Materials Engineering

Code: MK3ANISG05GX17-EN

ECTS Credit Points: 5

Year, Semester: 1st year, 1st semester

Its prerequisite(s): -

Further courses are built on it: Yes

Number of teaching hours/week (lecture + practice): 3+1

Topics:

The structure and composition of a material, including the types of atoms and their arrangement, as viewed over a range of length scales (nano-, micro-, meso-, and macro-scale). The crystalline structure of metals, crystal defects. Solid solutions, compounds, alloys. Equilibrium conditions of systems, binary systems, phase diagrams. The iron-carbon phase diagram. Austenite transformations, principles of transformation diagrams (isothermal, continuous cooling). Ferrous and non-ferrous metals, basic micro-structures. Polymers, ceramics, composites. Material properties (physical, mechanical, electrical, optical, and magnetic).Calculation tasks for crystalline systems, phase diagrams, transformation diagrams.

Literature:

Compulsory:

- William D. Callister, David G. Rethwisch: Fundamentals of materials science and engineering : SI version, John Wiley and Sons, 2013., ISBN 978 1 118 32269 7

Recommended:

- ASM Handbook, Vol. 3: Alloy Phase Diagrams, ASM International, 1992., ISBN-10: 0871703815

Schedule

1st week Registration week	
2nd week: **Lecture:** Introduction to material science. The classes and functions of materials and their properties. **Practice:** Overview of periodic system.	**3rd week:** **Lecture:** Production of metals. Chemical reactions during the production of iron. Steel, aluminium and copper production. **Practice:** Classification of steels and cast iron.
4th week: **Lecture:** Crystal structures. Crystalline and noncrystalline materials. Imperfections in solids. Defects type: point, line, bulk, surface. **Practice:** Crystallographic points, directions, and planes	**5th week:** **Lecture**: Mechanical properties of metals. Concepts of stress and strain. Elastic, plastic deformation. **Practice:** Tension Tests. Computation of Load to produce specified diameter change.
6th week: **Lecture:** Dislocations and strengthening mechanisms. Mechanisms of strengthening in metals **Practice:** Failure: fracture, fatigue, creeps.	**7th week:** **Lecture:** Phase diagrams. Basic concepts, binary and multi-component systems, the Gibbs phase rule. Development of microstructure in isomorphous alloys.

	Practice: Determination of phase amounts, Lever rules, types of phase diagrams
8th week: 1st drawing week	
9th week:	**10th week:**
Lecture: Development of microstructure in iron–carbon alloys.	**Lecture:** Types of metal alloys. Classification scheme for the various ferrous alloys and alloying elements.
Practice: Determination of iron – iron carbide phase diagram.	**Practice:** Structure of alloyed steels
11th week:	**12th week:**
Lecture: Phase transformations: Microstructural and Property Changes in Iron–Carbon alloys.	**Lecture:** Structures, characteristics, applications and processing of polymers.
Practice: TTT diagrams - Microstructural Determinations for Isothermal Heat Treatments	**Practice:** Production and design of ceramics
13th week:	**14th week:**
Lecture: Structures, characteristics, applications and processing of polymers.	**Lecture:** The classes and functions of composite materials and their properties.
Practice: Production and design of polymers.	**Practice:** Production and design of composites
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attendance on the lectures is recommended, but not compulsory. Participation at practice is compulsory. Student must attend the practices and not miss more than three practice during the semester. In case a student misses more than three, the subject will not be signed and the student must repeat the course. Student can't make up a practice with another group. The attendance on practice will be recorded by the practice leader. Being late is counted as an absence. In case of further absences, a medical certificate needs to be presented. Missed practices should be made up for at a later date, to be discussed with the tutor.

During the semester there are two tests: the mid-term test is in the first drawing week and the end-term test in the 2nd drawing week. Students have to sit for the tests. If the score of any test is below 60%, the student once can take a retake test covering the whole semester material.

B, for grade:

The course ends in a state exam, the grade is calculated as:

- 60% from the exam
- 20%-20% from the two tests

The minimum requirement for passing is 60%, the grade for the final mark is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)