Attachment No. 5 to Rector's ordinance No. 22/2020

DESCRIPTION OF THE COURSE OF STUDY

Course code	**0531.6.CHEM1.B/C.PK**	
Name of the course in	Polish	*Podstawy krystalografii*
	English	*Fundamentals of Crystallography*

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

1.1. Field of study	**Chemistry**
1.2. Mode of study	**Full-time studies**
1.3. Level of study	**1st degree**
1.4. Profile of study*	**General academic**
1.5. Person/s preparing the course description	**Agnieszka Jabłońska-Wawrzycka Ph.D.**
1.6. Contact	**Agnieszka.Jablonska-Wawrzycka@ujk.edu.pl**

2. GENERAL CHARACTERISTICS OF THE COURSE OF STUDY

2.1. Language of instruction	**English**
2.2. Prerequisites*	**Inorganic Chemistry, Math, Physics**

3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

3.1. Form of classes		Lectures (15 hrs), Seminar (10 hrs)
3.2. Place of classes		Classes in the teaching room of the UJK
3.3. Form of assessment		Lecture - exam, Seminar - credit with grade
3.4. Teaching methods		Lecture - informative lecture, discussion, description, Seminar - subject exercises
3.5. Bibliography	**Required reading**	Bojarski Z., Gigla M., Stróż K., Surowiec M., Krystalografia, Wydawnictwa Naukowe PWN, Warszawa 2007. Bojarski Z., Habla H., Surowiec M., Materiały do nauki krystalografii, Uniwersytet Śląski, Katowice 1993. Penkala T., Zarys krystalografii, PWN 1983. C. Giacovazzo, Fundamentals of crystallography, 2nd Edition, IUCR, Oxford University Press, 2002.
	Further reading	Trzaska-Durski Z., Podstawy krystalografii strukturalnej i rentgenowskiej, Wydawnictwa Naukowe PWN, Warszawa 1994. Luger P., Rentgenografia strukturalna monokryształów, Wydawnictwa PWN, Warszawa 1989. Van Meerssche M., Feneau-Dupont J., Krystalografia i chemia strukturalna, PWN 1985.

4. OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES

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

C1 - introducing basic knowledge in the field of crystallography enabling the characterization of the crystalline state, determining the symmetry of the crystal, developing visual-spatial processing skills; (Lecture)
C2 – using information about the structure of crystalline bodies contained in compendia; (Seminar)
C3 – ability to find relationships between the structure and properties of crystals; (Seminar)

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

Lecture

1. Introduction to the world of crystals - viewing interesting crystal forms. Division of the surrounding matter according to the degree of order. Mesomorphic phases. Properties of crystals changing continuously and discontinuously. Crystal definitions.
2. Identity vector, lattice parameters, unit cell, crystallographic systems. Indexing of lines and planes.
3. Crystal symmetry. Crystallographic notation.
4. Diffraction methods as a basic tool of modern crystallography. Sources and characteristics of X-ray radiation. Description of the diffraction phenomenon using the Laue and Bragg method. Elements of X-ray of polycrystalline substances: indexing of diffractograms and phase analysis.
5. Elements of crystallochemistry. Crystallization processes. Classification of crystal structures according to chemical interactions (metallic, ionic, covalent, hydrogen, van der Waals.). Grid energy. Review of selected structures of elements and inorganic compounds (A, B, C). Crystallochemical relationships of elements and chemical compounds. Isomorphism. Polymorphism.

Seminar
1. The concept of order. Distribution function. 2. Indexing lattice lines and planes. Weiss law. Interplanar distance. 3. Unit cell - calculating volume and mass. 4. Symmetry operations and elements, point groups.

4.3 Intended learning outcomes

Code	A student, who passed the course	Relation to learning outcomes
within the scope of **KNOWLEDGE:**		
W01	knows the basics of dividing the surrounding matter according to the degree of order	CHEM1A_W09
W02	knows the basic concepts of crystallography; has theoretical knowledge in the field of pointing lines and lattice planes	CHEM1A_W09
W03	demonstrates knowledge of basic concepts related to symmetry and spatial lattice	CHEM1A_W09
W04	has theoretical foundations regarding the principle of operation and properties of X-ray radiation	CHEM1A_W09
within the scope of **ABILITIES:**		
U01	has the ability to indicate straight lines and planes from regular, tetragonal, rhombic system	CHEM1A_U07
U02	uses the commonly accepted Hermann-Maugin symbolism used to determine the symmetry of molecules, the external form of crystals and their internal structure	CHEM1A_U07
U03	understands and uses basic crystallochemical concepts	CHEM1A_U07
U04	classifies crystal structures according to the types of chemical interactions and is able to indicate features characteristic of simple types of crystal structures	CHEM1A_U07
within the scope of **SOCIAL COMPETENCE:**		
K01	Is aware of the interdisciplinary nature of crystallography among other fields of science	CHEM1A_K01
K02	Demonstrates an accepting attitude towards mathematical methods in the subject area	CHEM1A_K01

Teaching outcomes *(code)*	**Method of assessment (+/-)**					
	Exam oral			**Test**		
	Form of classes			***Form of classes***		
	L	*S*	*...*	*L*	*S*	*...*
W01	+	—		+	+	
W02	+	—		+	+	
W03	+	—		+	—	
W04	+	—		+	—	
U01	—	—		—	+	
U02	+	—		+	—	
U03	+	—		+	—	
U04	+	—		—	—	
K01	+	—		—	+	
K02	—	—		—	+	

4.5. Criteria of assessment of the intended learning outcomes		
Form of classes	**Grade**	**Criterion of assessment**
Lecture (L) * (including e-learning)	**3**	Exam oral, obtaining 51-60% of the total number of available points
	3,5	Exam oral, obtaining 61-70% of the total number of available points
	4	Exam oral, obtaining 71-80% of the total number of available points
	4,5	Exam oral, obtaining 81-90% of the total number of available points
	5	Exam oral, obtaining 91-100% of the total number of available points
(S) ** (including e-	**3**	Credit with grade – obtaining 51-60% of the total number of points from partial tests
	3,5	Credit with grade – obtaining 61-70% of the total number of points from partial tests

	4	Credit with grade – obtaining 71-80% of the total number of points from partial tests
	4,5	Credit with grade – obtaining 81-90% of the total number of points from partial tests
	5	Credit with grade – obtaining 91-100% of the total number of points from partial tests

* L – The condition for taking the exam is obtaining at least 50% of the points in two partial tests; A student who obtains more than 65% points is exempt from the exam oral; The student receives three exam questions and, after short preparation, provides answers.
** S – Student receives a pass based on the points obtained in partial tests.

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/	***25***	
*Participation in lectures**	***15***	
*Participation in classes, seminars, laboratories**	***10***	
INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/	***25***	
*Preparation for the lecture**	***2***	
*Preparation for the classes, seminars, laboratories**	***10***	
*Preparation for the exam/test**	***13***	
TOTAL NUMBER OF HOURS	***50***	
ECTS credits for the course of study	***2***	

delete as appropriate

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

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