|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| To be completed by Course Team | Module name : **Engineering Materials I** | | | | | | Module code: C.8 | | |
| Course name: **Engineering Materials I** | | | | | | Course code: C.8.I | | |
| Faculty: **Institute of Technology** | | | | | | | | |
| Field of study:  **Mechanical engineering** | | | | | | | | |
| Mode of study :  **STATIONARY** | | | Learning profile:  **PRACTICAL** | | | Speciality: | | |
| Year/ semester: | | | Module/ course status: | | | Module/ course language:  **Consultation in English** | | |
| Type of classes | lecture | lessons | | lab | project | | tutorial | other (please specify) |
| Course load | **30** |  | | **15** |  | |  |  |

|  |  |
| --- | --- |
| Module/ course coordinator | Prof. Jerzy Łabanowski PhD, DSc, Eng. |
| Lecturer | Prof. Jerzy Łabanowski PhD, DSc, Eng. |
| Module/ course objectives | The aim of this course is to provide students with the general knowledge on structural materials necessary for the mechanical engineer. Education skills in the selection of materials and shaping their properties for technical applications.. |
| Entry requirements | no prerequirements |

|  |  |  |
| --- | --- | --- |
| **LEARNING OUTCOME** | | |
| Nr | LEARNING OUTCOME DESCRIPTION | Learning outcome reference |
| 1 | Student knows the research methods to determine the basic mechanical properties of metallic materials. Student knows the basic technologies of plastic deformation and heat treatment and their influence on mechanical properties of metallic materials. The student knows the structure and mechanical and physical properties of metalic construction materials. |  |
| 2 | Student can choose the proper grade of steel and cast iron for structural components and machine parts. Student is able to plan heat treatment processes of steel and non-ferrous alloys. Student can analyses and can interpret the information contained in the phase equilibrium diagrams of systems alloys, especially in the iron-carbon system. |  |
| 3 | Student is able to interact and work in a group. Student can think and act in an entrepreneurial manner |  |
|  |  |  |

|  |
| --- |
| **CURRICULUM CONTENTS** |
| **Lecture** |
| The structure of the materials. Characteristics of the major groups of materials. Metals. Ceramic materials. Polymers. Composite materials. Rules for selection of engineering materials for mechanical engineering applications. The crystal structure of materials. Defects in the crystal structure. Polymorphism. Crystallization of metals and alloys. Mechanical properties of materials. Methods of testing materials. Working conditions and mechanisms of wear and failure of engineering materials. Alloys. The strengthening mechanisms of metals and alloys, phase transformations. Phase equilibrium systems. Classification of phase transformations. Phase transformations in the solid state. Iron-carbon phase equilibrium system. Production of iron.  Metallurgy of steel. Steelmaking processes. Classification of steels. Structural steels. Tool steels. Steels of special properties – stainless steels, heat resistant and creep resistant steels. Cast steels and cast irons. Normalization and classification of steels and cast irons. Shaping the structure and mechanical properties of steels and cast irons. Plastic deformation and recrystallization. Heat treatments and thermo-chemical treatments. Structural transformations during heating and cooling of iron alloys. TTT charts. Hardenability of the steel. Annealing processes of steel, bulk and surface hardening, carburizing, nitriding. |
| Laboratory |
| Metallographic examinations macroscopic and microscopic. Hardness tests. Phase equilibrium diagram Fe-Fe3C. Cast irons - structure and properties. Carbon and low-alloy steels in the annealed condition. |

|  |  |
| --- | --- |
| 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. |
| 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 |

|  |  |  |  |
| --- | --- | --- | --- |
| Teaching methods | | Lecture with multimedia presentation, individual and teamwork at laboratory, individual consultations with the lecturer. | |
| Assessment method | | | Learning outcome number |
| test 2x per semester. | | | 1,2 |
| A short test of "entrance" at each laboratory Evaluation report of each laboratory | | | 1,2,3 |
|  | | |  |
| Form and terms of an exam | Lecture - 2 tests per semester, if not passed a written examine (test) in the session.  Laboratory - final score is the average of the ratings of each laboratory. The final evaluation (by weight): 60% completion of the lecture, 40% laboratory credit | | |

|  |  |  |
| --- | --- | --- |
| **STUDENT WORKLOAD** | | |
| Type of activities/activities | Number of hours | |
| Total | Including related activities with practical training |
| Participation in lectures | 30 |  |
| Independent study of lecture topics | 15 |  |
| Participation in tutorials, labs, projects and seminars | 15 | 15 |
| Independent preparation for tutorials\* | 25 | 25 |
| Preparation of projects/essays/etc. \* |  |  |
| Preparation/ independent study for exams | 15 |  |
| Participation during consultation hours | 5 |  |
| Other |  |  |
| **TOTAL student workload in hours** | 100 | 40 |
| **Number of ECTS credit per course unit** | **5** | |
| Number of ECTS credit associated with practical classes | **1,6** | |
| Number of ECTS for classes that require direct participation of professors | **2,0** | |