GDAŃSK UNIVERSITY OF TECHNOLOGY

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 2026	Academic year of realisation of subject	2026/2027
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	Department of Functional Materials Engineering -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Sebastian Molin	
	Teachers	dr hab. inż. Sebastian Molin mgr inż. Justyna Ignaczak dr inż. Patryk Błaszczak	

Lesson types

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_K02] can work in a group taking on different roles in it	Works in a team, communicates effectively, and presents work outcomes clearly	[SK1] Assessment of group work skills [SK3] Assessment of ability to organize work
[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	Independently performs analyses and evaluates 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

Subject contents	Course content – lecture Lecture 1: Introduction to Materials Engineering and Overview of Engineering Materials (1 hour) • Definition of Materials Engineering and its importance • Overview of engineering materials, their properties, and applications Lecture 2: Mechanical Properties of Materials (2 hours) • Hardness, tensile and bending strength • Wear and fatigue resistance Lecture 3: Thermal Processes (2 hours) • Hardening, tempering, and normalizing • Effect of thermal processes on the structure and properties of materials Lecture 4: Materials Design (3 hours) • Effect of material properties on structural design • Material selection based on properties and applications Lecture 5: Materials Testing and Quality Control (2 hours) • Non-destructive and destructive testing • Microstructure analysis and mechanical characteristics Lecture 6: Composite Materials and Ceramics (2 hours) • Overview of composite materials and ceramics • Applications of composite materials and ceramics in different contexts Lecture 7: Recap (1 hour) • Summary of course material Course content – laboratory L7: Determination of Young's modulus L8: Determination of thermal conductivity coefficient L9: Determination of linear thermal expansion coefficient L10: Determination of surface tension L11: Determination of dielectric permittivity L12: Peltier heat pump L13: Photovoltaic cell
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Final test	50.0%	75.0%
Laboratory grade	100.0%	25.0%

Recommended reading	Basic literature	1. Callister, W.D. Jr., Rethwisch, D.G. (2014). Materials Science and Engineering: An Introduction, 9th Edition, John Wiley & Sons, Hoboken, NJ. 2. Dieter, G.E. (2018). Mechanical Metallurgy, 3rd Edition, McGraw-Hill Education, New York, NY. 3. Ashby, M.F., Jones, D.R.H. (2013). Engineering Materials 1: An Introduction to Properties, Applications, and Design, 4th Edition, Butterworth-Heinemann, Oxford, UK. 4. Van Vlack, L.H. (1989). Elements of Materials Science and Engineering, 6th Edition, Addison-Wesley, Reading, MA. 5. Shackelford, J.F. (2017). Introduction to Materials Science for Engineers, 8th Edition, Pearson Education, Upper Saddle River, NJ.
	Supplementary literature	1. Richerson, D.W. (2017). Modern Ceramic Engineering: Properties, Processing, and Use in Design, 4th Edition, CRC Press, Boca Raton, FL. 2. Ogi, K., Imai, H., Ichikawa, Y. (2017). Composite Materials: Design and Applications, 3rd Edition, CRC Press, Boca Raton, FL. 3. Kalandyk, B. (2016). Inżynieria Materiałowa. Podstawy. Tom 1: Struktura i Właściwości Materiałów, Wydawnictwo Naukowe PWN, Warszawa. 4. Wierzchoń, T. (2012). Inżynieria Materiałowa. Wydawnictwo Politechniki Krakowskiej, Kraków. 5. Klimpel, A. (2007). Metody badań i kontrola jakości w inżynierii materiałowej. Wydawnictwo Naukowe PWN, Warszawa.
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. What types of fatigue testing methods are employed in the study of material properties? 2. What are the key applications for composite materials and advanced ceramics in various industries? 3. What non-destructive and destructive testing techniques are commonly utilized in materials characterization and evaluation? 4. What are the primary thermal processing methods applied in the heat treatment of materials for enhancing their properties?	
Practical activites within the subject	Not applicable	

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