COURSE DESCRIPTION CARD - SYLLABUS

Course name
Basics of thermodynamics [S1Lot2>PTerm]

Course

Field of study
Aviation

Year/Semester
2/3

Area of study (specialization)
Air Transport Safety

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

2,00

Coordinators

dr hab. inż. Magda Joachimiak prof. PP
magda.joachimiak@put.poznan.pl

Lecturers

Prerequisites

A student starting this subject should have basic knowledge of the basics of thermodynamics and energy flow and conversion processes in heat-flow machines and devices. They should also have the ability to effectively self- educate in the field related to the chosen field of study and be ready to cooperate within a team.

Course objective

Familiarization with basic thermodynamic processes, thermodynamic transformations and energy conservation equations. Familiarization with methods of describing various thermodynamic factors and thermodynamic cycles implementing assumed thermal and mechanical energy conversion processes in order to modernize or rebuild technological systems in the field of thermal energy. Practical mastery of the ability to describe the implementation of thermal processes.

Course-related learning outcomes

Knowledge:
1. has structured and theoretically based general knowledge of key technical issues and detailed knowledge of

selected issues related to air transport,
knows basic techniques, methods and tools used in the process of solving tasks related to air transport, mainly
of an engineering nature.
2. has structured, theoretically based general knowledge covering key issues in the field of technical thermodynamics, fluid mechanics, in particular aerodynamics

Skills:
1. is able to properly plan and perform experiments, including measurements and computer simulations, interpret the obtained results, and correctly draw conclusions from them.
2. is able to solve tasks using basic knowledge of aerodynamics, flight mechanics and flow around bodies.

Social competences:
1. is aware of the social role of a graduate of a technical university, in particular understands the need to formulate and communicate to the public, in an appropriate form, information and opinions regarding engineering activities, technical achievements, as well as the achievements and traditions of the engineering
profession
Methods for verifying learning outcomes and assessment criteria Learning outcomes presented above are verified
as follows: Lecture:
- assessment of knowledge and skills demonstrated in the written test - 1.5 hour exam Exercises:
Knowledge acquired during the exercises is verified by two 45-minute tests conducted during classes 3 and 7
Laboratories:
- checking preparation (knowledge) for laboratory classes,
- rewarding practical knowledge acquired during previous laboratory exercises,
- assessment of knowledge and skills related to performing measurements and their development in the form of a
report

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

none

Programme content

Lecture:
Introduction
Ideal gases
Efficiencies of cycles and transformations.
Real gases.
Engine cycles
Basics of heat flow.
Exercises:
The issues presented in the lecture are solved in the form of tasks. Laboratories:
1. Temperature measurement and calibration.
2. Thermometry. Temperature measurements using resistance and thermoelectric thermometers.
3. Pressure measurement and calibration.
4. Energy balance. First law of thermodynamics.
5. Heat flux measurement.
6. Ideal gas. Expansion process in ideal gases.
7. Testing the TA60 absorption unit. PART - 66 (THEORY - 22.5 hrs., 11.25 hrs.)
MODULE 2. PHYSICS
2.3 Thermodynamics
a) Temperature: thermometers and temperature scales: Celsius, Fahrenheit and Kelvin; definition of heat; [2]
b) Heat capacity, specific heat;
Heat exchange: convection, radiation and conduction; Volumetric expansion;

First and second laws of thermodynamics;
Gases: ideal gas laws; specific heat at constant volume and constant pressure, work done by an expanding gas;

Course topics

Lecture:
Introduction - basic relations, thermodynamic factor model. First law of thermodynamics. Ideal gases. Basic relations
for open systems. Second law of thermodynamics. Efficiencies of cycles and transformations. Typical transformations of an ideal gas. Real gases. Basics of describing combustion processes. Engine cycles. Counterclockwise cycles. Steam power plant cycles. Basics of heat flow.
Exercises:
The issues presented in the lecture are solved in the form of tasks. Laboratories:
Temperature measurement and calibration.
Thermometry. Temperature measurements using resistance and thermoelectric thermometers.
Pressure measurement and calibration.
Energy balance. First law of thermodynamics.
Heat flux measurement.
Ideal gas. Expansion process in ideal gases.
Testing the TA60 absorption unit. PART - 66 (THEORY - 22.5 hrs., 11.25 hrs.)
MODULE 2. PHYSICS
2.3 Thermodynamics
c) Temperature: thermometers and temperature scales: Celsius, Fahrenheit and Kelvin; definition of heat; [2]
d) Heat capacity, specific heat;
Heat exchange: convection, radiation and conduction; Volumetric expansion;
First and second laws of thermodynamics;
Gases: ideal gas laws; specific heat at constant volume and constant pressure, work done by an expanding gas;

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given on the board.
2. Exercises: examples given on the board and performing tasks given by the instructor - practical exercises.
3. Laboratories: Practical classes at laboratory and teaching stations.

Bibliography

Basic:
1. Kalinowski E.: Thermodynamics, Publisher P. Wr. 1994
2. Szargut J.: Technical thermodynamics, Publisher P. Śl. 1997
3. Szargut J. et al.: Tasks in technical thermodynamics, P. Śl. 1995
4. Wiśniewski St.: Technical thermodynamics, WNT 1995
5. Tuliszka E. Ed.: Technical thermodynamics. Collection of tasks, No. 889, Publisher P.P. 1980
6. Kestin J.: Course in Thermodynamics, New York, Hemisphere 1979
Supplementary
1. Tuliszka E.: Theory of thermal machines, No. 511, Publisher P.P. 1974
2. M.J. Morano, H.N.Shapiro: Fundamentals of Engineering Thermodynamics, John Wiley & Sons, New York, 1998

Additional:
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Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	45	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	5	0,50