
During experiments, the student performs laboratory exercises in the following branches of physical chemistry: thermodynamics (e.g. determination of partial molar quantities), thermochemistry (calorimetric measurements), transport processes
(e.g. liquid viscosity), phase equilibria, equilibria in electrolyte solutions, interfacial phenomena (e.g.
surface tension), electrochemistry (e.g. electrolysis), kinetics and catalysis. The student learns the basics of operation and operation of such basic devices as: calorimeter, conductivity meter, pH meter, electrolyzer, viscometer, tensionmeter.

4.3 Intended learning outcomes

Code	A student, who passed the course	Relation to learning outcomes
within the scope of **KNOWLEDGE:**		
W01	Characterizes and describes states of matter. Defines state functions. Correctly interprets equilibrium constants. Justifies kinetic equations.	CHEM1A_W05
W02	Understands the basic relationships in physical chemistry and the scope of their application. Knows the basic computational methods used in physical chemistry	CHEM1A_W05
W03	Knows the principles of operation of basic devices used to determine physicochemical quantities.	CHEM1A_W14
within the scope of **ABILITIES:**		
U01	Student can use molecular biology techniques for quantitative and qualitative assessment of the obtained bioproduct.	CHEM1A_U01
U02	Student use databases to search for specialized literature	CHEM1A_U01
U03	Student can use terms and expressions in the field of biotechnological process, its control and purification of bioproducts.	CHEM1A_U11
U04	Is able to learn independently, present issues in physical chemistry clearly and prepare written works on laboratory exercises performed	CHEM1A_U11
U05	Able to work in a group, develops self-control through punctuality and responsibility	CHEM1A_U14
within the scope of **SOCIAL COMPETENCE:**		
K01	Is aware of the critical assessment of his knowledge	CHEM1A_K01

4.4. Methods to verify the achievement of the learning outcomes												
Teaching outcomes *(code)*	**Method of verification (+/-)**											
	Exam oral/written*			**Test***			**Project***			**Group work***		
	Form of classes			***Form of classes***			***Form of classes***			***Form of classes***		
	W	*C*	*...*	*W*	*K*	*L.*	*W*	*K*	*L*	*W*	*K*	*L*
W01	+				+	+						
W02	+				+	+						
W03	+				+	+						
U01												+
U02					+							+
U03					+	+			+			+
U04					+	+			+			+
U05					+				+			
K01	+											

delete as appropriate

4.5. Criteria of assessment of the intended learning outcomes		
Form of classes	**Grade**	**Criterion of assessment**
lecture (L) (including e-learning)	**3**	Exam - test, 51-60% correct answers
	3,5	Exam - test, 61-70% correct answers
	4	Exam - test, 71-80%correct answers
	4,5	Exam - test, 81-90%correct answers
	5	Exam - test, 91-100% correct answers
Seminar (including e-learning)	**3**	Credit with grade - test, 51-60% correct answers
	3,5	Credit with grade - test, 61-70% correct answers
	4	Credit with grade - test, 71-80% correct answers
	4,5	Credit with grade - test ,81-90% correct answers
	5	Credit with grade - test, 91-100% correct answers
Laboratory exercises (including e-learning)	**3**	Credit with grade - test, 51-60% correct answers
	3,5	Credit with grade - test, 61-70% correct answers
	4	Credit with grade - test, 71-80% correct answers
	4,5	Credit with grade - test, 81-90% correct answers
	5	Credit with grade - test, 91-100% correct answers

5. BALANCE OF ECTS CREDITS – STUDENT'S WORK INPUT

Category	**Student's workload**	
	Full-time studies	**Extramural studies**
NUMBER OF HOURS WITH THE DIRECT PARTICIPATION OF THE TEACHER /CONTACT HOURS/	***165***	***95***
*Participation in lectures**	60	30
*Participation in classes, seminars, laboratories**	105	65
INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/	***135***	***205***
*Preparation for the lecture**	50	60
*Preparation for the classes, seminars, laboratories**	40	60
*Preparation for the exam/test**	45	85
TOTAL NUMBER OF HOURS	***300***	***300***
ECTS credits for the course of study	**12**	**12**

delete as appropriate

Accepted for execution *(date and legible signatures of the teachers running the course in the given academic year)*

.....