Kielce University of Technology

FACULTY OF MECHATRONICS AND MECHANICAL ENGINEERING

**Annex 9**
**to the Rector's Ordinance No. 35/19**
**of 12 June 2019**

# COURSE SPECIFICATION

| | |
|---|---|
| Course code | **M#1-S1-ME-209** |
| Course title in Polish | **Metaloznawstwo I** |
| Course title in English | **Metal Science I** |
| Valid from (academic year) | **2019/2020** |

## GENERAL INFORMATION

| | |
|---|---|
| Programme of study | **MECHANICAL ENGINEERING** |
| Level of qualification | **first-cycle** |
| Type of education | **academic** |
| Mode of study | **full-time** |
| Specialism | **all** |
| Department responsible | **Department of Metal Science and Manufacturing Processes** |
| Course leader | **dr hab. inż. Marek Konieczny, prof. PŚk** |
| Approved by | |

## COURSE OVERVIEW

| | |
|---|---|
| Course type | **basic** |
| Course status | **compulsory** |
| Language of instruction | English |
| Semester of delivery | **semester 2** |
| Pre-requisites | **chemistry, physics** |
| Examination required (YES/NO) | NO |
| ECTS value | **2** |

| **Mode of instruction** | **lecture** | **class** | **laboratory** | **project** | **seminar** |
|---|---|---|---|---|---|
| **No. of hours per semester** | **15** | | **15** | | |

## LEARNING OUTCOMES

| Category of outcome | Outcome code | Course learning outcomes | Corresponding programme outcome code |
|---|---|---|---|
| Knowledge | W01 | On completion of the course, students will have a basic knowledge of metals and alloys used in mechanical engineering. | MiBM1_W11 |
| Skills | U01 | On completion of the course, students will be able to select appropriate materials for their practical application. | MiBM1_U14 |
| | U02 | On completion of the course, students will have the ability to self-educate in order to solve and carry out new tasks. | MiBM1_U21 |
| Competence | K01 | On completion of the course, students will understand the need of lifelong learning in order to improve professional qualifications. | MiBM1_K01 |
| | K02 | On completion of the course, students will be aware of the importance of the role of a technical university graduate and will understand the need to provide other people with information related to the field of study. | MiBM1_K06 |

## COURSE CONTENT

| Type of instruction | Topics covered |
|---|---|
| lecture | 1. Bonds between atoms and intermolecular bonds. 7 crystallographic systems, 14 types of crystal lattice. Indicating directions and crystallographic planes in regular and hexagonal systems. |
| | 2. The phenomenon of allotropy. The structure of real crystals. Lattice defects: point, line and surface and their influence on the properties of metals. |
| | 3. Elastic and plastic deformation. The mechanism of plastic deformation: slip and twinning. The role of dislocation in plastic deformation. Deformation of mono and polycrystals. The phenomenon of anisotropy. |
| | 4. Investigation of mechanical properties: tensile test, hardness measurements, impact strength, creep, fatigue. |
| | 5. Strengthening the metal by plastic deformation. Recrystallization. |
| | 6. Diffusion. Crystallization. Metal alloys - basic concepts. Phase equilibrium systems. Basic phase transformations in alloys, taking place with the participation of the liquid phase: eutectic and peritectic transformation. |
| | 7. Influence of the allotropic transformation on the phase equilibrium system. Eutectoid and peritectoid transformation. |
| | 8. Deviations from phase equilibrium systems. |
| laboratory | 1. Characteristics of metals. |
| | 2. Investigation of mechanical properties - tensile test. |
| | 3. Investigation of mechanical properties - hardness and toughness measurements. |
| | 4. Metallographic preparation. |
| | 5. Solidification of metals and alloys. |
| | 6. Phase diagrams of alloys. |
| | 7. Strengthening metals by plastic deformation. Recrystallization. |
| | 8. Structure and properties of castings and products shaped by plastic deformation. |

## ASSESSMENT METHODS

| Outcome code | Methods of assessment *(Mark with an X where applicable)* | | | | | |
|---|---|---|---|---|---|---|
| | Oral examination | Written examination | Test | Project | Report | Other |
| W01 | | | X | | X | |
| U01 | | | X | | X | |

| | | | | | | |
|---|---|---|---|---|---|---|
| U02 | | | X | | X | |
| K01 | | | | | | Observation of attitude and behaviour |
| K02 | | | | | | Observation of attitude and behaviour |

## ASSESSMENT TYPE AND CRITERIA

| Mode of instruction | Assessment type | Assessment criteria |
|---|---|---|
| lecture | non-examination assessment | The pass mark is a minimum of 50% for the test. |
| laboratory | non-examination assessment | The pass mark is connected with submitting reports and obtaining at least 50% of test points during classes. |

## OVERALL STUDENT WORKLOAD

| ECTS weighting | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Activity type** | **Student workload** | | | | | **Unit** |
| 1. | Scheduled contact hours | L | C | Lab | P | S | h |
| | | 15 | | 15 | | | |
| 2. | Other contact hours (office hours, examination) | 2 | | 2 | | | h |
| 3. | **Total number of contact hours** | **34** | | | | | h |
| 4. | **Number of ECTS credits for contact hours** | **1,4** | | | | | ECTS |
| 5. | **Number of independent study hours** | **16** | | | | | h |
| 6. | **Number of ECTS credits for independent study hours** | **0,6** | | | | | ECTS |
| 7. | **Number of practical hours** | **25** | | | | | h |
| 8. | **Number of ECTS credits for practical hours** | **1,0** | | | | | ECTS |
| 9. | **Total study time** | **50** | | | | | h |
| 10. | **ECTS credits for the course**<br>*1 ECTS credit = 25-30 hours of study time* | **2** | | | | | ECTS |

## READING LIST


1. Askeland D.R.: The Science and Engineering of Materials.
2. Callister W.D.: Materials Science and Engineering: An Introduction
3. Ashby M.F., Jones D.R.: Engineering Materials: part 1 and 2.
4. Budinski K.G., Budinski M.K.: Engineering Materials Properties and Selection.
5. Konieczny M.: Metal Science Laboratory.