COURSE DESCRIPTION CARD - SYLLABUS

Course name
Material science [S1Lot2>Materiał]

Course

Field of study
Aviation

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Knowledge: The student should have knowledge of basic sciences, i.e. physics and chemistry, as well as knowledge of subjects covered in the first level of studies, i.e. physical chemistry, thermodynamics, mechanics, strength of materials, aircraft construction. The student should demonstrate a general ability to identify problems, create algorithms, methods of solving them and the ability to solve engineering tasks. The student should understand the basic phenomena occurring in solids, be able to identify and characterize them. Social competences: The student is ready to deepen knowledge of interdisciplinary subjects. The student is open to learning new technologies and engineering solutions.

Course objective

The aim of the course is to familiarize students with metals, plastics, ceramics and composites. In particular, to familiarize them with their structure and properties.

Course-related learning outcomes

Knowledge:
1. has technical knowledge related to aerospace engineering such as aerospace materials and fuels

Skills:
1. is able to properly plan and perform experiments, including measurements and computer simulations, interpret the obtained results, and correctly draw conclusions from them
2. is able to properly select materials for simple aviation constructions, to indicate the differences between fuels used in aviation
Social Competence
1. understands that in technology, knowledge and skills very quickly become obsolete

Social competences:
-

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The student is aware of the social role of a polytechnic graduate, in particular he or she understands the need to
formulate and convey to society in an appropriate form information and opinions about engineering activities,
technological achievements, as well as the achievements and traditions of the profession of aviation engineer.

Programme content

Classification of basic groups of engineering materials: metals and their alloys, plastics, ceramics and glass,
composites.
Technical metals and metal alloys. Crystal structure and polymorphism. Types of crystal structure defects and their
effect on properties. Phases in metal alloys - solid solutions, carbides, nitrides, intermetallic phases, non-metallic
inclusions. Phase equilibrium systems and their practical use for the selection of microstructure and properties of
alloys. Fe-Fe3ć diagram. types of phases in iron alloys.
Transformations occurring in steels. Carbon steels, alloy steels. Cast steels. Cast irons. Hardenability, the effect of
alloying additives on the hardenability of steel. Objectives and basics of heat treatment operations.
Basic types of heat treatment. Types of annealing. Hardening and tempering. Non-ferrous metals. Application of
metals in aircraft construction.
Plastics, polymer structure, covalent and van der Waals bonds, crystalline and amorphous structure, manufacturing
methods, polymer processing, molding, properties, types (plastomers, elastomers), application examples.
Selected properties of ceramic materials and composites, their assessment: general properties (density, viscosity, melt flow index, mechanical properties (yield point, elongation from yield point, tensile strength, modulus of elasticity in tension, bending strength), impact strength (Charpy, Isolde), hardness (Rockwell, ball
pressing).
Selected properties of ceramic materials; dielectricity, poor electrical conductivity, resistance to thermal shocks,
asymmetry of compressive and tensile strength. Ceramic processing; forming by: rolling, drawing, spreading,
blowing, drawing glass fiber, isostatic pressing (e.g. lighting candles),
extrusion on a screw press, turning (in plaster and on molded plaster), casting in a plaster mold. Special ceramic materials and their properties used in industry: carbon fibers, diamonds, nanotubes, fullerenes.
Special types of composites, their properties and applications: composites with a metal matrix, partial hardening, dispersion hardening, non-ferrous metal-based sinters, metal ceramics, cemented carbides, cermets, fiber composites, layered composites.
Composite manufacturing methods.
Selection of engineering materials for the construction of selected engineering objects: for a beam, for a reflecting telescope, on some car elements (body, bumpers), on house elements (e.g. external load-

bearing
walls).

Course topics

The classes cover basic aspects related to engineering materials, their characteristics - chemical composition, structure, properties.

Teaching methods

Lectures with multimedia presentation

Bibliography

Basic:
1. L. A. Dobrzański: Podstawy nauki o materiałach i metaloznawstwo, WNT, Gliwice 2002
2. K. Przybyłowicz, J. Przybyłowicz, Materiałoznawstwo w pytaniach i odpowiedziach, WNT, 2009
3. M. Ashby i in.: Inżynieria materiałowa tom I i II, Wydawnictwo Galaktyka, 2006
4. M. Ashby i in.: Materiały inżynierskie tom I i II, WNT, 1996
5. W. Domke: Vademecum materiałoznawstwa, NT, 1997
6. L.A. Dobrzański, R. Nowosielski: Metody badania metali i stopów. Badania własności fizycznych. WNT, W-wa, 1987

Additional:
1. Mały poradnik mechanika, tom I i II, WNT, 2002
2. L. A. Dobrzański.: Metaloznawstwo z podstawami nauki o materiałach, WNT, 1998;

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00