COURSE DESCRIPTION CARD - SYLLABUS

Course name
Applied Thermodynamics

Course

Field of study
Mechanical Engineering
Area of study (specialization)

Level of study
First-cycle studies
Form of study
full-time

Year/Semester
2/4
Profile of study
general academic
Course offered in
english
Requirements
compulsory

Number of hours

Lecture
30
Laboratory classes
0
Other (e.g. online)
0
Tutorials
15
Projects/seminars

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
prof. dr hab. eng. Ewa Tuliszka-Sznitko
e-mail: ewa.tuliszka-sznitko@put.poznan.pl
tel. 61 6652111
Institute of Thermal Engineering

Responsible for the course/lecturer:

Prerequisites

Student shoud have knowledge of mathematics and physics, should be able to obtain needed information (from the Internet and library), should be ready to work in team.

Course objective

The purpose of the course is to acquaint student with the basic laws of thermodynamics and their practical application. The aim of the course is also to draw attention to the issues of ecology.

Course-related learning outcomes

Knowledge

Student has knowledge in the field of thermodynamics necessary to understand the basic physical phenomena occurring in engineering practice.

Student knows the basic laws of thermodynamics, has knowledge of thermal circuits, thermal effects of chemical reactions and the heat transport.

Student is aware of the impact of thermodynamic processes on the natural environment.

Skills

Student knows how to find a source of knowledge that enables him to analyze and solve the considered problem in the field of thermodynamics.

Student is able to work individually and in a team in the field of thermodynamics, is able to estimate the time needed to carry out the task, is able to develop and implement a work schedule ensuring meeting deadlines.

Social competences

Student understands the need of continuous training in the field of thermodynamics, is ready to critically asses his knowledge, recognizes its importance in solving cognitive and practical problems.

Student understands the non-technical aspects of the engineer's activities in the field of thermodynamics, including its impact on the environment and the associated responsibility for the undertaken decisions, student is ready to fulfill social obligations.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquainted during the lecture is verified by a 90-minute written exam and a short oral exam. The written exam consist of 15 questions – the pass threshold is 50% of all scores student can get. A list of 30 questions is sent to students by e-mail 2-weeks in advance. Knowledge acquainted during tutorial classes is verified by the final test.

Programme content

Lecture: Basic definitions and units. Perfect gas equation and van der Waals equation. Definition of work. The status functions. The first law of thermodynamics (the closed and opened system). The specific heat. The second law of thermodynamics - spontaneous processes, irreversibility of processes, dissipation heat. The ideal gas / real gas. Mixture of perfect gases. Analysis of thermodynamic processes: isothermal process, isochoric process, isobaric process, reversible process, polytropic

process. The efficiency of compression and expansion processes. The right-hand and left-hand cycle. Thermal efficiency of the circuits (Carnot, Brayton-Joule). Free energy and free enthalpy. The third law of thermodynamics - Nernst theorem. Heat of combustion. The Kirchhoffa i Hessa laws. Chemical affinity. Maxwell's thermodynamic equations. Phase transitions. Water-vapor diagram. Supercritical fluids. The basic processes of humid air and drying process. Heat transfer. Conduction through the membranes without and with an internal heat source. The exemplary solutions of thermal conductivity equation. The natural and forced convection. Radiation - basic concepts of radiation, Stefan Boltzmann's law, radiation heat exchangers. Tutorial classes: solving practical problems.

Teaching methods

The lecture is conducted using a multimedia presentation (illustrated with examples on the board).

Tutorial classes: solving of an engineering problems on the board.

Bibliography

Basic

1. Szargut, J. Termodynamika, PWN, Warszawa, 2000.

2. Wiśniewski, S., Wiśniewski, T., Wymiana ciepła, WNT, 2002.

3. Furmański, P., Domański, R., Wymiana ciepła, Przykłady obliczeń i zadania, Oficyna Wydawnicza Politechniki Warszawskiej, 2002.

Additional

1.Cengel, Y., Boles, M.A., Thermodynamics, an engineering approach, Mc Graw Hill, 2008

2.Incropera, F., DeWitt, D., Fundamentals of heat and mass transfer, Wiley, 2008

3.Ghiaasiaan, M., Convective heat and mass transfer, Cambridge University Press, 2014

Breakdown of average student's workload

	Hours	ECTS
Total workload	110	4,0
Classes requiring direct contact with the teacher	50	2,0
Student's own work. Lecture: study of literature, preparing for the lecture and exam. Tutorial classes: preparing for classes and for the final tests. [1]	60	2,0

[1] delete or add other activities as appropriate