

**COURSE SPECIFICATION**

Course code	full-time programme:	<b>M#2-S2-ME-EM-212</b>
	part-time programme:	
Course title in Polish	<b>Ekspertyza materiałowa</b>	
Course title in English	<b>Failure Analysis</b>	
Valid from (academic year)	<b>2024/2025</b>	

**GENERAL INFORMATION**

Programme of study	<b>MECHANICAL ENGINEERING</b>
Level of qualification	<b>second-cycle</b>
Type of education	<b>academic</b>
Mode of study	<b>full-time programme</b>
Specialism	<b>Machine Operation and Maintenance</b>
Department responsible	<b>Department of Metal Science and Manufacturing Processes</b>
Course leader	<b>dr inż. Marcin Kargul</b>
Approved by	<b>dr hab. Jakub Takosoglu, prof. PŚk, Dean of the Faculty of Mechatronics and Mechanical Engineering</b>

**COURSE OVERVIEW**

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

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

**LEARNING OUTCOMES**



Category of outcome	Outcome code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	Has detailed knowledge of machine part manufacturing techniques, material bonding methods and material shaping and processing systems.	MiBM2_W05
	W02	Has an in-depth and structured knowledge of the creation of material expertise and technical documentation by means of graphic and calculation programmes.	MiBM2_W06
Skills	U01	Is able to solve engineering problems at the design, material selection and manufacturing stages using knowledge of physics, mechanics and strength of materials. Is able to analyze obtained results and evaluate them.	MiBM2_U01
	U02	Be able to produce technical documentation based on the results obtained using specialised terminology in mechanics and mechanical engineering.	MiBM2_U04
Competence	K01	Recognises the importance and understanding of non-technical aspects and effects of technical activities, such as impact on the safety of others and impact on the environment, and the responsibilities associated with these matters.	MiBM2_K02

## COURSE CONTENT

Mode of instruction	Topics covered
lecture	<ul style="list-style-type: none"> <li>• Basic concepts, arbitration material expertise.</li> <li>• Diagnostic material expertise and the objectives and scope of their conduct.</li> <li>• The participation of incorrect selection of materials or operating parameters in the occurrence of accidents, failures and disasters - post-accident expertise.</li> <li>• Qualitative expertise concerning the chemical composition, structure, surface quality of materials, etc. Detailed material expertise, examples.</li> <li>• Admission of materials for use from the point of view of environmental impact - admission material expertise.</li> <li>• Expertise conduct program from the point of view of the selection of methods, availability of research tools. Final development of expert opinion results in written form – examples.</li> </ul>





laboratory	<ul style="list-style-type: none"> <li>• The influence of chemical composition on the formation of the microstructure and mechanical properties of selected iron alloys in the cast state (steel), microscopic examinations and hardness testing.</li> <li>• Tests of mechanical properties of selected steel types after various heat treatment procedures. Macroscopic examinations of fractures in brittle and ductile materials. Cracking of heat-treated and welded materials, technological test of bending samples made of various materials, including welded joints.</li> <li>• The influence of temperature and time of heating alloy and non-alloy steel on the amount of material mass loss under the influence of oxidation.</li> <li>• Tests of the effects of intergranular corrosion of high-alloy austenitic and ferritic steel. Microscopic and macroscopic examinations.</li> <li>• Material expertise after a fire - changes in the mechanical properties of steel rods under the influence of fire in a warehouse of various products, including steel.</li> <li>• Tests of mechanical properties and microscopic observations of galvanized and alu-galvanized sheets.</li> <li>• Strength tests of steels used for the production of double-threaded screws.</li> </ul>
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**ASSESSMENT METHODS**

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

**ASSESSMENT TYPE AND CRITERIA**

Mode of instruction	Assessment type	Assessment criteria
lecture	non-examination assessment	Obtaining at least 50% of points in the test
laboratory	non-examination assessment	Obtaining at least 50% of the points from the colloquium. Passing individual reports from the exercises

**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.	<b>Total number of contact hours</b>	<b>34</b>										h
4.	<b>Number of ECTS credits for contact hours</b>	<b>1,4</b>										ECTS
5.	<b>Number of independent study hours</b>	<b>16</b>										h



6.	<b>Number of ECTS credits for independent study hours</b>	<b>0,6</b>		ECTS
7.	<b>Number of practical hours</b>	<b>25</b>		h
8.	<b>Number of ECTS credits for practical hours</b>	<b>1,0</b>		ECTS
9.	<b>Total study time</b>	<b>50</b>		h
10.	<b>ECTS credits for the course</b> <i>1 ECTS credit = 25-30 hours of study time</i>		<b>2</b>	ECTS

**READING LIST**

1. Inżynieria metali i ich stopów. Redakcja Stanisław J. Skrzypek, Karol Przybyłowicz. Wydawnictwa AGH, Kraków, 2012;
2. Przybyłowicz K.: Nowoczesne Metaloznawstwo. Wydawnictwo Naukowe AKAPIT, Kraków, 2012;
3. Blicharski M.: Wstęp do inżynierii materiałowej. Wydanie trzecie zmienione. Wydawnictwa NaukowoTechniczne, Warszawa, 2006;
4. Blicharski M.: Inżynieria materiałowa – stal. Wydawnictwa Naukowo-Techniczne, Warszawa, 2004;
5. Przybyłowicz K.: Inżynieria stopów żelaza. Wydawnictwo Politechniki Świętokrzyskiej, Kielce, 2008;
6. Majta J.: Odształcanie i Własności. Stale mikrostopowe. Wybrane zagadnienia. Uczelniane Wydawnictwa Naukowo-Dydaktyczne, Kraków, 2008;
7. Przybyłowicz K.: Podstawy teoretyczne metaloznawstwa. Wydawnictwa Naukowo-Techniczne, Warszawa, 1999;
8. Malkiewicz T.: Metaloznawstwo stopów żelaza. Państwowe Wydawnictwo Naukowe. Warszawa-Kraków, 1978;
9. Colombier L., Hochmann J.: Stale odporne na korozję i stale żaroodporne. Wydawnictwo „Śląsk”. Katowice 1964;
10. Benesch R., Janowski J., Mamro K.: Metalurgia żelaza. Podstawy fizykochemiczne procesów. Wydawnictwo „Śląsk” 1979;
11. Encyklopedia Techniki. Metalurgia. Wydawnictwo „Śląsk” Katowice 1978;
12. Encyklopedia Techniki. Materiałoznawstwo. Wydawnictwa Naukowo-Techniczne, Warszawa, 1975;
13. Błażewski S., Mikoszewski J.: Pomiary twardości metali. Wydawnictwa Naukowo-Techniczne, Warszawa, 1981;
14. Inżynieria materiałowa, Przegląd spawalnictwa, inne. Wybrane artykuły;
15. Wybrane normy PN-EN

