COURSE DESCRIPTION CARD - SYLLABUS

Course name
Thermodynamics [N1IBiJ1>TERM]

Course

Field of study
Safety and Quality Engineering

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
9

Laboratory classes
0

Other (e.g. online)
0

Tutorials
9

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

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:
1. Defines thermodynamic parameters such as pressure, volume, temperature, system composition, and explains their significance in the analysis of thermodynamic processes [K1_W01].
2. Describes the mechanisms of achieving thermodynamic equilibrium and the differences between reversible, spontaneous, and forced processes [K1_W01].
3. Characterizes methods of heat transfer: conduction, convection, radiation, and applies the barometric

formula to describe atmospheric pressure [K1_W01].
4. Explains the basic principles of thermodynamics, including the first and second laws of thermodynamics, and defines the concept of entropy and its application in describing thermodynamic processes [K1_W01].

Skills:
1. Applies analytical, simulation, and experimental methods to solve thermodynamic problems, including calculations of heat balance, work, changes in internal energy, and entropy [K1_U04].
2. Designs experiments and simulations to analyze thermodynamic processes, using appropriate methods and techniques to achieve high standards of quality and safety [K1_U07].
3. Plans and manages individual and team work in the implementation of thermodynamic projects, ensuring high quality of experiment results, measurements, and simulations [K1_U11].

Social competences:
1. Recognizes cause-and-effect relationships in the analysis and design of thermodynamic systems, applying knowledge to solve engineering problems with consideration of the importance and significance of tasks [K1_K01].

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.

Course topics

none

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	50	2,00
Classes requiring direct contact with the teacher	18	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	32	1,00