COURSE DESCRIPTION CARD - SYLLABUS

Course name
Technical and automotive thermodynamics [S1MiTPM1>TTiS]

Course

Field of study
Materials and technologies for automotive industry

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
0

Tutorials
15

Projects/seminars
0

Number of credit points

4,00

Coordinators

prof. dr hab. inż. Michał Kulka
michal.kulka@put.poznan.pl

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 of applying the principles of technical thermodynamics in materials and automotive vehicles.

Course-related learning outcomes

Knowledge:
1. The student has basic knowledge of thermodynamics, thermodynamic processes and systems characteristic of motor vehicle engineering and materials processing.

Skills:
1. The student is able to use analytical, simulation and experimental methods to formulate and solve engineering tasks.

2. The student is able to assess the usefulness of standard methods and tools for solving simple practical engineering tasks, characteristic of materials and technologies in the automotive industry, and to select and use appropriate methods and tools.

Social competences:
1. The student is aware of the importance and understanding of non-technical aspects and effects of engineering activities, including its impact on the environment and the related responsibility for decisions made.
2. The student is able to cooperate and work in a group, taking on various roles in it.

Methods for verifying learning outcomes and assessment criteria

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

Analysis of basic issues of technical thermodynamics with particular emphasis on automotive thermodynamics and alloy thermodynamics.

Course topics

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.
8. Gas as a thermodynamic medium. Combustion. Engine comparison circuits.
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. The influence of chromium content in steel on its heat resistance; oxidation resistance of steel after thermo-chemical treatment. Thermodynamics of oxidation reactions.
2. Determination of the recrystallization temperature by hardness measurement.
3. Determination of the chemical composition of the gas atmosphere in a state of thermo-dynamic equilibrium.
4. The influence of alloy additions on carbon activity in austenite.

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. Gustof P. Termodynamika w pojazdach samochodowych. Politechnika Śląska, Gliwice, 2016
2. Tyrkiel E. Termodynamiczne podstawy materiałoznawstwa. Oficyna Wyd. Politechniki Warszawskiej,

Additional:
1. Wiśniewski S. Termodynamika techniczna. WNT, Warszawa, 2009

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	47	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	53	2,00