COURSE SPECIFICATION

Course code	full-time programme:	**M#2-S1-ME-307**
	part-time programme:	
Course title in Polish	**Materiałoznawstwo II**	
Course title in English	**Material Science II**	
Valid from (academic year)	**2024/2025**	

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**first-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. Marek Konieczny, 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 III**
	part-time programme	
Pre-requisites		
Examination required (YES/NO)		**YES**
ECTS value		**5**

Mode of instruction		**lecture**	**class**	**laboratory**	**project**	**seminar**
No. of hours per semester	full-time programme	**30**		**30**		
	part-time programme					

LEARNING OUTCOMES

Category of outcome	**Outcome code**	**Course learning outcomes**	**Corresponding programme outcome code**
Knowledge	W01	On completion of the course, students will have an in-depth knowledge of metals and alloys used in mechanical engineering.	MiBM1_W08

Skills	U01	On completion of the course, students will be able to select appropriate materials for their practical application.	MiBM1_U01
	U02	On completion of the course, students will be able to select appropriate metal engineering materials to ensure proper operation of the machine.	MiBM1_U14
Competence	K01	The student is ready to critically evaluate his knowledge and the need to obtain new information both from the literature and from experts in the field of materials engineering.	MiBM1_K01
	K02	The student is aware of the importance and understanding of non-technical aspects and effects of engineering activities, including its impact on the safety of other people and the impact on the environment and the responsibility related to these issues.	MiBM1_K02

COURSE CONTENT

Type of instruction lecture	Topics covered
lecture	Metallurgical process of steel production. Analysis of the iron-cementite phase equilibrium system. Austenite diffusion transformations: pearlitic and bainitic transformations. Kinetics of austenite transformation. Diffusionless (martensitic) transformation of austenite. Transformations during tempering of hardened steel. The transformation of perlite into austenite. Carbon steels (unalloyed). Influence of carbon content on the microstructure and mechanical properties of annealed steel. Steel heat treatment technology: annealing, hardening and tempering of carbon steels. White cast iron. Gray cast iron - Fe - graphite phase equilibrium system. Malleable cast iron. Influence of the geometrical form of graphite particles and the type of matrix on the mechanical properties of cast iron. Alloying elements in steel - division into elements forming carbides and elements dissolving in ferrite. Classification of alloy carbides. Influence of alloying elements on the kinetics of austenite transformation. Hardenability of steel. Influence of alloying elements on the martensitic transformation, transformation during tempering and the selection of austenitization temperature. Strengthening mechanisms of metals and their alloys: work hardening, solution hardening, by grain size reduction, dispersion and precipitation hardening, and hard-ening by martensitic transformation. Surface treatments of steel. Rules for marking steel according to PN-EN. Structural steels. Machine steels. Tool steels. Corrosion-resistant steels. Aluminium - properties, metallurgical manufacturing process. Aluminium alloys. Division into casting alloys and alloys for plastic processing. Precipitation strength-ening of aluminium alloys. Use of aluminium alloys. Copper - properties, copper metallurgy. Copper alloys: brass, bronze, copper-nickel. Division into casting alloys and alloys for plastic processing. The use of copper and its alloys. Alloys of other non-ferrous metals. Ceramic materials and their application.

laboratory	Performing 12 laboratory exercises: • Influence of carbon content on the microstructure and mechanical properties of carbon steel • Annealing of steels • Hardening of carbon steels • Tempering of hardened steels • Hardenability of steel • Heat treatment of alloy steels • Aluminium alloys • Copper alloys • Alloys of other non-ferrous metals • Surface treatment • Sinters • Metallic and ceramic composites

ASSESSMENT METHODS

Outcome code	Methods of assessment *(Mark with an X where applicable)*					
	Oral examination	Written examination	Test	Project	Report	Other
W01		X	X		X	
U01			X		X	
U02			X		X	
K01						X
K02						X

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	examination assessment	The pass mark is a minimum of 50% for the final in-class test.
laboratory	non-examination assessment	The pass mark is a minimum of 50% for the final in-class test and each post-lab report.

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	30		30								h
2.	Other contact hours (office hours, examination)	4		2								h
3.	**Total number of contact hours**	**66**										h
4.	**Number of ECTS credits for contact hours**	**2,6**										ECTS
5.	**Number of independent study hours**	**59**										h

6.	**Number of ECTS credits for independent study hours**	**2,4**		ECTS
7.	**Number of practical hours**	**63**		h
8.	**Number of ECTS credits for practical hours**	**2,5**		ECTS
9.	**Total study time**	**125**		h
10.	**ECTS credits for the course** *1 ECTS credit = 25-30 hours of study time*	**5**		ECTS

READING LIST

1. Askeland D.R.: The Science and Engineering of Materials.
2. Callister W.D.: Materials Science and Engineering: An Introduction
3. Ashby M.F., Jones D.R.: Engineering Materials: part 1 and 2.
4. Budinski K.G., Budinski M.K.: Engineering Materials Properties and Selection.
5. Konieczny M.: Metal Science Laboratory.