GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Experimental methods in mechanics, PG_00064925		
Field of study	Mechanical Engineering		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2027/2028
Education level	second-cycle studies	Subject group	Specialty subject group Subject group related to scientific research 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	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jacek Łubiński	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	9.0	0.0	9.0	0.0	0.0	18

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	18	11.0	46.0	75

Subject objectives

Attendance to the course builds acwuaintance with the fundamentals of experimental research in mechanics and machine design. The introduction covers the historic and civilisational sources of empiric methods with quantified mesurement of physical parameters driving the course of experimental and industrial systems. In each segment of the course, based on examples, illustration is given of technical means of inflicting desired phenomena in controlled conditions or for observation and detailed data gathering in real-life systems, e.g. industrial machinery.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U13] evaluates the feasibility and potential for utilizing new technical and technological achievements in accomplishing tasks characteristic for the field of study	The student assesses the usefulness and possibility of using new achievements (techniques and technologies) in the implementation of tasks characteristic of the field of study	[SU1] Assessment of task fulfilment
[K7_W03] demonstrates a well-structured and theoretically grounded knowledge of the key issues in Mechanical Engineering to enable the design and diagnosis of mechanical systems, processes and devices	The student demonstrates structured and theoretically supported knowledge covering key issues in the field of Mechanics and Mechanical Engineering allowing for the design and diagnosis of mechanical systems, processes and devices	[SW1] Assessment of factual knowledge
[K7_U03] plans and carries out experimental investigations to determine the parameters of devices, processes or systems in the field of Mechanical Engineering and Mechanical Engineering, appropriately selects methods, techniques and tools, interprets results and estimates measurement errors	The course adept plans and implements experimental research to determine the parameters of devices, processes or systems in the field of Mechanics and Machine Construction, properly selects methods, techniques and tools, interprets the results and estimates measurement errors	[SU3] Assessment of ability to use knowledge gained from the subject

<table>
<tr><td>Subject contents</td><td>Course content – lecture

Organisation of the course. Basics of the philosophy of science - the origins of experiment in mechanics. Sliding friction. Significance in technology and experimental testing.Hydrodynamic sliding friction. Significance in technology and experimental testing.
Examples of practical applications of the measurement of physical parameters in the assessment of machines' condition
Measurement of force and displacement with regard to specimen and structure
The use of strain gauges in deformation/stress and torque measurement, Other methods: thermography, DIC.
The quality of measurement results - independent party calibration of sensors, measurement errors and uncertainty
Examples of practical application of measurements by strain gauges, thermography, DIC and other methods.
Temperature in sliding contacts and methods of its measurement.
Wear particles emissions in sliding contact and methods of measurement.
Sliding friction induced vibration and methods of its measurement.
What happens in metals and metal alloys in indentation test?
What properties of materials can be evaluated in indentation tests?
Internal stress in cristalline materials.Hall - Williamson analysis.
Why dislocations are important in metals and how to evaluate the structure of dislocations.

Course content – laboratory

Sliding friction. Importance in technology and experimental research. Sliding friction, hydrodynamic. Importance in Engineering and Experimental Research Examples of practical applications of measurements of physical quantities in the assessment of the condition of machines Measurement of force and displacement in sample and structure Use of strain gauge bridges in the measurement of strains/stresses and torque. Other methods: thermography, DIC Result Quality Assurance - The Role of External Calibrations, Errors and Measurement Uncertainties Examples of practical applications of measurements using strain gauge, thermographic, DIC and other methods Sliding Contact Temperature and Methods of Measuring It Emission of wear particles from sliding contact and methods for measuring their characteristics Vibrations caused by sliding friction and methods of measuring them What happens to metals and alloys during the indentation test What material properties can be determined in the indentation test Self-stresses in crystalline materials
Williamson-Hall AnalysisWhy Dislocations in Metals Are Important and How to Determine the Dislocation Structure</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Completed courses or advanced self-acquired knowledge and engineering skills in technical mechanics, materials science, machine design. Comprehension in the principles of measurement of physical parameters with the use of transducers outputting signal proportional to the magnitude of the parameter being measured. Fond knowledge on the principles of operation of typical mechanisms and machines used in industry and in everyday life.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>laboratory reports</td><td>60.0%</td><td>67.0%</td></tr>
<tr><td>tests</td><td>59.0%</td><td>33.0%</td></tr>
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<tr><td>Recommended reading</td><td>Basic literature</td><td>Tribology Handbook
Mechanical Engineer's Handbook
Materials' Engineering Handbook
Fundamentals of analogue and digital measurements</td></tr>
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Supplementary literature	Michał Heller, Tadeusz Pabjan: Elementy filozofii przyrody. Kraków: Copernicus Center Press, 2014. ISBN 978-83-7886-065-5. Andrzej Kajetan Wróblewski: Historia fizyki. Warszawa: Wydawnictwo Naukowe PWN, 2007, s. 2833. ISBN 978-83-01-14635-1 Edward Dolnick: Wielki zegar Wszechświata. Wiek geniuszy i narodziny nowoczesnej nauki. Warszawa: Prószyński i S-ka, 2012. ISBN 978-83-7839-172-2. Michał Heller: Wszechświat u schyłku stulecia. Kraków: Znak, 1994. ISBN 83-7006-348-9. Michał Heller, Tadeusz Pabjan: Elementy filozofii przyrody. Kraków: Copernicus Center Press, 2014. ISBN 83-7886-065-5. Kirk, Mechanism, [w:] Honderich (red.), The Oxford Companion to Philosophy, Oxford: Oxford University Press, 2005 Margaret J. Osler: Divine Will and the Mechanical Philosophy: Gassendi and Descartes on Contingency and Necessity in the Created World. Cambridge University Press, 2004-06-07. ISBN 978-0-521-52492-6 Osler, Mechanical Philosophy, [w:] Horowitz (red.), New Dictionary of the History of Ideas, 2005, s. 1389-1392, ISBN 0-684-31452-5. Stathis Psillos: Philosophy of Science A-Z. Edinburgh: Edinburgh University Press, 2007 Stephen D. Snobelen: The Myth of the Clockwork Universe. Newton, Newtonianism, and the Enlightenment. W: The Persistence of the Sacred in Modern Thought. Chris L. Firestone, Nathan Jacobs (red.). Notre Dame: University of Notre Dame Press, 2012 Acton H.B., Dialectical Materialism, [w:] D.M. Borchert (red.), Encyclopedia of Philosophy, t. 3, Thomson Gale, 2006, s. 5667, ISBN 0-02-866072-2. Mortimer Adler: Dialectic. New York, London: Columbia University, Routledge, 2001, seria: International Library of Philosophy. ISBN 0-415-22550-7. Monika Bogdanowska: Topika. W: Retoryka. Piotr Wilczek, Maria Barłowska, Agnieszka Budzyńska-Daca (red.). Warszawa: Wydawnictwo Naukowe PWN, 2008, s. 3556. ISBN 978-83-01-15678-7. Wojciech Chudy: Dialektyka. W: Powszechna encyklopedia filozofii. Lublin: Polskie Towarzystwo Tomasza z Akwinu, Katedra Metafizyki KUL, 2001, s. 110. ISBN 83-914431-4-0. Ernst Robert Curtius: Literatura europejska i łacińskie średniowiecze. Kraków: Wydawnictwo Universitas, 1997. ISBN 83-7052-128-2. Etienne Gilson: Historia filozofii chrześcijańskiej w wiekach średnich. Sylwester Zalewski (tł.). Warszawa: Instytut Wydawniczy PAX, 1987. ISBN 83-211-0453-3. Hall R., Dialectic, [w:] D.M. Borchert (red.), Encyclopedia of Philosophy, t. 3, Thomson Gale, 2006, s. 5256, ISBN 0-02-866072-2.

		George Alexander Kennedy: Classical Rhetotic & Its Christian & Secular Tradition from Ancient to Modern Times. Second edition, revised and enlarged. Chapel Hill, Londyn: The University of North Carolina Press, 1999. ISBN 0-8078-2467-4. (ang.) Brian Lawn: The rise and decline of the scholastic Qauaestio Disputata. Leiden, New York, Köln: Brill, 1993. ISBN 90-04-09740-6. Heinrich Lausberg(ang.): Retoryka literacka. Podstawy wiedzy o literaturze. Albert Gorzkowski (tł.), Jerzy Axer, Andrzej Borowski, Maria Cytowska, Romuald Turasiewicz (konsultacja naukowa). Bydgoszcz: Wydawnictwo Homini, 2002. ISBN 83-87933-21-X. Tadeusz Kwiatkowski. Dialektyka Arystotelesa. Roczniki Filozoficzne. 11 (1), s. 81101, 1963. Lublin: Katolicki Uniwersytet Lubelski. ISSN 0035-7685. David Ross: Aristotle. John L.Ackrill(ang.) (Introduction and new material). London: Routledge, Taylor & Francis Group, 2016. ISBN 1-138-14104-6. Sara Rubinelli: Ars topica.The classical technique of constructing arguments from Aristotle to Cicero. Dodrecht: University of Lugano, Springer, 2009, seria: Argumentation Library. ISBN 978-1-4020-9548-1. Schwemmer O., Dialektik, [w:] J. Mittelstraß (red.), Enzyklopädie Philosophie und Wissenschaftstheorie, t. 2, Stuttgart - Weimar: Verlag J.B. Metzler, 2005, s. 181187, ISBN 978-3-476-02101-4. Marek Skwara. O Arystotelesowskiej teorii dowodzenia retorycznego. Pamiętnik Literacki: czasopismo kwartalne poświęcone historii i krytyce literatury polskiej. 85 (4), s. 130152, 1994. Wrocław: Instytut Badań Literackich Polskiej Akademii Nauk. ISSN 0031-0514. Marta Spranzi: The art of dialectic between dialogue and rhetoric. The Aristotelian tradition. Amsterdam, Philadelphia: University of Paris Descartes, John Benjamins, 2011. ISBN 978-90-272-8684-0. Jerzy Ziomek: Retoryka opisowa. Wrocław, Warszawa, Kraków: Zakład Narodowy im. Ossolińskich, 1990. ISBN 83-04-03544-8. Mario Bunge, O przyczynowości (1959, wyd. pol. 1968),
	eResources addresses	
Example issues/ example questions/ tasks being completed	Platonic concept of methods of obtaining knowledge. What is dialectics? Aristhotelic views on the methods of obtaining knowledge by humans. What is logics and what is its purpose? Define the concept of mechanics as science. What are the principles of reductionistic analysis of complex systems? What are the fundamental assumptions of the determinism of cause and physical determinism? Define the concept of materialism. Describe the basic laws of sliding friction. Is the basic model of sliding friction a fully accurate reflection of reality? Is the coefficient of sliding friction a constant? The role of friction induced vibrations in sliding friction.	
Practical activites within the subject	Not applicable	

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