COURSE DESCRIPTION CARD - SYLLABUS

Course name
Thermodynamics

Course

Field of study Safety Engineering	Year/Semester 1/2
Area of study (specialization)	Profile of study general academic
Level of study First-cycle studies	Course offered in English
Form of study full-time	Requirements compulsory

Number of hours

Lecture 15	Laboratory classes	Other (e.g. online)
Tutorials 15	Projects/seminars	

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

Prerequisites

Basic knowledge in the field of experimental physics and analytical mathematics. Skills in solving basic physical problems. Skill in searching required information from different sources, including the Internet.

Course objective

Introduction to the theoretical and practical description of the heat and work in thermodynamic process in macro- and microsystems (fenomenological and statistical thermodynamics). Heat transport: conduction, convection and radiation. Calorimetry. Ideal and real gases. Principles of thermodynamics. Construction, efficiency and application of heat engines and heat pomps.

Course-related learning outcomes

Knowledge

The student will learn about the thermal equilibrium, how to measure thermodynamic parameters such as temerature, pressure; principles of thermometers constructions, operation and properties [K1_W01]:

a) the student knowns the meaning of heat, how the heat is transferred by conduction, convection and radiation; differences between ideal and real gases. How the interaction between gas molecules determine the properties of the gas, liquid and solid substance, and how to analyze adiabatic thermodynamic processes in an gas;

b) knows differences between reversible and irreversible processes, efficiency of the heat engine and heat pomps and knows the second law of thermodynamics sets limits on the efficiency of the engine and refrigerators. The student understands entropy and how it changes

c) The student knows the rules of statistical view on entropy; an introduction to statistical thermodynamics: Brownian motion, statistical definitions of temperature and pressure.

Skills

The student can obtain information from various sources and apply it to solve thermodynamic problems [K1_U01]:

a) The student is able to adapt the techniques of measuring thermodynamic quantities (temperature, pressure) to specific issues;

b) The student knows how to calculate the heat exchange between objects by heat transfer or radiat and how to calculate entropy in thermodynamic processes ;

c) The student is able to calculate a gaseous state after a few cycles of thermodynamic processes .

Social competences

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Discussion about particular problems during lectures. Final writing test and defence of the described thermodynamic problems. 51% of maximum points are require to pass the final exam. The semester grade is average note of all subjects.

Writing form describing two or three problems is required to pass semester. 51% of the maximum points are required.

Programme content

The student will learn about the meaning of thermal equilibrium, how to measure thermodynamical parameters such as temerature, pressure, principies of thermometers operation and properties, the meaning of heat and work, how to calculate the involve heat flow, how the heat is transferred by conduction, convection and radiation. Differences between ideal and real gases. How the interaction between gas molecules determine the properties of the gas, liquid and solid substance. How to calculate the work done by different thermodynamic systems. How to analyze adiabatic thermodynamic processes in an gas. Differences between reversible and irreversible processes. Efficiency of the heat engine. Relation between heat engines and refrigerators. How the second law of thermodynamics sets limits on the efficiency of the engine and refrigerators. The meaning of entropy, and how to calculate entropy in thermodynamic processes. Statistical view on entropy. Probability and entropy. Introduction to statistical thermodynamics: Brownian motion, statistical definitions of temperature and pressure.

Teaching methods

Classical lecture with blackboard to discuss thermodynamic problems together with help of multimedia presentations. A few simple real and virtual experiments demonstrated during the lecture.

Bibliography

Basic

1. D. Holiday, R. Resnick, J. Walker , “Fundamentals of Physics”, vol. 2, Wiley, NYC 2001.

2. H. D. Young, R. A. Freedman, A. L. Ford, “University Physics”, chap. 17-20, Person International Edition, San Francisco 2008.

Additional

1. J. M. Seddon, J. D. Gale, “Thermodynamics and Statistical Mechanics” Royal Society of Chemistry, Cambridge, 2001.

2. M. W. Zemansky, R. H. Dittman, “HEAT AND THERMODYNAMICS - An Intermediate Textbook“, McGraw-Hill, NYC, 1997.

Breakdown of average student's workload

	Hours	ECTS
Total workload	70	2
Classes requiring direct contact with the teacher	30	1
Student's own work (literature studies, preparation for tutorials, preparation for tests/exam) [1]	40	1

[1] delete or add other activities as appropriate