Kielce University of Technology

FACULTY OF MECHATRONICS AND MECHANICAL ENGINEERING

Annex 9
to the Rector's Ordinance No. 35/19
of 12 June 2019

COURSE SPECIFICATION

Course code	**M#1-S1-ME-308**
Course title in Polish	**Metaloznawstwo II**
Course title in English	**Metal Science II**
Valid from (academic year)	**2019/2020**

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**first-cycle**
Type of education	**academic**
Mode of study	**full-time**
Specialism	**all**
Department responsible	**Department of Metal Science and Manufacturing Processes**
Course leader	**dr hab. inż. Marek Konieczny, prof. PŚk**
Approved by	

COURSE OVERVIEW

Course type	**basic**
Course status	**compulsory**
Language of instruction	English
Semester of delivery	**semester 3**
Pre-requisites	**Metal Science I**
Examination required (YES/NO)	YES
ECTS value	**5**

Mode of instruction	**lecture**	**class**	**laboratory**	**project**	**seminar**
No. of hours per semester	**30**		**30**		

LEARNING OUTCOMES

Category of outcome	Outcome code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	On completion of the course, students will have a basic knowledge of metals and alloys used in mechanical engineering.	MiBM1_W11
Skills	U01	On completion of the course, students will be able to select appropriate materials for their practical application.	MiBM1_U14
	U02	On completion of the course, students will have the ability to self-educate in order to solve and carry out new tasks.	MiBM1_U21
Competence	K01	On completion of the course, students will understand the need of lifelong learning in order to improve professional qualifications.	MiBM1_K01
	K02	On completion of the course, students will be aware of the importance of the role of a technical university graduate and will understand the need to provide other people with information related to the field of study.	MiBM1_K06

COURSE CONTENT

Type of instruction	Topics covered
Lecture	1. Metallurgical process of steel production. Analysis of the iron-cementite phase equilibrium system.
	2. Austenite diffusion transformations: pearlitic and bainitic transformations. Kinetics of austenite transformation - CTPi and CTPc graphs.
	3. Diffusionless (martensitic) transformation of austenite. Transformations during tempering of hardened steel. The transformation of perlite into austenite.
	4. 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.
	5. 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.
	6. 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.
	7. Influence of alloying elements on the martensitic transformation, transformation during tempering and the selection of austenitization temperature.
	8. Strengthening mechanisms of metals and their alloys: work hardening, solution hardening, by grain size reduction, dispersion and precipitation hardening, and hardening by martensitic transformation.
	9. Surface treatments of steel.
	10. Rules for marking steel according to PN-EN. Steels for flat products.
	11. Structural steels. Machine steels.
	12. Tool steels. Corrosion-resistant steels.
	13. Aluminium - properties, metallurgical manufacturing process. Aluminium alloys. Division into casting alloys and alloys for plastic processing. Precipitation strengthening of aluminium alloys. Use of aluminium alloys.
	14. 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.
	15. Alloys of other non-ferrous metals.
laboratory	1. Influence of carbon content on the microstructure and mechanical properties of carbon steel
	2. Annealing of steels

	3. Hardening of carbon steels
	4. Tempering of hardened steels
	5. Hardenability of steel
	6. Heat treatment of alloy steels
	7. Aluminium alloys
	8. Copper alloys
	9. Alloys of other non-ferrous metals
	10. Surface treatment
	11. Sinters
	12. Metallic 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		X	
U02		X	X		X	
K01						Observation of attitude and behav-iour
K02						Observation of attitude and behav-iour

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	**examination assess-ment**	The pass mark is a minimum of 50% for the examination test.
laboratory	non-examination assessment	The pass mark is connected with submitting reports and ob-taining at least 50% of test points during classes.

OVERALL STUDENT WORKLOAD

ECTS weighting								
	Activity type	**Student workload**					**Unit**
1.	Scheduled contact hours	L	C	Lab	P	S	h
		30		30			
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.