University of Gdańsk

Subject card

Subject name and code	Mechanoscopy and physical methods of examining traces - lecture, PG_00132723						
Field of study	Criminology						
Date of commencement of studies	October 2026		Academic year of realisation of subject	2026/2027			
Education level	Master's 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	2.0			
Learning profile	academic		Assessment form	exam			
Conducting unit	Faculty of Law and Administration -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Anna Synak				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	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	15		0.0	35.0	50	
Subject objectives	Familiarizing students with physical research methods used in Mechanoscopy [a branch that examines traces of the impact of a given thing (tool) on another thing] and other methods supporting this branch. Discussing research equipment (mainly microscopic techniques) used in modern forensics to identify traces. Familiarizing students with the technical parameters of the equipment, its capabilities and limitations from the perspective of its use in preparing an expert opinion. Learning the basic physical phenomena and processes necessary to understand the research methods discussed						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[KRYMMU2_W02] Has an in-depth knowledge of the nature of natural sciences related to the studied major, their place in the system of sciences and their mutual relations	The student: is familiar with basic and advanced microscopy techniques used in toolmark examination (mechanoscopy) and understands their application in the identification and analysis of mechanical traces; is able to propose an appropriate analytical method, including a suitable microscopic or instrumental technique, depending on the type of material under examination and the objectives of the forensic investigation; is familiar with the construction, operating principles, and applications of optical, stereoscopic, digital, electron, and scanning probe microscopes used in toolmark examination; possesses knowledge of the operating principles and potential applications of X-ray (RTG) methods and refractometry in the examination of materials and forensic traces; understands the capabilities and limitations of various microscopic techniques and instrumental methods, including X-ray methods and refractometry, used for the examination, analysis, and interpretation of toolmarks.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
	[KRYMMU2_K05] Is able to responsibly perform professional roles while taking into account changing social needs, contribute to the development and maintenance of professional achievements and ethos, as well as observe and develop the principles of professional ethics and promote compliance with these principles.	The student is aware of the professional responsibility associated with conducting toolmark examinations and applying microscopic techniques and instrumental methods in forensic analyses. The student adheres to the principles of professional ethics and good laboratory practice when performing examinations and interpreting the results of toolmark analyses. The student recognizes the need for continuous professional development and for updating their knowledge of modern microscopic techniques and analytical methods used in forensic science. The student responsibly and critically evaluates the results of laboratory examinations, taking into account the capabilities and limitations of the applied methods and their significance for the forensic evidence and the judicial process.	[SK1] oral statement/conversation/ discussion

	Course outcome	Subject outcome	Method of verification
	[KRYMMU2_W05] Has an in-depth knowledge of research methods and tools, including techniques of data collection, analysis and interpretation, specific to criminology and forensic science.	The student possesses knowledge of physics and is able to apply it to solve and interpret problems related to toolmark examination (mechanoscopy) and the analysis of forensic evidence. The student is able to select an appropriate analytical method according to the type of material under examination and the objectives of the forensic investigation. The student is familiar with trace analysis techniques used in forensic science, particularly microscopic techniques and instrumental methods, and understands their capabilities, limitations, advantages, and disadvantages. The student possesses knowledge of the construction, operating principles, and applications of microscopic techniques and instrumental methods used for the acquisition, analysis, and interpretation of data and toolmarks for forensic purposes.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
Subject contents	Discussion of modern physical laboratory methods used mainly in Mechanoscopy, in the study of crime evidence. The program includes: optical and electron microscopy, physical methods of glass examination, X-ray methods of examining hidden objects and analysis of unknown substances.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	egzamin pisemny/ustny	51.0%	100.0%

Recommended reading	Basic literature	[1] M. Pluta, Mikroskopia optyczna, PWN, Warszawa, 1980. [2] D. Halliday, R. Resnick, J. Walker, Podstawy fizyki, t. 4, PWN, 2012. [3] E. Hecht, Optyka, PWN, 2012. [4] A. Barbacki, Mikroskopia elektronowa, Wyd. Politechniki Poznańskiej, 2005. [5] W. Dziadur, J. Mikuła, Mikroskopia elektronowa, transmisyjna, skaningowa, tom 1, tom 2, Kraków 2016. [6] E. U. Kurczyńska, D. Borowska-Wykręt, Mikroskopia świetlna w badaniach komórki roślinnej, PWN, 2007. [7] M. Wędzony, Mikroskopia fluorescencyjna dla botaników, Kraków, 1996. [8] J.Liu, J.Tan, Confocal Microscopy, Morgan&Claypool Publishers, 2016. [9] A. Ho-Pui Ho, D. Kim, M.G.Somekh (Editors) Handbook of Photonics for Biomedical Engineering, Springer, 2017r. [10] J. Pawley (Editor), Handbook of Biological Confocal Microscopy (any edition). [11] J.A.Litwin, M. Gajda, Podstawy technik mikroskopowych, Wydawnictwo Uniwersytetu Jagiellońskiego, 2011. [12] K. Kurzydłowski, M. Lewandowska, Nanomateriały inżynierskie - konstrukcyjne i funkcjonalne, PWN, Warszawa, 2010.[14] J. Widacki - Kryminalistyka" , Wydawnictwo C.H. Beck, 2012. [13] A. Filewicz, W. Krawczyk, A. Musiał - Ślady fizykochemiczne. Ślady kryminalistyczne. Ujawnianie, zabezpieczenie, wykorzystanie" pod redakcjąM. Goca i J. Moszczyńskiego, Diffin, Warszawa 2007.

	Supplementary literature	[1]. A. Szummer - Podstawy ilościowej mikroanalizy rentgenowskiej". Wydawnictwo Naukowo - Techniczne, Warszawa 1994; [2]. C. Aitken, A. D. Stoney - The Use of Statistic in Forensic Science", Ellis Horwood, New York, 2000; [3]. A. Gorski, W. C. Mc Crone - Birefringence of fibres', The Mickroskope", 1998, 46, 3 - 16;6. M. Grieve - Fibres and their Examination in ForensicScience", Forensic Science Progress, vol. 4,Springer - Verlag, Berlin 1990; [4]. J. Wąs - Gubała - Pojedyncze włókno - śladem w badaniach kryminalistycznych, Przegląd Włókienniczy, 1999; [5].R. Howland, L. Benater, STM/AFM Mikroskopy ze skanującą sondą. Elementy teorii i praktyki, Warszawa,2002. [6] Z.Hrynkiewicz, E. Rokita (red.) - Fizyczne metody badań w biologii, medycynie i ochronie środowiska", Wydawnictwo Naukowe PWN, Warszawa1999; [7]J.R. Taylor, Wstęp do analizy błędu pomiarowego, PWN Warszawa 1999 [8]H. Szydłowski, Pracownia fizyczna wspomagana komputerem, PWN 2012,
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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