



## Subject card

Subject name and code	Fundamentals of materials engineering II, PG_00058342						
Field of study	Hydrogen Technologies and Electromobility						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2022/2023		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Laboratorium Materiałów Funkcjonalnych ETI -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Sebastian Molin				
	Teachers		dr hab. inż. Sebastian Molin				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	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	45	5.0		25.0	75	
Subject objectives	The aim of the course is to deepen knowledge of materials engineering and to teach them a problem-solving. The course covers advanced topics such as mechanical properties, thermal processes, design considerations, testing and quality control, and composite materials and ceramics. Students will learn to analyze and design structures and choose appropriate materials. They will also develop skills in analytical thinking, design, and the use of tools and techniques. Additionally, they will learn teamwork, communication, and cultivate attitudes of responsibility and continuous improvement.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W13] knows the properties of materials used in the field of hydrogen energy and electromobility		Students should understand complex phenomena related to the properties of engineering materials, their structure, and their applications in various contexts. They should also acquire knowledge in techniques and research methods used in materials engineering		[SW1] Assessment of factual knowledge		
	[K6_U01] Is able to obtain information from literature, databases and other sources, integrate them, interpret them and draw conclusions and formulate opinions; has the ability to self-educate m.in. in order to improve professional competences		Students should acquire analytical thinking skills, design skills for structures, as well as the ability to use tools and techniques applied in materials engineering. They should also be able to independently conduct analysis and assessment of the quality of engineering materials		[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information		
	[K6_K02] can work in a group taking on different roles in it		Students should be able to work in groups and demonstrate communication and presentation skills for their work results. They should cultivate attitudes of responsibility for the quality of their work, as well as a drive for improving their skills and knowledge in the field of materials engineering		[SK1] Assessment of group work skills [SK3] Assessment of ability to organize work		

Subject contents	<p>Lecture 1: Introduction to Materials Engineering and Overview of Engineering Materials (1 hour)</p> <ul style="list-style-type: none"> <li>• Definition of Materials Engineering and its importance</li> <li>• Overview of engineering materials, their properties, and applications</li> </ul> <p>Lecture 2: Mechanical Properties of Materials (2 hours)</p> <ul style="list-style-type: none"> <li>• Hardness, tensile and bending strength</li> <li>• Wear and fatigue resistance</li> </ul> <p>Lecture 3: Thermal Processes (2 hours)</p> <ul style="list-style-type: none"> <li>• Hardening, tempering, and normalizing</li> <li>• Effect of thermal processes on the structure and properties of materials</li> </ul> <p>Lecture 4: Materials Design (3 hours)</p> <ul style="list-style-type: none"> <li>• Effect of material properties on structural design</li> <li>• Material selection based on properties and applications</li> </ul> <p>Lecture 5: Materials Testing and Quality Control (2 hours)</p> <ul style="list-style-type: none"> <li>• Non-destructive and destructive testing</li> <li>• Microstructure analysis and mechanical characteristics</li> </ul> <p>Lecture 6: Composite Materials and Ceramics (2 hours)</p> <ul style="list-style-type: none"> <li>• Overview of composite materials and ceramics</li> <li>• Applications of composite materials and ceramics in different contexts</li> </ul> <p>Lecture 7: Recap (1 hour)</p> <ul style="list-style-type: none"> <li>• Summary of course material</li> </ul>											
Prerequisites and co-requisites												
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="453 1021 796 1055">Subject passing criteria</th> <th data-bbox="799 1021 1142 1055">Passing threshold</th> <th data-bbox="1145 1021 1485 1055">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="453 1059 796 1093">Laboratory grade</td> <td data-bbox="799 1059 1142 1093">100.0%</td> <td data-bbox="1145 1059 1485 1093">25.0%</td> </tr> <tr> <td data-bbox="453 1097 796 1122">Final test</td> <td data-bbox="799 1097 1142 1122">50.0%</td> <td data-bbox="1145 1097 1485 1122">75.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Laboratory grade	100.0%	25.0%	Final test	50.0%	75.0%
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Laboratory grade	100.0%	25.0%										
Final test	50.0%	75.0%										
Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. Callister, W.D. Jr., Rethwisch, D.G. (2014). <i>Materials Science and Engineering: An Introduction</i>, 9th Edition, John Wiley &amp; Sons, Hoboken, NJ.</li> <li>2. Dieter, G.E. (2018). <i>Mechanical Metallurgy</i>, 3rd Edition, McGraw-Hill Education, New York, NY.</li> <li>3. Ashby, M.F., Jones, D.R.H. (2013). <i>Engineering Materials 1: An Introduction to Properties, Applications, and Design</i>, 4th Edition, Butterworth-Heinemann, Oxford, UK.</li> <li>4. Van Vlack, L.H. (1989). <i>Elements of Materials Science and Engineering</i>, 6th Edition, Addison-Wesley, Reading, MA.</li> <li>5. Shackelford, J.F. (2017). <i>Introduction to Materials Science for Engineers</i>, 8th Edition, Pearson Education, Upper Saddle River, NJ.</li> </ol>										

	Supplementary literature	<ol style="list-style-type: none"> <li>1. Richerson, D.W. (2017). Modern Ceramic Engineering: Properties, Processing, and Use in Design, 4th Edition, CRC Press, Boca Raton, FL.</li> <li>2. Ogi, K., Imai, H., Ichikawa, Y. (2017). Composite Materials: Design and Applications, 3rd Edition, CRC Press, Boca Raton, FL.</li> <li>3. Kalandyk, B. (2016). Inżynieria Materiałowa. Podstawy. Tom 1: Struktura i Właściwości Materiałów, Wydawnictwo Naukowe PWN, Warszawa.</li> <li>4. Wierzchoń, T. (2012). Inżynieria Materiałowa. Wydawnictwo Politechniki Krakowskiej, Kraków.</li> <li>5. Klimpel, A. (2007). Metody badań i kontrola jakości w inżynierii materiałowej. Wydawnictwo Naukowe PWN, Warszawa.</li> </ol>
	eResources addresses	<p>Adresy na platformie eNauczanie:</p> <p>PODSTAWY INŻYNIERII MATERIAŁOWEJ II [2022/23] - Moodle ID: 28538</p> <p><a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=28538">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=28538</a></p>
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. What types of fatigue testing methods are employed in the study of material properties?</li> <li>2. What are the key applications for composite materials and advanced ceramics in various industries?</li> <li>3. What non-destructive and destructive testing techniques are commonly utilized in materials characterization and evaluation?</li> <li>4. What are the primary thermal processing methods applied in the heat treatment of materials for enhancing their properties?</li> </ol>	
Work placement	Not applicable	