

## Formularz opisu przedmiotu (formularz sylabusa)

### A. Ogólny opis przedmiotu

Nazwa pola	Komentarz
Name of the subject (in Polish and English)	Chemia stosowana i materiałów Applied and materials chemistry
Unit offering the subject	Faculty of Chemistry
Unit for which the subject is offered	Faculty of Chemistry
Subject code	
ERASMUS code	
Number of ECTS credits	2
Method of assessment	Examination
Language of instruction	English
Designation whether a subject may be credited more than once	No
Allocation of the subject to subject groups	<i>obligatory</i>
Total student workload	<p><i>Contact hours with teacher:</i></p> <ul style="list-style-type: none"> <li>- participation in lectures - 30 hrs</li> </ul> <p><i>Self-study hours:</i></p> <ul style="list-style-type: none"> <li>- preparation for lectures - 2 hrs</li> <li>- preparation for test/ examination- 18 hrs</li> </ul> <p><i>Altogether: 50 hrs (2 ECTS)</i></p>
Learning outcomes - knowledge	<p>W1: Knows the basics of general chemistry (understands concepts and laws), chemical terminology and nomenclature – K_W01,</p> <p>W2: Knows the structure of matter – K_W01,</p> <p>W3: Knows the structure and properties of metals and non-metals, and of simple chemical compounds – K_W01,</p> <p>W4: Knows different sources of energy and raw materials for energy production – K_W01.</p>
Learning outcomes - skills	<p>U1: Can describe chemical laws – K_U01,</p> <p>U2: Can associate the structure of a material with its properties – K_U01.</p>
Learning outcomes - social competencies	<p>K1: Can work independently and effectively with a large amount of information – K_K01,</p> <p>K2: Thinks creatively about improving existing or developing new approaches – K_K02,</p> <p>K3: Is geared towards the constant acquisition of new knowledge, skills and experience; sees the need for continuous improvement and enhancing professional expertise; is aware of the limitations of his/her own knowledge and understands the need for ongoing</p>

	education – K_K05, K4: Is capable of independently seeking information in the subject literature and scientific databases – K_K07.
Teaching methods	- Lecture with multimedia presentations
Prerequisites	Required knowledge of chemistry on completion of secondary education
Brief description of the subject	<p>The aim of the subject is to acquaint students with the problems of producing and applying chemical materials and substances, the principles of their rational utilisation and management.</p> <ul style="list-style-type: none"> <li>• Fundamental problems associated with the structure of solids, transitional phases and allotropy.</li> <li>• Band theory of solids – conducting and semiconducting properties of materials.</li> <li>• Metals, alloys, metal oxides.</li> <li>• Ceramics, glasses, building materials.</li> <li>• Natural and synthetic polymers – structure, properties, manufacture, application and recycling methods.</li> <li>• Energy production – types of fuels and techniques of their combustion; renewable sources of raw materials and energy.</li> <li>• The problem of post-consumer communal and hazardous wastes. Technologies for the management (recycling) of wastes.</li> </ul>
Complete description of the subject	<ol style="list-style-type: none"> <li>1. “Green chemistry”: principles and means of implementation; environmentally friendly technologies.</li> <li>2. Wastes – the scale of the problem, division, classification, properties and waste management principles. Waste processing technologies. Recycling and energy recovery.</li> <li>3. Conventional and renewable energy production. Primary and final energy. Raw materials: solid, liquid and gaseous fuels. Combustion processes and exhaust gas purification. Prospects and directions of development for energy production (nuclear energy, biofuels, fuel cells). Hydrogen as a source of energy.</li> <li>4. The structure of matter: chemical bonds and intermolecular interactions. Real gases, condensation (phase transitions). Properties of liquids due to intermolecular interactions: surface tension, viscosity, solubility.</li> <li>5. Solids – phase transitions, types of phase, properties. Crystals – definitions, spatial and crystal lattices. Miller indices, unit cells and systems for classifying crystals. Aspects of symmetry and</li> </ol>

	<p>parameters characterising the spatial lattice of crystals.</p> <p>6. Mechanical properties of solids: hardness, elasticity, elongation. Hardness scales. Allotropy and anisomerism. Disruptions and defects in the crystal lattice.</p> <p>7. Metals – types of crystal structure, band theory of conductivity.</p> <p>8. Band model of solids – division into conductors, semiconductors and insulators. The chemical “systematics” of semiconductors. Intrinsic and doped semiconductors. Application of semiconductors. Superconductors, liquid crystals, glasses.</p> <p>9. Magnetic properties of solids: diamagnetism, paramagnetism and ferromagnetism.</p> <p>10. Physico-chemical and technological properties of metals. Metallurgy of iron and other metals (ferrous and non-ferrous). Steels and alloys – properties and applications.</p> <p>11. Colloids and nanomaterials.</p> <p>12. Chemistry of building materials – cements and ceramics.</p> <p>13. Natural and synthetic polymers. Thermoplastic polymers and elastomers. Thermosetting polymers.</p> <p>14. Surface phenomena: adhesion, adsorption, heterogeneous catalysis, electrode processes.</p> <p>15. Corrosion of materials (electrochemical, atmospheric). Prevention of corrosion.</p>
Literature	<p>1. <i>Shriver and Atkins; Inorganic Chemistry (Fifth Edition).</i></p> <p>2. <i>Lesley E. Smart, Elaine A. Moore; Solid State Chemistry: An Introduction, (Fourth Edition) 2012 by CRC Press.</i></p> <p>3. <i>B. Fahlman; Materials Chemistry. 2007 by Springer Verlag</i></p> <p>4. <i>Geoffrey Ozin and André Arsenault; Nanochemistry: A Chemical Approach to Nanomaterials; RSC Publishing (2005)</i></p> <p>5. <i>R.J.D. Tilley, Understanding Solids: The Science of Materials; John Wiley &amp; Sons (2004)</i></p>
Assessment methods & criteria	<p>Assessment methods:</p> <ul style="list-style-type: none"> <li>- written examination- K-W01, K-U01 – 90%</li> <li>- activity – K-K01, K-K02, K-K05, K-K07 – 10%</li> </ul> <p>fail- below 50%</p> <p>satisfactory- 51-59%)</p> <p>satisfactory plus- 60-67%</p> <p>good – 68-74%</p> <p>good plus- 75-81%</p> <p>very good- 82-100%</p>
Work placement	not applicable

**B) Opis przedmiotu cyklu**

<b>Nazwa pola</b>	<b>Komentarz</b>
Didactic cycle	2014/2015
Method of assessment of the subject in the cycle	written examination
Type of classes, number of hours of classes and methods of assessment	lecture- 30 hrs; examination
Subject coordinator	Dr hab. Stanisław Biniak, prof.UMK
Subject teachers	Dr hab. Stanisław Biniak, prof.UMK
Nature of the subject	obligatory
Limit of places available in each group	1 group - no limit
Time and place	Faculty of Chemistry- date will be specified later
Learning outcomes	As in part A
Assessment methods & criteria	As in part A
List of topics	As in part A
Teaching methods	As in part A
Literature	As in part A