



## Subject card

Subject name and code	Chemistry of construction materials, PG_00061706						
Field of study	Civil Engineering						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2023/2024		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study		
Mode of study	Part-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Environmental Engineering Technology -> Faculty of Civil and Environmental Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Aneta Łuczkiwicz					
	Teachers	mgr inż. Filip Pawlak mgr inż. Anna Wilińska-Lisowska mgr inż. Emilia Bączkowska					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	10.0	15.0	0.0	0.0	40
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	40		5.0		80.0	125
Subject objectives	<ol style="list-style-type: none"><li>1. To acquaint students with the basics of chemistry for civil engineers and general chemistry at the academic level</li><li>2. To acquaint students with the chemical characteristics of various building materials</li><li>3. Presentation of aspects related to the creation and destruction of various classes of building materials</li><li>4. Acquainting students with the chemical aspects of building materials protection against destruction (including corrosion protection)</li><li>5. Acquainting students with the laboratory research of building materials</li></ol>						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W05] Demonstrate knowledge and understanding of research methods (obtaining information, simulations, experimental methods) in the field of civil engineering.	01 - is able to apply the basic concepts and laws of general chemistry, discussed during classes to the description of chemical processes; 02 - is aware of the dangers of working in a chemical laboratory and knows the rules of occupational health and safety and observes them.	[SW3] Assessment of knowledge contained in written work and projects
	[K6_U02] Analyse & solve engineering issues & problems in the field of civil engineering by applying appropriate and relevant established analytical, numerical and experimental methods.	01 - can cooperate in a small team performing chemical determinations and prepare reports on the results obtained during the experiments; 02 - uses laboratory equipment, with which he performs and interprets simple quantitative determinations;	[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools
	[K6_U01] Apply knowledge and understanding of mathematics as well as sciences and engineering disciplines underlying civil engineering to solve engineering problems and issues.	01 - can use the known laws and relationships for chemical calculations (in particular regarding concentrations of solutions, pH of solutions);	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
	[K6_W01] Demonstrate knowledge and understanding of mathematics as well as sciences and engineering disciplines underlying civil engineering at a level necessary to achieve the other programme outcomes.	01 - knows and understands the basic concepts and laws of general chemistry, discussed during classes,	[SW1] Assessment of factual knowledge

Subject contents	<p><b>LECTURE</b></p> <ol style="list-style-type: none"> <li>1. The structure of materials, the built-up of molecules and atoms</li> <li>2. Types of chemical bonds and their characteristics; Types of chemical reactions occurred in civil engineering</li> <li>3. Characterization of homogenous and heterogenous material systems; dispersion systems.</li> <li>4. Role of water in building materials (Chemical equilibriums. The concept of pH. Dissociation. Hydrolysis of salts)</li> <li>5. Electrochemistry. Redox processes, corrosion of metals</li> <li>6. Inorganic construction binders. Gypsum and lime</li> <li>7. Inorganic construction binders. Cement</li> <li>8. Inorganic construction binders. Factors influencing the binding of cement. Cement corrosion</li> <li>9. Organic construction binders. (Polymers additives, resins etc.)</li> <li>10. Chemia materiałów organicznych (chemia bitumów, chemia drewna)</li> <li>11. Novelty in the field of chemistry in civil engineering-new products and applications in the context of circular economy approach</li> </ol> <p><b>LABORATORY</b></p> <p>ACTIVITY 1: Qualitative analysis of mixing water</p> <p>ACTIVITY 2: Determining the color of the water and determining the aggressive CO<sub>2</sub></p> <p>ACTIVITY 3: Water hardness analysis Determining the acidity and alkalinity of water; pH measurement</p> <p>ACTIVITY 4: Determination of chloride and sulfate ions (VI), determination total alkalinity and calculation of the Larson-Skold index</p> <p>ACTIVITY 5: Morphology of building materials - microscopic analysis</p> <p><b>EXERCISES</b></p> <p>Computational tasks taking into account the following issues: mol, equivalents, percentage composition, reaction stoichiometry, writing chemical equations; molar and normal concentrations; percentages, balancing redox reactions; water hardness - conversion of indicators; electrolytic dissociation, pH;</p>														
Prerequisites and co-requisites	<ol style="list-style-type: none"> <li>1. The student has basic knowledge of general chemistry (solves basic computational problems, correctly writes equations of simple chemical reactions reaction reaction stoichiometry)</li> <li>2. The student knows the symbols of chemical elements as well as the molecular and structural formulas of basic acids, bases and salts</li> <li>3. The student knows the basic physical and chemical phenomena (e.g. phase transitions of water, neutralization reaction)</li> <li>4. Is aware of the importance of chemical phenomena in social life and the civil engineering.</li> </ol>														
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="448 1749 794 1787">Subject passing criteria</th> <th data-bbox="794 1749 1141 1787">Passing threshold</th> <th data-bbox="1141 1749 1487 1787">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 1787 794 1821">Test</td> <td data-bbox="794 1787 1141 1821">60.0%</td> <td data-bbox="1141 1787 1487 1821">40.0%</td> </tr> <tr> <td data-bbox="448 1821 794 1854">Test</td> <td data-bbox="794 1821 1141 1854">60.0%</td> <td data-bbox="1141 1821 1487 1854">30.0%</td> </tr> <tr> <td data-bbox="448 1854 794 1888">Report</td> <td data-bbox="794 1854 1141 1888">60.0%</td> <td data-bbox="1141 1854 1487 1888">30.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Test	60.0%	40.0%	Test	60.0%	30.0%	Report	60.0%	30.0%
Subject passing criteria	Passing threshold	Percentage of the final grade													
Test	60.0%	40.0%													
Test	60.0%	30.0%													
Report	60.0%	30.0%													
Recommended reading	Basic literature	<ul style="list-style-type: none"> <li>• T. Broniewski, L. Czarnecki, O. Henning Chemia w budownictwie, Wydawnictwo Arkady, Warszawa, 2018</li> <li>• Edward Szymański Materiały budowlane Tom 1, Podręczniki Wyższej Szkoły Ekologii i Zarządzania, 2011</li> </ul>													

	Supplementary literature	<p>Open AGH e-textbooks - peer-reviewed academic-level e-textbooks for science, developed by AGH employees for any use.</p> <p>Link: <a href="https://epodreczniki.open.agh.edu.pl/openagh-podreczniki.php?categId=82">https://epodreczniki.open.agh.edu.pl/openagh-podreczniki.php?categId=82</a></p> <p><b>Chemistry for civil engineers:</b> <a href="https://emkhk.bme.hu/wp-content/uploads/2015/11/CHEMISTRY-FOR-CIVIL-ENGINEERS-Supplementary-Academic-Educational-Material.pdf">https://emkhk.bme.hu/wp-content/uploads/2015/11/CHEMISTRY-FOR-CIVIL-ENGINEERS-Supplementary-Academic-Educational-Material.pdf</a></p>
Example issues/ example questions/ tasks being completed	eResources addresses	<p>Adresy na platformie eNauczanie:</p> <p>What is the pH of the solution in which the concentration of hydroxide ions is <math>3.5 \cdot 10^{-5} \text{ mol / dm}^3</math>.</p> <p>What are asphaltenes?</p> <p>What is the phenomenon of corrosion?</p> <p>How is an atomic bond different from an ionic bond?</p>
Work placement		Not applicable