



## Subject card

Subject name and code	Experimental methods in mechanics, PG_00059389						
Field of study	Mechanical Engineering						
Date of commencement of studies	February 2023	Academic year of realisation of subject			2023/2024		
Education level	second-cycle studies	Subject group			Optional 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			4.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jacek Łubiński					
	Teachers	dr hab. inż. Jacek Łubiński dr inż. Jakub Kowalski dr hab. inż. Marek Szkodo dr hab. inż. Oleksii Nosko					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	18.0	0.0	9.0	0.0	0.0	27
	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	27	10.0		63.0	100	
Subject objectives	Attendance to the course builds acquaintance with the fundamentals of experimental research in mechanics and machine design. The introduction covers the historic and civilisational sources of empiric methods with quantified measurement 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_U05] is able to plan and conduct the experimental research determining the parameters of a device or system, assesses the usability and correctly selects methods and tools, is able to interpret the results and estimate the measurement errors and is able to apply computer systems to simulate the operation of a machine or technology	Development of practical skills in experimental research activity pertaining to mechanics and machine design/maintenance/development by performing laboratory exercises.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information
	[K7_W01] possesses a profound mathematical knowledge useful in the analysis and description of the operation of complex mechanical systems, technological processes and operating properties of machines and devices; is familiar with the main development trends	Understanding of relations between a physical parameter, the measured signal and the fundamentals of the processing of signals for practical use and conclusion formulation.	[SW1] Assessment of factual knowledge
	[K7_W02] possesses a wide and profound knowledge on continuum mechanics and materials strength within the range of modelling and simulating multi-function mechanical systems	Broadening of the scope of knowledge by introduction to research methods used in laboratory testing of selected mechanical systems with associations to real-life engineering practice.	[SW1] Assessment of factual knowledge
Subject contents	<p>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.</p> <p>Examples of practical applications of the measurement of physical parameters in the assessment of machines' condition</p> <p>Measurement of force and displacement with regard to specimen and structure</p> <p>The use of strain gauges in deformation/stress and torque measurement, Other methods: thermography, DIC.</p> <p>The quality of measurement results - independent party calibration of sensors, measurement errors and uncertainty</p> <p>Examples of practical application of measurements by strain gauges, thermography, DIC and other methods.</p> <p>Temperature in sliding contacts and methods of its measurement.</p> <p>Wear particles emissions in sliding contact and methods of measurement.</p> <p>Sliding friction induced vibration and methods of its measurement.</p> <p>What happens in metals and metal alloys in indentation test?</p> <p>What properties of materials can be evaluated in indentation tests?</p> <p>Internal stress in crystalline materials. Hall - Williamson analysis.</p> <p>Why dislocations are important in metals and how to evaluate the structure of dislocations.</p>		
Prerequisites and co-requisites	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.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	tests	59.0%	33.0%
	laboratory reports	60.0%	67.0%
Recommended reading	Basic literature	Tribology Handbook Mechanical Engineer's Handbook Materials' Engineering Handbook Fundamentals of analogue and digital measurements	

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.

		<p>George Alexander Kennedy: Classical Rhetoric &amp; Its Christian &amp; 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.)</p> <p>Brian Lawn: The rise and decline of the scholastic Quaestio Disputata. Leiden, New York, Köln: Brill, 1993. ISBN 90-04-09740-6.</p> <p>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.</p> <p>Tadeusz Kwiatkowski. Dialektyka Arystotelesa. Roczniki Filozoficzne. 11 (1), s. 81101, 1963. Lublin: Katolicki Uniwersytet Lubelski. ISSN 0035-7685.</p> <p>David Ross: Aristotle. John L.Ackrill(ang.) (Introduction and new material). London: Routledge, Taylor &amp; Francis Group, 2016. ISBN 1-138-14104-6.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>Jerzy Ziomek: Retoryka opisowa. Wrocław, Warszawa, Kraków: Zakład Narodowy im. Ossolińskich, 1990. ISBN 83-04-03544-8.</p> <p>Mario Bunge, O przyczynowości (1959, wyd. pol. 1968),</p>
	eResources addresses	<p>Adresy na platformie eNauczanie:  Metody eksp w mech ZAOCZN, PG_00057460 2023/24 - Moodle ID: 34345  <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=34345">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=34345</a></p>
Example issues/ example questions/ tasks being completed	<p>Platonic concept of methods of obtaining knowledge. What is dialectics? Aristotelic 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.</p>	
Work placement	Not applicable	