



COURSE SPECIFICATION

Course code	full-time programme:	M#2-S2-ME-205
	part-time programme:	
Course title in Polish	Badania nieniszczące	
Course title in English	Non-Destructive Testing	
Valid from (academic year)	2024/2025	

GENERAL INFORMATION

Programme of study	MECHANICAL ENGINEERING
Level of qualification	second-cycle
Type of education	academic
Mode of study	full-time programme
Specialism	all
Department responsible	Department of Metal Science and Manufacturing Processes
Course leader	dr hab. inż. Wojciech Depczyński, prof. PŚk
Approved by	dr hab. Jakub Takosoglu, prof. PŚk, Dean of the Faculty of Mechatronics and Mechanical Engineering

COURSE OVERVIEW

Course type	programme-specific	
Course status	compulsory	
Language of instruction	English	
Semester of delivery	full-time programme	Semester II
	part-time programme	Semester II
Pre-requisites	NO	
Examination required (YES/NO)	NO	
ECTS value	2	

Mode of instruction		lecture	class	laboratory	project	seminar
No. of hours per semester	full-time programme	15		15		
	part-time programme					

LEARNING OUTCOMES





Category of outcome	Outcome code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	Has an in-depth and structured knowledge of physics, including mechanics, wave physics, kinetics of crystallization processes, in particular the knowledge necessary to understand the physical phenomena occurring in all types of materials, including welded joints, metallic materials and mechanical systems, including systems for shaping and machining various types of materials.	MiBM2_W02
	W02	Has in-depth and theoretically supported knowledge of technical solutions used in various areas of mechanics and mechanical engineering, safety.	MiBM2_W02 MiBM2_W09
	W03	He has a detailed and in-depth knowledge of techniques for the manufacture of machine components, methods of bonding materials, taking into account incremental technologies, laser technologies, rapid prototyping issues, as well as a structured and in-depth knowledge of the construction of various types of systems for processing and shaping materials.	MiBM2_W07 MiBM2_W09
Skills	U01	Is able to efficiently obtain information on selected problems of diagnostics of material connections, is able to combine obtained information, perform in-depth analysis and draw conclusions. Is able to use specialist software to conduct destructive and non-destructive tests in material tests.	MiBM2_U02 MiBM2_U03
	U02	Can efficiently prepare documentation for complex engineering tasks in the field of mechanics and mechanical engineering, including welding, prepare a text including a discussion of the results of the task.	MiBM2_U04
	U03	Students are able to perform testing of welded joints using non-destructive methods.	MiBM2_U11
Competence	K01	Understands the importance of and knows the opportunities for continuous improvement (third level studies, postgraduate studies, courses), which leads to the improvement of professional, personal and social competences.	MiBM2_K01 MiBM2_K03
	K02	Is aware of the importance of and understands the links between engineering and non-engineering activities, in terms of environmental impacts and responsibility for decisions.	MiBM2_K01 MiBM2_K03 MiBM2_K04

COURSE CONTENT

Mode of instruction	Topics covered
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lecture	<p>Introduction, basic concepts. Diagnostics, destructive and non-destructive testing in materials testing. Material discontinuities, characterisation of discontinuities and their effect on mechanical properties of materials including welded joints. Non-destructive testing methods Discontinuities in welds, swc and base materials made by conventional and COS methods, discontinuities in forgings, discontinuities in castings. Penetration method, scope of application, characteristics of the method. Materials necessary for penetrant testing and standards. Examples of penetrant testing. Ultrasonic method, characteristics of the method, ultrasonic waves speed of wave propagation in materials, wave attenuation. Characteristics of ultrasonic testing equipment, measurements by ultrasonic method. Radiological method, purpose, scope and characteristics of the method. X-ray sources, construction and principle of operation of the X-ray tube, spectrum of pro-radiation, recording of test result. Gamma ray sources, radionuclide isotopes used in defectoscopy, gammagraphic apparatus, gamma ray spectrum, recording of examination result. Course of radiological examination. Examples of radiographs of rolled products, castings and welded joints. Health and safety at radiological examinations. Eddy current method, characteristics of the method, theoretical basis of the method - phenomenon of electromagnetic induction, magnetic field in objects, Maxwell's equation. Magnetic method, characteristics of the method, methods of magnetic field excitation, magnetic field detectors, standards used in the method. Other non-destructive testing methods used in technology.</p>
laboratory	<p>Penetration testing of selected welded joints and forgings. Ultrasonic testing by the shadow and echo method of selected welded joints. Ultrasonic echo testing of welded joints. Analysis of defects in welding, casting and in plastic-worked products on available radiographs obtained by radiological methods; using X-rays and gamma rays, tomographic examinations. Investigations of selected welded joints on low alloy steel sheets using eddy current method. Testing of selected welded joints using the magnetic particle method Summary of laboratory exercises.</p>

ASSESSMENT METHODS

Outcome code	Methods of assessment					
	Oral examination	Written examination	Test	Project	Report	Other
W01			X			
W02			X			
W03			X			
U01			X		X	
U02			X		X	
U03			X		X	
K01						X
K02						X

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	non-examination assessment	The pass mark is a minimum of 50% for all the in-class tests.
laboratory	non-examination assessment	The pass mark is a minimum of <i>50 points out of a possible 100</i> for each post-lab report and the final in-class test.



**OVERALL STUDENT WORKLOAD**

ECTS weighting												
No.	Activity type	Student workload										Unit
		full-time programme					part-time programme					
		L	C	Lb	P	S	L	C	Lb	P	S	
1.	Scheduled contact hours	15		15								h
2.	Other contact hours (office hours, examination)	2		2								h
3.	Total number of contact hours	34										h
4.	Number of ECTS credits for contact hours	1,4										ECTS
5.	Number of independent study hours	16										h
6.	Number of ECTS credits for independent study hours	0,6										ECTS
7.	Number of practical hours	25										h
8.	Number of ECTS credits for practical hours	1,0										ECTS
9.	Total study time	50										h
10.	ECTS credits for the course <i>1 ECTS credit = 25-30 hours of study time</i>						2					ECTS

READING LIST

1. B. Staniszewski: *Wymiana ciepła*, PWN, Warszawa 1980
2. Ferenc K., *Spawalnictwo*. WNT, Warszawa 2018
3. Klimpel A.: *Spawanie, zgrzewanie i cięcie metali*. Technologie. WNT, Warszawa 2005
4. Jakubiec M., Lesiński K., Czajkowski H.: *Technologia konstrukcji spawanych*. WNT, Warszawa 1986
5. Praca zbiorowa. *Poradnik inżyniera – spawalnictwo. T1 i T2*. WNT, Warszawa 2017
6. *Instrukcje do ćwiczeń laboratoryjnych*.
7. Ferenc K., Ferenc J.: *Konstrukcje spawane. Połączenia*. WNT, Warszawa 2019
8. Pilarczyk J., Pilarczyk J.: *Spawanie i napawanie elektryczne metali*. Śląsk, Katowice 1996
9. Nowacki J. i inni: *Lutowanie w budowie maszyn*. WNT, Warszawa 2007
10. Ferenc K. *Technika spawalnicza w praktyce. Poradnik inżyniera, konstruktora i technologa*. Wydawnictwo Verlag Dashofer

