## 1.3. Module/ course form

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| To be completed by Course Team | Module name : **Materials science** | Module code: |
| Course name: **Materials science** | Course code: |
| Faculty: **Institute of Technology** |
| Field of study: |
| Mode of study : | Learning profile:**practical** | Speciality:  |
| Year/ semester:  | Module/ course status: | Module/ course language:**English** |
| Type of classes | lecture | lessons | lab | project | tutorial | other (please specify) |
| Course load  | **30** |  |  |  |  |  |

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| Module/ course coordinator  | dr hab. inż. Jerzy Łabanowski |
| Lecturer | dr hab. inż. Jerzy Łabanowski |
| Module/ course objectives | The aim of this course is to provide students with the general knowledge on specific groups of materials and their properties. Introduction to materials science, and main groups of iron alloys and nonferrous alloys |
| Entry requirements  | no prerequirements |

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| **LEARNING OUTCOME** |
| Nr | LEARNING OUTCOME DESCRIPTION | Learning outcome reference |
| 1 | Sudent explains the origins and materials engineering tasks. Identifies the main groups of materials. Student describes the crystal structure of materials and knows the relationship between the structure of the material and its properties. Explains the construction of alloy systems and describes the phase equilibrium diagrams.  |  |
| 2 | Student recognizes methods of material testing. Aanalyzes the changes in metals under the influence of cold working. Estimates the technical aspects of plastic deformation and recrystallization. |  |
| 3 | Student analyzes the phase transformations in iron alloys. Identifies steels and cast irons. |  |

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| **CURRICULUM CONTENTS** |
| **Lecture** |
| Origin and materials engineering tasks. Development trends of materials science. Distribution and general characteristics of the materials. Chemical bonds. Fundamentals of crystallography. The structure of metals, ceramics and polymers. Point and linear defects at crystal structure. Diffusion: equations and mechanisms. Grain boundaries. Single crystals and policrystalline materials. Influence of the crystal structure defects on the mechanical properties of metals. Structure of metal alloys. Solid solutions. Intermetallic phases. Thermodynamic equilibrium. Gibbs phase rule. Binary and ternary phase equilibrium systems. Phase transitions. Examination of structure of materials. Properties of materials. Examination of the mechanical properties. Crystallization from the liquid phase: nucleation, crystal growth, crystallization kinetics. Technical aspects of crystallization. Plastic deformation of metals. Mechanisms of plastic deformation. Changes in the metal under the influence of cold plastic deformation. Recovery and recrystallization. Technical aspects of plastic deformation and recrystallization. Phase equilibrium system iron-carbon and iron-cementite. Classification of iron alloys – steels, cast steels, and cast irons. Constructional and tool steels. Special-purpose iron alloys – corrosion resistant, and heat resistant. Nonferrous metals and alloys.  |
| Tutorial |
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| Basic literature | 1. Ashby F.A., Jones D.R.: Engineering Materials. Part 1 and 2. Butterworth-Heinemann 1986.
2. Callister Jr. W. D. Materials Science and Engineering. An Introduction. John Wiley and Sons 2000.
3. Materials and Processes. Part A: Materials. Young J. F. and Shane R. S. Eds. Marcel Dekker New York 1985.
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| Additional literature | 1. Metals Handbook Desk Edition. American Society for Metals, Metals Park, Ohio 1997.
2. Pickering F. B.: Physical Metallurgy and the Design of Steel. Applied Science Publishers, London 1978
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| Teaching methods | Lecture with multimedia presentation, individual consultations with the lecturer. |
| Assessment method | Learning outcome number |
| test 2x per semester. | 1,2,3 |
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| Form and terms of an exam | Lecture - 2 tests per semester, if not passed a written examine (test) in the session |

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| **STUDENT WORKLOAD** |
|  | Number of hours  |
| Participation in lectures | 30 |
| Independent study of lecture topics | 30 |
| Participation in tutorials, labs, projects and seminars |  |
| Independent preparation for tutorials\* |  |
| Preparation of projects/essays/etc. \* |  |
| Preparation/ independent study for exams | 35 |
| Participation during consultation hours | 5 |
| Other |  |
| **TOTAL student workload in hours** | 100 |
| **Number of ECTS credit per course unit** | **4** |
| Number of ECTS credit associated with practical classes | **1,4** |
| Number of ECTS for classes that require direct participation of professors  | **1,4** |