

Course Syllabus

I. General Information

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| Course name | Physical chemistry |
| Programme | Biotechnology |
| Level of studies (BA, BSc, MA, MSc, long-cycle MA) | BSc |
| Form of studies (full-time, part-time) | part-time |
| Discipline | Biological sciences |
| Language of instruction | English |

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| Course coordinator/person responsible | dr Ludomir Kwietniewski |
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| Type of class (<i>use only the types mentioned below</i>) | Number of teaching hours | Semester | ECTS Points |
|---|--------------------------|----------|-------------|
| lecture | 30 | II | 6 |
| tutorial | | | |
| classes | 30 | II | |
| laboratory classes | | | |
| workshops | | | |
| seminar | | | |
| introductory seminar | | | |
| foreign language classes | | | |
| practical placement | | | |
| field work | | | |
| diploma laboratory | | | |
| translation classes | | | |
| study visit | | | |

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| Course pre-requisites | Basics of chemistry, physics and mathematics |
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II. Course Objectives

To gain a knowledge of the general principles of thermodynamics, electromagnetic properties of molecules, theories of adsorption, chemical kinetics, rate laws for chemical reactions and reaction mechanisms.

III. Course learning outcomes with reference to programme learning outcomes

| Symbol | Description of course learning outcome | Reference to programme learning outcome |
|----------------------------|--|---|
| KNOWLEDGE | | |
| W_01 | describes issues in the field of physics, mathematics and chemistry required to understand and interpret basic natural phenomena and processes | K_W02 |
| W_02 | presents knowledge in terms of statistics and computer science giving the possibility to describe and interpret natural phenomena especially relevant for biotechnology | K_W03 |
| W_03 | presents the principles of health, safety work and ergonomics, indicates the psychophysical possibilities of a human in the work environment | K_W09 |
| SKILLS | | |
| U_01 | carries out observations and performs physical, chemical and biological measurements | K_U02 |
| U_02 | describes, explains and interprets chemical and physicochemical phenomena at an advanced level | K_U08 |
| U_03 | uses knowledge in the field of physical-chemical conditions of phase boundary in order to describe and interpret life sciences phenomena | K_U09 |
| U_04 | performs qualitative and quantitative analyzes by using classical and instrumental method | K_U10 |
| U_05 | prepares a written study on issues related to biotechnology sciences in the language in which classes are conducted and in another modern language using the scientific language | K_U13 |
| U_06 | uses statistical methods and information technology to describe natural phenomena as well as to analyze and process experimental data | K_U14 |
| U_07 | designs and performs research tasks or expertise in the field of chemistry, biochemistry and biology | K_U15 |
| U_08 | learns independently in a targeted manner in the field of biotechnology, updates his knowledge and skills, applies new research techniques and plans his professional development | K_U17 |
| SOCIAL COMPETENCIES | | |
| K_01 | possesses appropriate habits required to the work in scientific laboratories especially in aseptic conditions, proceeds according to work safety regulations, knows how to react in states of danger | K_K04 |

IV. Course Content

First Law of Thermodynamics. Thermodynamic functions. Hess's law and Kirchhoff's law. Second Law of Thermodynamics. Entropy in irreversible processes.
Molecules in electric, magnetic and electromagnetic fields. Dipole moments. Electrical double layer. Classification of electricity conductors. Electrolytes and their properties.
Theoretical ground of kinetics. Rate of chemical reactions. Kinetic equations. Orders of chemical

reactions. Activation energy. Catalysis – homo- and heterogeneous.
Partition of substances between two phases. Homo- and heterogeneous solid surfaces. Physical and chemical adsorption. Adsorptive surface layers. Theories and isotherms of adsorption.

V. Didactic methods used and forms of assessment of learning outcomes

| Symbol | Didactic methods (choose from the list) | Forms of assessment (choose from the list) | Documentation type (choose from the list) |
|----------------------------|--|---|--|
| KNOWLEDGE | | | |
| W_01 | Conventional lecture | Exam | Rated text of the written work |
| W_02 | Laboratory classes | Colloquium/test/written test | Completed and evaluated colloquium/test/written test |
| W_03 | Laboratory classes | Observation | Evaluation card |
| SKILLS | | | |
| U_01 | Laboratory classes | Report | Print / Report file |
| U_02 | Laboratory classes Conventional lecture | Report Print / Report file Exam | Print / Report file Rated text of the written work |
| U_03 | Laboratory classes | Report | Print / Report file |
| U_04 | Laboratory classes | Report | Print / Report file |
| U_05 | Laboratory classes | Report | Print / Report file |
| U_06 | Laboratory classes | Report | Print / Report file |
| U_07 | Laboratory classes | Report | Print / Report file |
| U_08 | Laboratory classes Conventional lecture | Colloquium/test/written test Exam | Completed and evaluated colloquium/test/written test Rated text of the written work |
| SOCIAL COMPETENCIES | | | |
| K_01 | Laboratory classes | Observation | Evaluation card |

VI. Grading criteria, weighting factors.....

Lecture: Grade from the written exam (100 %).

Classes: Written tests in the form of colloquia and / or tests on issues from the main chapters (80%), preparation of written reports on the classes (8%), assessment of student's activity during classes (theoretical preparation for classes, practical exercises, activity, ability to work in a group, compliance with health and safety rules, 12%).

| Mark | Evaluation criteria | |
|---------------------|---|---|
| verygood (5) | the student realizes the assumed learning outcomes at a very good level | the student demonstrates knowledge of the education content at the level of 91-100% |

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| overgood (4.5) | the student accomplishes the assumed learning outcomes an over good level | the student demonstrates knowledge of the education content at the level of 86-90 % |
| good(4) | the student accomplishes the assumed learning outcomes at a good level | the student demonstrates knowledge of the education content at the level of 71-85% |
| quitegood(3.5) | the student accomplishes the assumed learning outcomes at a quite good level | the student demonstrates knowledge of the education content at the level of 66-70% |
| sufficient (3) | the student accomplishes the assumed learning outcomes at a sufficientlevel | the student demonstrates knowledge of the education content at the level of 51-65% |
| insufficient (2) | the student accomplishes the assumed learning outcomes at an insufficientlevel | the student demonstrates knowledge of the education content below the level of 51% |

VII. Student workload

| Form of activity | Number of hours |
|--|-----------------|
| Number of contact hours (with the teacher) | 60 |
| Number of hours of individual student work | 90 |

VIII. Literature

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| Basic literature |
| P. Atkins. The Elements of Physical Chemistry, 6th edition. Oxford University Press, 2013. P. Atkins, J. De Paula. Physical Chemistry for Life Science, 2nd edition. Oxford University Press, 2010. |
| Additional literature |
| C. Trapp, M. Caddy. Solutions Manual to accompany Physical Chemistry for the Life Sciences. Oxford University Press, 2011 |