# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Non-metallic materials [N1MiBP1>MN]

## Course

Field of study
Mechanical and Automotive 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
compulsory

## Number of hours

Lecture
9

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

## Number of credit points

1,00

## Coordinators

prof. dr hab. inż. Leszek Małdziński
leszek.maldzinski@put.poznan.pl

## Lecturers

## Prerequisites

Knowledge: The student should have knowledge of basic sciences, i.e. physics and chemistry, as well as knowledge of subjects carried out at the first degree of studies, i.e. physical chemistry, thermodynamics, mechanics, strength of materials, machine construction. Skills: The student should demonstrate the general ability to identify problems, create algorithms, ways 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 the knowledge of interdisciplinary subjects. The student is open to learning about new technologies and engineering solutions.

## Course objective

The aim of the course: Non-metallic materials is to familiarize students with such materials as plastics, ceramics and composites. In particular, getting to know their structure and properties.

## Course-related learning outcomes

Knowledge:
Has basic knowledge in the field of chemistry, in the construction of the periodic table of elements and their properties, the theory of chemical bonds, organic and inorganic compounds, types of chemical

reactions, chemical analysis: in the scope enabling understanding of lectures on metal and non-metal materials, protection sciences environment, fuels and lubricants, building materials and soil, biomechanics and biological materials processed by agricultural and food machinery.
Has a basic, structured knowledge of non-metallic and composite materials used in the construction and operation of machines, mainly ceramic materials, synthetic materials, non-metallic natural materials (wood, glass, stone) and fuels, lubricants, technical gases, refrigerants, etc.
Has basic knowledge of the strength of materials, including the basics of the theory of elasticity and plasticity, stress hypotheses, calculation methods for beams, membranes, shafts, joints and other simple structural elements, as well as methods of testing the strength of materials and the state of deformation and stress in mechanical structures.

Skills:
Can competently advise on the selection of a machine for a given application in the industry covered by the selected diploma path based on the acquired knowledge about a given group of machines.
Can design a technology of making a simple machine element as well as a technology for assembling and disassembling a machine.
Has the ability to self-educate with the use of modern teaching tools, such as remote lectures, websites and databases, teaching programs, e-books.

Social competences:
Is ready to recognize the importance of knowledge in solving cognitive and practical problems and to consult experts in case of difficulties in solving the problem on his own.
Is ready to initiate actions for the public interest.
Is ready to fulfill professional roles responsibly, including:
- observing the rules of professional ethics and requiring this from others, - caring for the achievements and traditions of the profession.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
written verification

## Programme content

Classification of basic groups of engineering materials: metals and their alloys, plastics, ceramics and glass, composites.
Structure of metal materials, metal bonds, crystal structure, crystal lattice and its elements, crystallographic systems and lattice types, defects of crystal structure, solid solutions and factors determining their formation, intermetallic phases, interstitial and complex structure phases, phase mixtures, equilibrium diagrams , metal alloys, heat treatment, mechanical properties (tensile strength, tensile modulus, bending strength, impact strength, hardness), types of metal alloys (ferrous, non-ferrous), examples of application.
Plastics, polymer structure, covalent and van der Waals bonds, crystalline and amorphous structure, manufacturing methods, polymer processing, molding, properties, types (plastomers, elastomers), examples of use.
Structure of ceramic materials, covalent and ionic bonds, crystal and amorphous structure, manufacturing methods, processing of ceramics and glass, forming, properties, types (traditional, engineering), examples of application.
Composites structure, types of composites, methods of production, properties, examples of application.

## Teaching methods

Lecture 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
Additional
1. Mały poradnik mechanika, tom I i II, WNT, 2002

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 25 | 1,00 |
| Classes requiring direct contact with the teacher | 9 | 0,50 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 16 | 0,50 |