MODULE DESCRIPTION

Module code	full-time studies:	**Z-ZIP1-E-208**
	part-time studies:	**Z-ZIPN1-E-208**
Module name	**Materials Science**	
Module name in Polish	**Materiałoznawstwo**	
Valid from academic year	**2019/2020**	

MODULE PLACEMENT IN THE SYLLABUS

Field of study	**MANAGEMENT AND PRODUCTION ENGINEERING**
Level of education	**1st degree**
Studies profile	**General**
Form and method of conducting classes	**Full-time and Part-time**
Specialisation	**All**
Unit conducting the module	**Department of Mathematics and Physics**
Module co-ordinator	**Medard Makrenek, PhD, DSc**
Approved by:	**Dariusz Bojczuk, PhD, DSc**

MODULE OVERVIEW

Type of subject / group of subjects	**Major**
Module status	**Compulsory**
Language of conducting classes	**English**
Module placement in the syllabus - semester	**Semester II**
Initial requirements	**No requirements**
Examination (YES/NO)	**YES**
Number of ECTS credit points	**4**

Method of conducting classes		**Lecture**	**Classes**	**Laboratory**	**Project**	**Other**
Per semester	full-time studies:	**30**	**10**	**30**		
	part-time studies:	**18**	**6**	**18**		

TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

Category	Symbol	Learning outcomes	Assignations to the directional learning outcomes
Knowledge	W01	A student has knowledge concerning materials, their selection and application in production and utilisation processes.	ZIP1_W07 ZIP1_W09 ZIP1_W18
	W02	A student has knowledge of quality assurance as regards materials and products.	ZIP1_W07 ZIP1_W09
Skills	U01	A student is able to design a simple technological process together with documentation and justification.	ZIP1_U15
Social competences	K01	A student understands the need of constant improvement of his/her knowledge as regards the knowledge of new materials and technological processes and to transfer it to society.	ZIP1_K01 ZIP1_K06

TEACHING CONTENTS

Method of conducting classes	Teaching contents
Lecture	The classification of engineering materials applied in machine and device construction. The structure and properties of construction materials. The parameters characterising utility properties of materials. Crystallographic sets. Typical metal lattices. The metallic state theory. Actual structure of metals. Crystallisation and the structure of pure metals. The deformation mechanism of a monocrystal and polycrystal body. The notion of a crumple. The process of recrystallisation. The structure of metal alloys. Iron alloys. Iron-cementite system. Non-alloy steels – their division and application. Pig and cast iron. The graphitisation process. Heat treatment of metal alloys and its theoretical background. Heat treatment of steel. Transformations accompanying heating. Pearlite, bainite, and martensite transformation. Hardenability. Pr Transformations accompanying steel tempering. The elements of heat treatment. The types of hardening. Toughening. Annealing. Sub-zero treatment. Dispersion hardening. Thermo-chemical treatment. General information on the impact of alloy additions. Alloy steels – the principles of labelling, divisions, and application. Alloys of non-ferrous metals. Aluminium alloys and their division, properties and application. Copper alloys and their division, properties, and application. Tin and its alloys. Bearing alloys. Light and ultra-light alloys. Titanium alloys. Modern metal alloys. Fusible alloys. Solders. Titanium and its alloys. Zinc and its alloys. Noble metal alloys. Fibrous materials. Natural and artificial fibres – obtaining and application. Yarns, fabrics, and felts. Types of leather and their classification, properties, and application. Rubber materials. Drying oils, putties, packings – their properties and application. Ceramics. Glass and its properties. The types of glass and their application. Metallic glasses. Porcelain and its properties and application. Earthenware - its properties and application. Wood and wooden products. Physical and mechanical properties of wood. Protecting wooden products. Glues and glue materials. Rocks, stones – their properties and applications. Construction materials and their types, stone composites. Functional materials, shape-memory materials, piezoelectrics, electro- and magne-

	torheological materials.
Classes	The basics of phase equilibrium systems. The phase rule. Solid solutions. Total lack of solubility in a solid body. Limited solubility in a solid state with a eutectic transformation. Limited solubility in a solid state with a peritectic transformation. Limited changeable solubility in a solid state. Equilibrium systems with a chemical compound. Equilibrium systems with intermetallic phases. Limited solubility in a liquid state. Transformations in a solid state. The properties of two-component alloys. Cooling curves and equilibrium diagrams.
Laboratory	Rockwell, Brinell, and Vickers hardness measurements. Dynamic hardness measurements. Microhardness. Thermal analysis. Phase equilibrium systems. Non-alloy steels. Structures, division, and labelling. Heat treatment. Copper alloys. Structures, properties, and application. Spectroscopy on selected examples.

METODS OF ASSESSING TEACHING RESULTS

Symbol	Methods of checking the learning outcomes *(select X)*					
	Oral exam	**Written exam**	**Test**	**Project**	**Statement**	**Other**
W01	X	X				
W02			X			
U01			X			
K01						X

FORM AND CONDITIONS OF PASSING

Form of classes	Form of credit	Passing conditions
Lecture	Exam	Short homework assignments. Obtaining at least 50% points in the exam.
Classes	Credit with grade	Obtaining at least 50% of the test points.
Laboratory	Credit with grade	Obtaining positive grades from all laboratory exercises.

STUDENT WORKLOAD

<table>
<tr><th colspan="13">Balance of ECTS points</th></tr>
<tr><th rowspan="3">No.</th><th rowspan="3">Type of student's activity</th><th colspan="10">Student's workload</th><th rowspan="3">Unit</th></tr>
<tr><th colspan="5">full-time</th><th colspan="5">part-time</th></tr>
<tr><th>Lc</th><th>C</th><th>Lb</th><th>P</th><th>O</th><th>Lc</th><th>C</th><th>Lb</th><th>P</th><th>O</th></tr>
<tr><td>1.</td><td>Participation in the activities</td><td>30</td><td>10</td><td>10</td><td></td><td></td><td>18</td><td>6</td><td>6</td><td></td><td></td><td>h</td></tr>
<tr><td>2.</td><td>Other (consultation, exam)</td><td>4</td><td>2</td><td>2</td><td></td><td></td><td>4</td><td>2</td><td>2</td><td></td><td></td><td>h</td></tr>
<tr><td>3.</td><td>Number of hours of a student's assisted work</td><td colspan="5">58</td><td colspan="5">38</td><td>h</td></tr>
<tr><td>4.</td><td>Number of ECTS credit points which are allocated for assisted work</td><td colspan="5">2,3</td><td colspan="5">1,5</td><td>ECTS</td></tr>
<tr><td>5.</td><td>Number of hours of a student's unassisted work</td><td colspan="5">42</td><td colspan="5">62</td><td>h</td></tr>
<tr><td>6.</td><td>Number of ECTS credit points which a student receives for unassisted work</td><td colspan="5">1,7</td><td colspan="5">2,5</td><td>ECTS</td></tr>
<tr><td>7.</td><td>Work input connected with practical classes</td><td colspan="5">40</td><td colspan="5">40</td><td>h</td></tr>
<tr><td>8.</td><td>Number of ECTS credit points which a student receives for practical classes</td><td colspan="5">1,6</td><td colspan="5">1,6</td><td>ECTS</td></tr>
<tr><td>9.</td><td>Total number of hours of a student's work</td><td colspan="5">100</td><td colspan="5">100</td><td>h</td></tr>
<tr><td>10.</td><td>Punkty ECTS za moduł
1 ECTS=25 hours</td><td colspan="10">4</td><td>ECTS</td></tr>
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LITERATURE

1. Callister W.D. (2007), *Materials science and engineering: an introduction*, John Wiley & Sons, New York.
2. Chou T.W. (ed.) (2005), *Materials Science and Technology. Structure and properties of composites,* Wiley-VCH-Verlag.
3. Hummel R.E. (2004), *Understanding materials science: history, properties, applications*, Springer, New York.
4. Lifshin E.(ed.) (2005), *Characterization of materials*, Wiley-VCH, Weinheim.
5. Williams D.F. (ed.) (2005), *Materials Science and Technology. Medical and dental materials*, Wiley-VCH-Verlag.