GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00061827		
Field of study	Management and Production Engineering		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Zakład Materiałoznawstwa I Technologii Materiałowych -> Institute of Manufacturing and Materials Technology -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Marek Szkodo	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	15.0	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	0.0	0.0	45

Subject objectives

The aim of the course is to familiarize students with the content of the subject and to achieve the assumed educational goals.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_K01] is aware of the need to expand knowledge and verify the methods of solving problems by consulting experts	The student is able to critically analyze the results of the nanoindentation test	[SK5] Assessment of ability to solve problems that arise in practice
[K7_K02] is aware of the importance and understanding of non-technical aspects and effects of engineering activities, including its impact on the environment, and the related responsibility for decisions made demonstrates knowledge of actions to reduce risk and anticipate the social impact of engineering and manufacturing activities	The student is able to assess the value of the data obtained using contact mechanics	[SK5] Assessment of ability to solve problems that arise in practice
[K7_U01] can obtain information from literature, databases and others sources, also in English or another foreign language recognized as the language of international communication in a given engineering discipline; is able to integrate the obtained information, interpret it, as well as draw conclusions and formulate and justify opinions.	The student is able to analyze the obtained results of the nanoindentation test	[SU3] Assessment of ability to use knowledge gained from the subject

Subject contents

Lecture: Hertz theory in contact mechanics. Sneddon's equations in contact mechanics. Non-Hertzian theories in contact mechanics. Hardness measurement methods and differences between them. Indentation test for determining the mechanical properties of the surface layer of engineering materials. Laboratory: Determination of hardness and elastic modulus of engineering materials using nanoindentation. Determination of the critical stress intensity factor in the indentation test. Determination of residual stresses using the indentation method. Determination of the creep velocity of materials in the indentation test. Determination of dislocation density and their mobility in the indentation test.

Prerequisites and co-requisites

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Completing and passing all exercises	100.0%	50.0%
	Passing the colloquium at the end of the semester	50.0%	50.0%
Recommended reading	Basic literature	1. S. Arunkumar, A Review of Indentation Theory, Materials Today: Proceedings, Volume 5, Issue 11, Part 3, 2018, Pages 23664-236732. Vanlandingham, Mark. (2003). Review of Instrumented Indentation. Journal of Research of the National Institute of Standards and Technology. 108. 249. 10.6028/jres.108.024.3. Liu, M.; Lin, J.-y.; Lu, C.; Tieu, K.A.; Zhou, K.; Koseki, T. Progress in Indentation Study of Materials via Both Experimental and Numerical Methods. Crystals 2017, 7, 258. https://doi.org/10.3390/cryst71002584. Broitman, E. Indentation Hardness Measurements at Macro-, Micro-, and Nanoscale: A Critical Overview. Tribol Lett 65, 23 (2017). https://doi.org/10.1007/s11249-016-0805-55. A. Stanisławska. Mechanika kontaktu w charakteryzowaniu materiałów inżynierskich. 2023. Wydawnictwo Politechniki Gdańskiej	
	Supplementary literature	1. Madhumali, S.P.L., Jayasinghe, J.A.S.C., Bandara, C.S., Dammika, A.J. (2023). Spherical Indentation Test to Determine Metal Properties Using Representative Strain Concept: A Review. In: Dissanayake, R., Mendis, P., Weerasekera, K., De Silva, S., Fernando, S., Konthesingha, C. (eds) 12th International Conference on Structural Engineering and Construction Management. Lecture Notes in Civil Engineering, vol 266. Springer, Singapore. https://doi.org/10.1007/978-981-19-2886-4_4 2. VanLandingham MR. Review of Instrumented Indentation. J Res Natl Inst Stand Technol. 2003 Aug 1;108(4):249-65. doi: 10.6028/jres.108.024. PMID: 27413609; PMCID: PMC4846235	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	1. Why is there a non-linear relationship between the load and the ball's displacement in Hertz's theory?2. State the differences in determining hardness using different methods.3. What conditions must be met for the nanoindentation test to be considered reliable4. How is the material creep speed determined in the indentation test5. How is the depth of contact of the indenter with the tested material determined using the Olivier-Pharr method?		
Work placement	Not applicable		