



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Materials science with chemistry basics

### Course

Field of study

Mechanical Engineering

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

1 / 1

Profile of study

general academic

Course offered in

polish language

Requirements

compulsory

### Number of hours

Lecture

45

Laboratory classes

Other (e.g. online)

Tutorials

Projects/seminars

### Number of credit points

3

### Lecturers

Responsible for the course/lecturer:

Responsible for the course/lecturer:

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Faculty of Materials Engineering and Technical  
Physics

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### Prerequisites



The student should have a basic knowledge in physics and chemistry. The student should be able to obtain information from specified sources and be willing to cooperate as part of a team.

### Course objective

To provide the students a basic knowledge in the field of materials science, including: Classification and characterization of materials: metals, polymers, ceramics, composites. Other categories of classification of materials: structural, functional, ecomaterials, biomaterials. Structure of the materials in the macro, micro and nano scale. Bonds in the crystal structure. Defects of crystalline materials. The most important material properties: physical, chemical, mechanical, technological. Basic methods for measuring the properties of materials. Fundamentals of thermodynamics and diffusion in materials. Phase equilibria of metal alloys, definition of phases and solutions. Mechanism of crystallization. Characteristics of phase transformations and their classification. The methods of shaping the material properties.

### Course-related learning outcomes

#### Knowledge

1. Posses the knowledge in the material science, including natural and engineering technical materials (comparison of their structure, properties and applications), rules for the selection of engineering materials in machine construction, shaping the structure and properties of engineering materials using technological methods, methods of testing materials, elements Computer Aided Materials Design (CAMD) and Computer Aided Materials Selection (CAMS), the importance of engineering materials in the construction and operation of machines, obtaining metals and their alloys in metallurgical processes. [P6S\_WG\_08]

#### Skills

1. Can obtain information from literature, databases and other properly selected sources (also in English or another foreign language recognized as the language of international communication) in the field of mechanics and machine construction as well as other engineering and technical issues in accordance with the field of study; is able to integrate the obtained information, interpret it, as well as draw conclusions and formulate and justify opinions. [P6S\_UW\_01]

2. Can select engineering materials for applications in mechanics and machine construction. [P6S\_UW\_13]

3. Is able to select and use manufacturing technologies in order to shape the form, structure and properties of products, design technological processes together with the selection of technological machines, tools and instrumentation and their organization. [P6S\_UW\_14]

#### Social competences

1. Understands the need for lifelong learning; can inspire and organize the learning process of other people [P6S\_KK\_01]

2. Is aware of the importance and understanding of non-technical aspects and effects of engineering activities, including its impact on the environment, and the responsibility for the decisions made. [P6S\_KK\_02]



### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired during the lecture is verified by the exams in the test form. The test consists of 10-20 questions (test and open), variously scored. Passing threshold: 50% of points. Final issues on the basis of which questions are developed are presented in lectures and discussed in detail during their duration.

### Programme content

1. Classification and characterization of materials: metals, polymers, ceramics, composites.
2. Other categories of classification of materials: structural, functional, ecomaterials, biomaterials
3. Structure of the materials in the macro, micro and nano scale.
4. Bonds in the crystal structure.
5. Defects of crystalline materials
6. The most important material properties: physical, chemical, mechanical, technological
7. Basic methods for measuring the properties of materials.
8. Fundamentals of thermodynamics and diffusion in materials.
9. Phase equilibria of metal alloys the definition of phases and solutions.
10. Mechanism of crystallization.
11. Characteristics of phase transformations and their classification
12. The methods of shaping the material properties.

### Teaching methods

The lecture illustrated in the multimedia introduction including under discussion of program contents.

### Bibliography

Basic

1. Blicharski M. Wstęp do inżynierii materiałowej. WNT, Warszawa, 2003.
2. Przybyłowicz K. Metaloznawstwo, WNT, Warszawa, 2007.
3. Dobrzański L. Podstawy nauki o materiałach i metaloznawstwo. WTN, Warszawa, 2002

Additional

1. Materiały inżynierskie tom. 1 i 2, Ashby M.F., Jones D.R.H., WNT, 2004.



2. Współczesne materiały konstrukcyjne i narzędziowe, Leda H. , Wydawnictwo Politechniki Poznańskiej, Poznań, 1996
3. Wybrane metalowe materiały konstrukcyjne ogólnego przeznaczenia, Leda H. , Wydawnictwo Politechniki Poznańskiej, Poznań, 1997
4. Strukturalne aspekty własności mechanicznych wybranych materiałów, Leda H. , Wydawnictwo Politechniki Poznańskiej, Poznań, 1998
5. Współczesne materiały konstrukcyjne i narzędziowe, Leda H. , Wydawnictwo Politechniki Poznańskiej, Poznań, 1996
6. Wybrane metalowe materiały konstrukcyjne ogólnego przeznaczenia, Leda H. , Wydawnictwo Politechniki Poznańskiej, Poznań, 1997
7. Strukturalne aspekty własności mechanicznych wybranych materiałów, Leda H. , Wydawnictwo Politechniki Poznańskiej, Poznań, 1998

#### Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	35	1,0

<sup>1</sup> delete or add other activities as appropriate