COURSE DESCRIPTION CARD - SYLLABUS

Course name
Technical thermodynamics [S1IMat1>TT]

Course

Field of study
Materials Engineering

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Knowledge: basic knowledge of chemistry, physics, mechanics, mathematics, materials science. Skills: logical thinking, use of the information obtained from the library and the Internet. Social competencies: understanding the need for learning and acquiring new knowledge.

Course objective

To know the theoretical and practical problems in the application of the thermodynamics principles in materials engineering.

Course-related learning outcomes

Knowledge:
1. student has a detailed knowledge from the scope of the technical thermodynamics. (t1a _ w04, inza_w 05) k_w13

Skills:
1. student is able to apply simulation and experimental analytical methods for formulating and solving engineering problems. (t1a _ u09, inza_u 02) k_u10

2. student is able to assess the usefulness of routine methods and tools for solving simple engineering problems about practical character, characteristic of the materials engineering and to choose and to apply appropriate methods and tools. (t1a _ u15, inza_u07) k_u18

Social competences:
1. student is aware of importance and understanding the differents aspects and effects of engineering activity, including its impact on the environment and the associated responsibility for decisions. (t1a_k02, inza_k01) k_k02
2. student is able to interact and work in a group, taking in the various roles. (t1a_k03) k_k03

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: Ranking based on written test consisting of general and test questions (ranking in case of getting at least 51% of points: <51% 2 - ndst, 51%-62% 3 - dst, 63%-72% 3,5 - dst+, 73%-83% 4 - db, 84%-94% 4,5 - db+, > 94% 5 – bdb).
Classes: Ranking based on oral answers and written test consisting of general and test questions. Ranking in case of getting at least 51% of points: <51% 2 - ndst, 51%-62% 3 - dst, 63%-72% 3,5 - dst+, 73%-83% 4 - db, 84%-94% 4,5 - db+, > 94% 5 - bdb.
Laboratory: Ranking based on an oral answer from the scope of contents of the performed laboratory excersise and report on every laboratory exercise according to indications of the leading the laboratory exercises.The average score of all the laboratory exercises is calculated. All the exercises have to be accepted in respect of oral answer and report.

Programme content

Lecture:
1. Characteristics of the thermodynamic system, types of systems, thermodynamic functions.
2. Principles of thermodynamics and their application in engineering practice.
3. Thermodynamic equilibrium, phase equilibrium of the system.
4. Criterion of voluntariness of processes and the stability of the system.
5. Solid solutions and their thermodynamic activity, the methods for calculating the activity.
6. Thermodynamic methods of construction of equilibrium diagrams.
7. Thermodynamic classification and the criterion of stability of phase transformation and heat treatment or thermo-chemical processes and corrosion.
Classes:
1. Calculations of the values and interpreting the parameters of the thermodynamic functions: temperature, pressure, specific heat, enthalpy, entropy, Gibbs energy, equilibrium constant
2. Application of computer assist to calculate and analyze selected processes in materials engineering: phase transformations, nucleation and growth of grains, oxidation, determination of the chemical composition of atmospheres for the thermo-chemical treatment
3. Analyzing and describing the selected phase equilibrium diagrams.
Laboratory:
1. Determination of the chemical composition of the gas atmosphere in thermodynamic equilibrium. Part 1.
2. Determination of the chemical composition of the gas atmosphere in thermodynamic equilibrium. Part 2.
3. Determination of the impact of iron alloy composition and thermo-chemical treatment on the gas corrosion resistance.
4. Examination of the impact of alloying elements on the activity of carbon in austenite. Part 1.
5. Examination of the impact of alloying elements on the activity of carbon in austenite. Part 2.
6. Determination of the termodynamic aspects of cold work and recrystallization.

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples on the board.
2. Laboratory: practical exercises, performing experiments, discussing, working in a team.
3. Classes: Solving tasks, discussion, case studies.

Bibliography

Basic
1. Wiśniewski S. Termodynamika techniczna. WNT, Warszawa, 2009
2. Tyrkiel E. Termodynamiczne podstawy materiałoznawstwa. Oficyna Wyd. Politechniki Warszawskiej, Warszawa, 2005
Additional
1. Walentynowicz J. Termodynamika techniczna i jej zastosowanie. Wyd. Wojskowej Akademii Technicznej, Warszawa, 2010

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	4,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	2,00