POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Materials science [N1MiBM2>MATER]

Course

Field of study
Mechanical Engineering

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
elective

Number of hours

Lecture
8

Laboratory classes
16

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

Lecturers

Prerequisites

Knowledge: basic in chemistry, physics, mathematics and materials science. Skills: logical thinking, associating image and selected properties with description. Social competence: understanding the need to learn and acquire knowledge.

Course objective

To learn the relationship between the chemical composition, properties and structure of a material in connection with the technologies used in mechanical engineering.

Course-related learning outcomes

Knowledge:
1. The student has a basic knowledge of materials science.
2. The student knows the groups of engineering materials consisting of metals and their alloys, plastics, ceramic materials and composite materials.
3. The student knows the properties of materials: physical, chemical, mechanical, technological, operational.
4. The student knows the structural components present in metal alloys according to phase equilibrium diagrams.
5. Students shall know the phase transformations present in metal alloys.
6. Students should explain how different material processing methods affect the microstructure and

mechanical properties of alloys.

Skills:
1. The student is able to analyze and interpret the results of microstructural and mechanical tests.
2.The student understands and can apply heat treatment techniques taking into account the analysis of the microstructure of the studied alloys.
3.The student is able to determine from the analysis of the structure and selected properties the preliminary possible cause of damage to machine parts or tools.
4. The student is able to obtain information from literature and the Internet.
5. The student is able to select engineering material for applications in mechanical engineering.
6. The student is able to select manufacturing technology to shape the structure and properties of the final product.
7. The student is able to compare the effects of material treatments and evaluate their effectiveness in changing application properties.
8.The student is able to design material treatment processes in a simplified manner on the basis of specific application requirements.
9. The student is able to apply theoretical knowledge to the analysis of real cases of material treatments in industry and evaluate their effectiveness in application variants.

Social competences:
1. The student understands the need for lifelong learning.
2. The student is able to cooperate in a group.
3. The student is aware of the role of materials in the economy.
4. The student develops his/her communication skills through group discussions and presentations of results.
5. The student strengthens teamwork skills through collaborative problem solving.
6. The student is encouraged to think critically and analyze by evaluating different approaches to materials processing.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Grade at the end of the semester (percentage range):
<90-100> - grade 5.0
<80-90) - grade 4.5
<70-80) - grade 4.0
<60-70) - grade 3.5
<50-60) - grade 3.0
<0-50 - grade 2.0

Formative assessment:
(a) in terms of laboratory classes on the basis of a written answer from each exercise and the completion of all reports,
b) in terms of lectures on the basis of additional activity during the discussion of the discussed topics.

Summative assessment:
a) in terms of laboratory classes, the average of all partial grades,
b) in terms of lectures - the final written pass of the course.

Programme content

Lecture:
Application of phase equilibrium diagrams in materials shaping technologies.
Effect of shaping technologies of materials on the structure and properties of engineering materials.
Engineering materials with application in the construction and operation of machinery with examples of steel products, tool and ceramic materials, heat-resistant and heat-resistant materials, lightweight materials based on aluminum, copper and its alloys, titanium and its alloys, composite materials and plastics, and surface engineering.
Advantages and disadvantages of methods of shaping engineering materials with application on parts of

machines and tools.

Laboratory:
1. Why steel products play a key role in the construction and operation of machinery?
2. Foundry iron alloys.
3. Tool materials and engineering ceramics.
4. Heat-resistant and refractory materials.
5. Lightweight materials based on aluminum.
6. Copper and its alloys.
7. Titanium and its alloys.
8. Composite materials and plastics.
9. Surface engineering.

Course topics

Lecture: Application of phase equilibrium diagrams in material shaping technologies (heat treatment, forming, machining, material joining technologies). Discussion of phase transformations occurring in Fe, Al, Cu, Ti, Ni alloys on the example of two- and three-step equilibrium graph and CTP diagrams.
Influence of the formation of materials technology on the structure and properties of engineering materials (Fe, Al, Cu, Ti, Ni alloys, plastics, ceramic materials, composite materials).
Discussion of products of engineering materials applicable to mechanical engineering and operation (Fe, Al, Cu, Ti; Ni alloys, plastics, ceramic materials, composite materials).
Advantages and disadvantages of methods of shaping engineering materials having application on parts of machines and tools and structural defects that may occur.
Methods of surface treatment of shaping materials (diffusion treatment, galvanic treatment, laser treatment) that increase their mechanical, operational and service properties.

Teaching methods

Lectures: multimedia presentation,
Laboratory exercises: microscopic observations; performance of tasks given by the instructor - practical exercises.

Bibliography

Basic:
1. Dobrzański L. A.: Podstawy nauki o materiałach i metaloznawstwo, WNT, Warszawa, 2002
2. Przybyłowicz K.: Metaloznawstwo. WNT, Warszawa, 1999
3. Blicharski M.: Wstęp do inżynierii materiałowej. WNT, Warszawa, 1998
4. Głowacka M., Łabanowski J., Landowski M.: Współczesne materiały inżynierskie. Wybrane grupy materiałów. Wydawnictwo Politechniki Gdańskiej, Gdańsk, 2021
5. Kaczorowski M., Krzyńska A.: Konstrukcyjne materiały metalowe, ceramiczne i kompozytowe. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2017
6. Barbacki A.: Materiały w budowie maszyn. Praca zbiorowa, Wydawnictwo Politechniki Poznańskiej, Poznań, 2006
7. Burakowski T., Wierzchoń T.: Inżynieria powierzchni metali. WNT, Warszawa, 1995
8. Ashby M.F., Jones D.R.H.: Materiały inżynierskie t. 1 i 2, WNT, Warszawa, 1995, 1996

Additional:
1. Leda H.: Współczesne materiały konstrukcyjne i narzędziowe. Wydawnictwo Politechniki Poznańskiej, Poznań, 1998
2. Młynarczak A., Jakubowski J.: Obróbka powierzchniowa i powłoki ochronne. Wydawnictwo Politechniki Poznańskiej, Poznań, 1998

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	24	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	51	2,00