**DESCRIPTION OF THE COURSE OF STUDY**

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| **Course Code:** |  | 0916.4.FAR.B/C.CHFIZ  |
| **Course Name:** | Polish : | **Chemia fizyczna**  |
| English:  | ***Physical Chemistry***  |

**1. USYTUOWANIE PRZEDMIOTU W SYSTEMIE STUDIÓW**

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| **1.1. Field of study** | **PHARMACY** |
| **1.2. Mode of study** | **Full-time** |
| **1.3. Level of study:** | **Integrated Master’s Degree** |
| **1.4. Profile of study** |  **Practical** |
| **1.5. Person/s preparing the course description** | dr hab. Katarzyna Jedynak prof. UJK  |
| **1.6. Contact** | katarzyna.jedynak@ujk.edu.pl  |

# 2. GENERAL COURSE CHARACTERISTICS

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| **2.1. Language of instruction** | Polish |
| **2.2. Prerequisites** | mathematics, physics, basic chemistry |

**3. DETAILED COURSE CHARACTERISTICS**

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| **3.1. Form of classes** | Lectures, Laboratory Sessions |
| **3.2. Place of classes** | Teaching facilities at UJK,  |
| **3.3. Form of assessment** | ExaminationGraded credit |
| **3.4. Teaching methods** | lecture, use of audiovisual medialaboratories, independent practical experiments |
| **3.5. Bibliography** | **Primary:** | 1. Atkins P.W., Podstawy chemii fizycznej, Wydawnictwo Naukowe PWN, Warszawa 2009. 2. Hermann T., Chemia Fizyczna, Podręcznik dla Studentów Farmacji i analityki medycznej, Wydawnictwo Państwowy Zakład Wydawnictw Lekarskich, Warszawa 2019 |
| **Supplementary:** | 1. Pigoń K., Z. Ruziewicz, Wydawnictwo Naukowe PWN, Warszawa 2019. 2. Główka F. Farmacja fizyczna – ćwiczenia laboratoryjne dla studentów farmacji i analityki medycznej. Wydawnictwo UM , Poznań 2016 3. Demichowicz-Pigoniowa J., Olszowski A., Chemia fizyczna t. 3, Wydawnictwo Naukowe PWN, Warszawa 2010. 4. Atkins P.W, Chemia fizyczna, Wydawnictwo Naukowe PWN, Warszawa 2001. 5. Sobczyk L., Kisza A., Katner K., Koli A., Eksperymentalna chemia fizyczna, Wydawnictwo Naukowe PWN, Warszawa 1982.  |

**4. OBJECTIVES, CONTENT, AND LEARNING OUTCOMES**

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| **4.1. Course Objectives** Lecture: Cl. - Teaching the student the basic issues of physical chemistry. C2. - Understanding the relationship between physicochemical laws and specific problems. Laboratory: C3. - Independent performance of laboratory tasks by the student and correct development of measurement results. C4. - Principles of operation and operation of basic physicochemical equipment. C5. - Ability to analyze results obtained during measurements.  |
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| **4.2.** **Course Content****Lecture** 1. Properties of gases, solids and liquids. Density. Surface tension. Viscosity of liquids. 2. Thermochemistry: Heat of chemical reactions. Hess's law. Heat of formation and heat of combustion. Heat capacity and molar heat. Dependence of the heat of reaction on temperature. Kirchoff's law. 3. Thermodynamics I: Law of conservation of energy. Thermodynamic systems. Work and heat. Internal energy. Enthalpy. First law of thermodynamics. 4. Thermodynamics II: Second law of thermodynamics. Entropy. Free enthalpy. Reactions in equilibrium. 5. Phase equilibria in one- and two-component systems: evaporation, condensation, crystallization, melting, sublimation, resublimation. Raoult's law. 6. Physical transformations of single-component systems, critical temperature, melting point, critical point, triple point. 7. Gibbs phase rule. Nernst partition law.8. Chemical equilibrium. Equilibrium constant. Van’t Hoff isotherm. Van’t Hoff isobar. Equilibria in solutions of electrolytes. 9. Conductivity of electrolytes. Measurement of electrolyte conductivity. Specific, molar, equivalent conductivity. 10. Chemical kinetics. Rate of chemical reaction. Order and molecularity of chemical reaction. First- and second-order reactions. Methods for determining the order of reaction. Effect of temperature on reaction rate. Catalysis. Kinetics of enzymatic reactions. Pharmacokinetics. 11. Adsorption. Classification of adsorption processes. Mathematical description of the adsorption process. 12. Physicochemistry of dispersion systems, colloids and their properties, dispersion systems used in pharmaceutics: emulsions, gels, microparticles and liposomes. Surfactants, critical micelle concentration, HLB index. 13. Polarimetric measurements. Specific rotation. Light polarization phenomenon. Optically active substances. Specific rotation.**Laboratory**During classes, the student performs laboratory exercises on the following topics of physical chemistry:thermodynamics (e.g. determination of partial molar quantities), thermochemistry (calorimetric measurements),transport processes (e.g. viscosity of liquids), phase equilibria (e.g. Nernst's partition law), conductivity of electrolytes, interphase phenomena (e.g. surface tension), kinetics and catalysis, surface phenomena (e.g. adsorption at the solid-solution interface), colloidal systems, surfactants. The student learns the basics of operation and use of such basic devices as: calorimeter, conductometer,pH meter, viscometer, stalagmometer, tensiometer, polarimeter. |

## 4.3. Subject learning outcomes

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| **Code**  | **A student, who passed the course** | **Relation to learning****outcomes** |
|  | within the scope of KNOWLEDGE: |  |
| W01  | mechanisms of formation and types of chemical bonds and mechanisms of intermolecular interactions; | FAR\_B.W6.  |
| W02  | theoretical and methodological foundations of spectroscopic, electrochemical, chromatographic and mass spectrometric techniques and the functioning of devices used in these techniques; | FAR\_B.W12. |
| W03  | the basics of thermodynamics and chemical kinetics and the quantum foundations of the structure of matter | FAR\_B.W15.  |
| W04 | physicochemistry of multiphase systems and surface phenomena, and mechanisms of catalysis. | FAR\_B.W16.  |
|  | within the scope of **ABILITIES:** |  |
| U01  | measure or determine physical, biophysical and physicochemical quantities using appropriate laboratory equipment and perform physical and chemical calculations; | FAR\_B.U1.  |
| U02 | conduct studies of the kinetics of chemical reactions; | FAR\_B.U8. |
| U03 | analyze the physicochemical properties and processes that underlie the biological action of drugs and pharmacokinetics. | FAR\_B.U9. |
| U04 | use mathematical, statistical and computer tools to develop, interpret and present the results of experiments, analyses and measurements | FAR\_B.U11. |
|  | within the scope of SOCIAL COMPETENCE: |  |
| K01  | formulating conclusions from your own measurements or observations; | FAR\_K.08.  |

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| **4.4. Methods of assessment of the intended learning outcomes** |  |  |
| **Teaching****outcomes****(code)** | **Method of assessment (+/-)** |  |  |
| **Exam ~~oral~~/written****\***  | **Colloquium\* written or oral** | **Project\***  | **Effort****in class\*** | **Self-study\*** | **Group****work\*** | **Others\* e.g.****standardized test****used in elearning** |
| Form of classes | Form of classes | Form of classes | Form of classes | Form of classes | Form of classes | Form of classes |
| *L*  | *E*  | *Lab*  | *L*  | *E*  | *Lab*  | *L*  | *E*  | *Lab*  | *L*  | *E*  | *Lab*  | *L*  | *E*  | *Lab*  | *L*  | *E*  | *Lab*  | *L*  | *E*  | *Lab* |
| W01 -W04 | **+** |  |  |  |  | **+** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| U01 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **+** |  |  |  |
| U02 |  |  |  |  |  | **+** |  |  |  |  |  |  |  |  |  |  |  | **+** |  |  | **+** |
| U03 | **+** |  |  |  |  | **+** |  |  |  |  |  |  |  |  |  |  |  | **+** |  |  | **+** |
| U04 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **+** |
| K01 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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| **4.5. Criteria of assessment of the intended learning outcomes** |
| **Form of****classes** | **Grade**  | **Assessment criterion** |
|  **(lecture (L) \*** | **3**  | the result of the written exam is 61-68% |
| **3,5**  | the result of the written exam is 69-76% |
| **4**  | the result of the written exam is 77-84% |
| **4,5**  | the result of the written exam is 85-92% |
| **5**  | the result of the written exam is 93-100% |
| **laboratory** **(L)** | **3**  | Passes written or oral entrance tests with 61-68%. Completes all exercises. Submits all reports. |
| **3,5**  | Passes written or oral entrance tests with 69-76% Completes all exercises. Submits all reports. |
| **4**  | Passes written or oral entrance tests with 77-84% Completes all exercises. Submits all reports on time. |
| **4,5**  | Passes written or oral entrance tests with 85-92% Completes all exercises. Submits all reports.on time |
| **5**  | Passes written or oral entrance tests with 93-100%Completes all exercises. Submits all reports on time, without errors.. |

# 5. BALANCE OF ECTS CREDITS – STUDENT’S WORK INPUT

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| **Kategoria**  | **Student's workload** |
| **Full-time****studies** | **Extramural studies** |
| *NUMBER OF HOURS WITH THE DIRECT PARTICIPATION OF THE TEACHER**/CONTACT HOURS/* | ***80*** |  |
| *Participation in lectures* | 20 |   |
| *Participation in laboratories* | 60 |   |
| *SAMODZIELNA PRACA STUDENTA /GODZINY NIEKONTAKTOWE/*  | 70 |  |
| *Preparation for exercises, laboratory* | 20 |   |
| *Preparation for the exam/colloquium* | 50 |   |
| ***TOTAL NUMBER OF HOURS*** | ***150*** |  |
| **ECTS credits for the course of study** | 6 |  |

***I accept for implementation (date and legible signatures of persons teaching the subject in a given academic year)***

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