MODULE DESCRIPTION

Module code	**Z-0088**
Module name	**Materiałoznawstwo**
Module name in English	**Materials Science**
Valid from academic year	**2016/2017**

A. MODULE PLACEMENT IN THE SYLLABUS

Field of study	**Management and Production Engineering**
Level of education	**1st degree** *(1st degree / 2nd degree)*
Studies profile	**General** *(general / practical)*
Form and method of conducting classes	**Full-time** *(full-time / part-time)*
Specialisation	**All**
Unit conducting the module	**The Department of Production Engineering**
Module co-ordinator	
Approved by:	

B. MODULE OVERVIEW

Type of subject/group of subjects	**Major** *(basic / major / specialist subject / conjoint / other HES)*
Module status	**Compulsory** *(compulsory / non-compulsory)*
Language of conducting classes	**English**
Module placement in the syllabus - semester	**2nd semester**
Subject realisation in the academic year	**Summer semester** *(winter / summer)*
Initial requirements	**No requirements** *(module codes / module names)*
Examination	**Yes** *(yes / no)*
Number of ECTS credit points	**4**

Method of conducting classes	Lecture	Classes	Laboratory	Project	Other
Per semester	**30**	**10**	**10**		

C. TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

Module target	The aims of the module are as follows: acquiring basic knowledge of construction materials used in machines, devices and household appliances; learning the parameters determining utility properties of construction materials and examination methods; acquiring the skills of selecting and using the available construction materials in the design and construction processes.

Effect symbol	Teaching results	Teaching methods *(l/c/lab/p/other)*	Reference to subject effects	Reference to effects of a field of study
W_01	A student has knowledge concerning materials, their selection and application in production and utilisation processes.	l/c/lab	K_W07 K_W09	TA1_W04 TA1_W06
W_02	A student has knowledge of quality assurance as regards materials and products in the manufacturing process.	l/c	K_W07 K_W09	TA1_W04 TA1_W06
U_01	A student is able to design a simple technological process together with documentation and justification.	l/c	K_U15	TA1_U02 TA1_U10
K_01	A student understands the need of constant improvement of his/her knowledge as regards the knowledge of new materials and technological processes.	l/c/lab	K_K01	TA1_K01

Teaching contents:

1. Teaching contents as regards lectures

Lecture number	Teaching contents	Reference to teaching results for a module
1	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.	W_01 K_01
2	Crystallographic sets. Typical metal lattices. The metallic state theory. Actual structure of metals.	W_01 W_02 K_01
3	Crystallisation and the structure of pure metals. The deformation mechanism of a monocrystal and polycrystal body.	W_01 W_02 K_01
4	The notion of a crumple. The process of recrystallisation. The structure of metal alloys. Iron alloys. Iron-cementite system.	W_01 W_02 U_01 K_01
5	Non-alloy steels – their division and application. Pig and cast iron. The graphitisation process.	W_01 W_02 U_01 K_01
6	Heat treatment of metal alloys and its theoretical background. Heat treatment of steel. Transformations accompanying heating. Pearlite, bainite, and martensite transformation. Hardenability.	W_01 W_02 U_01 K_01
7	Pr Transformations accompanying steel tempering. The elements of heat treatment. The types of hardening. Toughening. Annealing. Sub-zero treatment. Dispersion hardening.	W_01 W_02 U_01 K_01
8	Thermo-chemical treatment. General information on the impact of alloy	W_01

	additions. Alloy steels – the principles of labelling, divisions, and application.	W_02 U_01 K_01
9	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.	W_01 W_02 U_01 K_01
10	Fusible alloys. Solders. Titanium and its alloys. Zinc and its alloys. Noble metal alloys.	W_01 W_02 U_01 K_01
11	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.	W_01 W_02 U_01 K_01
12	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.	W_01 W_02 U_01 K_01
13	Wood and wooden products. Physical and mechanical properties of wood. Protecting wooden products. Glues and glue materials.	W_01 W_02 U_01 K_01
14	Rocks, stones – their properties and applications. Construction materials and their types, stone composites.	W_01 W_02 U_01 K_01
15	Functional materials, shape-memory materials, piezoelectrics, electro- and magnetorheological materials.	W_01 W_02 U_01 K_01

2. Teaching contents as regards classes

Class number	Teaching contents	Reference to teaching results for a module
1	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.	W_01 K_01
2	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 binary alloys. Equilibrium systems of three-component alloys. The ironcementite system.	W_01 K_01
3	Heat treatment technology. Tempering stresses. Producibility of steel elements shape. Tempering methods. Surface tempering.	W_01 K_01
4	Heat and chemical treatment. The technology of carbonization, nitration, and cyanation. Diffusion metallisation.	W_01 K_01
5	Flow of metals. Corrasion. Material charts. Selecting steel substitutes.	W_01 K_01

3. Teaching contents as regards laboratory classes

Laboratory class number	Teaching contents	Reference to teaching results for a module
1	Testing mechanical properties of steel. Static tension test. Rockwell, Brinell, and Vickers hardness measurements. Dynamic hardness measurements. Microhardness. Impact resistance tests.	W_01 K_01

2	Thermal analysis. Phase equilibrium systems.	W_01 K_01
3	Non-alloy steels. Structures, division, and labelling. Heat treatment.	W_01 K_01
4	Copper alloys. Structures, properties, and application.	W_01 K_01
5	Aluminium alloys. Structures, properties, and application. Dispersion hardening.	W_01 K_01

4. The characteristics of project assignments

The methods of assessing teaching results

Effect symbol	**Methods of assessing teaching results** *(assessment method, including skills – reference to a particular project, laboratory assignments, etc.)*
W_01	An examination in the form of a test, a final test during the classes.
W_02	A final test during the classes.
U_01	A final test during the classes, tests during laboratory classes.
K_01	Comments during the lectures, a discussion during the classes.

D. STUDENT'S INPUT

ECTS credit points		
	Type of student's activity	**Student's workload**
1	Participation in lectures	**30**
2	Participation in classes	**10**
3	Participation in laboratories	**10**
4	Participation in tutorials (2-3 times per semester)	**12**
5	Participation in project classes	
6	Project tutorials	
7	Participation in an examination	**3**
8		
9	**Number of hours requiring a lecturer's assistance**	**65** *(sum)*
10	**Number of ECTS credit points which are allocated for assisted work** *(1 ECTS point=25-30 hours)*	**2.2**
11	Unassisted study of lecture subjects	**15**
12	Unassisted preparation for classes	**10**
13	Unassisted preparation for tests	**5**
14	Unassisted preparation for laboratories	**10**
15	Preparing reports	**5**
15	Preparing for a final laboratory test	**5**
17	Preparing a project or documentation	
18	Preparing for an examination	**5**
19		
20	**Number of hours of a student's unassisted work**	**55** *(sum)*
21	**Number of ECTS credit points which a student receives for unassisted work** *(1 ECTS point=25-30 hours)*	**1.8**
22	**Total number of hours of a student's work**	**120**
23	**ECTS points per module** *1 ECTS point=25-30 hours*	**4**
24	**Work input connected with practical classes** *Total number of hours connected with practical classes*	**55**
25	**Number of ECTS credit points which a student receives for practical classes** (1 ECTS point=25-30 hours)	**1.8**

E. LITERATURE

Literature list	1. Grabski M.W., Kozubowski J.A., *Inżynieria materiałowa*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2003. 2. Ashby M.F., Jones D.R.H., *Materiały inżynierskie*, WNT, Warszawa 1996. 3. Rudnik S., *Metaloznawstwo*, PWN, Warszawa 1994. 4. Hetmańczyk F.M., *Podstawy nauki o materiałach*, Wydawnictwo Politechniki Śląskiej, Gliwice 1996 5. Wielgosz R., Pytel S., *Zajęcia laboratoryjne z metaloznawstwa*, Wydawnictwo Politechniki Krakowskiej, Kraków 2003. 6. Przybyłowicz K., *Metaloznawstwo*, WNT, Warszawa 2004. 7. Dobrzański L.A., *Metalowe materiały inżynierskie*, WNT, Warszawa 2004. 8. Pacyna J., *Metaloznawstwo*, AGH, Kraków 2005.

	9. Lubuśka A.Z., *Atlas struktur żelaza i stali*, Wydawnictwo Politechniki Świętokrzyskiej, Kielce 1996.
Module website	