# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Construction and operating materials

## Course

Field of study
Energetics

Year/Semester
3/5

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
part-time

Requirements

## Number of hours

Lecture
20

Laboratory classes

Other (e.g. online)

Tutorials

Projects/seminars

## Number of credit points

3

## Lecturers

Responsible for the course/lecturer:
dr hab. inż. Marta Paczkowska

Responsible for the course/lecturer:
dr inż. Andrzej Waliszewski

## Prerequisites

The student starting this subject should have basic knowledge in mathematics, physics, mechanics and thermodynamics. Should have the ability to obtain information from specified sources.

## Course objective

Providing students with knowledge of metal and ceramic materials, plastics and composites, methods of their production and processing, practical applications as well as consumables (oils, lubricants).

## Course-related learning outcomes

Knowledge

The student has ordered knowledge of materials that meet the construction and operational requirements of machines and devices, strength analysis of materials; has the knowledge needed to understand the principles of the material for typical machine parts; knows and understands the phenomena associated with the aging of materials. Knows and understands the principles of correct operation of machines and devices made of specific materials, knows the basic processes occurring in the life cycle of devices.

Skills

The student is able to use the known analytical and experimental methods to critically evaluate existing and designed technical solutions in terms of the materials used.

Social competences

Studnet understands the need and knows the possibilities of continuous training, raising professional, personal and social competences (e.g. through second and third degree studies, postgraduate studies, courses); and is ready to critically assess knowledge, recognizes its importance in solving cognitive and practical problems.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Checking knowledge during the last lecture.

## Programme content

Classification of basic groups of engineering materials: metals and their alloys, plastics, ceramics and glass, composites.

Construction of metal materials, metallic bonds, crystal structure, crystal lattice and its elements, crystallographic systems and types of lattice, crystalline defects, solid solutions and factors conditioning their formation, intermetallic phases, interstitial phases and complex structures, phase mixtures, balance diagrams , metal alloys, heat treatment, mechanical properties (tensile strength, tensile modulus, bending strength, impact resistance, hardness), types of metal alloys (ferrous, non-ferrous), examples of application.

Plastics, polymers construction, covalent and van der Waals bonds, crystalline and amorphous structure, methods of polymer processing, molding, properties, types (plastomers, elastomers), examples of application.

Construction of ceramic materials, covalent and ionic bonds, crystal and amorphic structure, methods of ceramic and glass processing, molding, properties, types (traditional, engineering), examples of application.

Construction of composites, types of composites, production methods, properties, examples of application.

The types of friction and the conditions in which they occur. Hydrodynamic and elastohydrodynamic lubrication of friction nodes. Construction and preparation of mineral and synthetic lubricating oils. Functions and required properties of lubricants. Lubricants used in the automotive industry (engine and transmission oils, plastic lubricants). Motor fuels. Industrial consumables (machine, compressor, turbine, transmission, hydraulic oils, etc.). Areas of application of lubricants in power industry. Classification of turbine oils. Components of hydraulic turbines subject to lubrication. Required properties of turbine oils. Types and properties of electro-insulating oils. Synthetic transformer oils. Occupational aging of oils and working fluids (diagnosis of states). Consumables and the natural environment.

Teaching methods used: lecture with multimedia presentation (including drawings, photos, animations, films) supplemented with examples given on the board, taking into account different aspects of the presented issues, presenting a new topic preceded by a reminder of related content known to students in other subjects.

## Teaching methods

Lecture with multimedia presentations.

## 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. Zwierzycki W.: Oleje, paliwa i smary dla motoryzacji i przemysłu, Wyd. ITeE, Radom 2001.

Additional

1. M. Ashby i in.: Inżynieria materiałowa tom I i II, Wydawnictwo Galaktyka, 2006.

2. M. Ashby i in.: Materiały inżynierskie tom I i II, WNT, 1996.

3. Mały poradnik mechanika, tom I i II, WNT, 2002.

4. L.A. Dobrzański, R. Nowosielski: Metody badania metali i stopów. Badania własności fizycznych. WNT, W-wa, 1987.

5. W. Domke: Vademecum materiałoznawstwa, NT, 1997.

6. F. Wojtking, J. Soncew: Materiały specjalnego przeznaczenia, Wydawnictwo Politechniki Radomskiej, 2001.

7. Zwierzycki W.: Płyny eksploatacyjne dla środków transportu drogowego. Charakterystyka funkcjonalna i ekologiczna. Wyd. Politechniki Poznańskiej, Poznań 2006.

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 45 | 3,0 |
| Classes requiring direct contact with the teacher | 20 | 1,0 |
| Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1] | 25 | 2,0 |

[1] delete or add other activities as appropriate