COURSE DESCRIPTION CARD - SYLLABUS

Course name

Technical thermodynamics

Course

Field of study

Aerospace Engineering

Year/Semester

2/3

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

30

Laboratory classes

15

Other (e.g. online)

Tutorials

15

Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

dr hab. inż. Agnieszka Wróblewska, prof.PP

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tel. 61 665 2201

Responsible for the course/lecturer:

Prerequisites

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

Course objective

Acquainting with basic thermodynamic processes, thermodynamic transformations and energy conservation equations. Getting to know the methods of description of various thermodynamic factors and thermodynamic cycles implementing the assumed processes of thermal and mechanical energy conversion 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 knowledge in physics, covering the basics of classical mechanics, optics, electricity and magnetism, solid state physics, thermodynamics, necessary to understand issues in the field of theory of structural materials and materials science, theory of machines and mechanisms, theory of drives and mechatronic systems.

2. has basic knowledge in the field of measurement methods, characteristics of measuring instruments and their classification according to purpose, principles of operation and features, knows sensors and measuring transducers, registration of results, measurement systems, measurement errors - influence of external factors, statistical analysis of measurement results, principles of organization active and passive experiment

3. has ordered, theoretically founded general knowledge covering key issues in the field of technical thermodynamics, i.e. the theory of thermodynamic changes, heat flow, machines. thermal and cooling.

Skills

1. has the ability to self-study using modern teaching tools, such as remote lectures, websites and databases, teaching programs, e-books.

2. can perform elementary technical calculations in the field of fluid mechanics and thermodynamics, such as heat and mass balances, pressure losses in flows around technical flying objects and their modules, select parameters of fans, compressors and turbines for flow systems, as well as calculate waveforms thermodynamic in heat machines.

3. is able to conduct a research experiment using measuring apparatus, computer simulations, is able to make measurements, such as measurements of temperature, velocity and flow rate, pressure and operating forces, as well as interpret results and draw conclusions.

Social competences

1. is aware of the importance of maintaining the principles of professional ethics.

2. understands the need for critical assessment of knowledge and continuous learning.

3. is able to inspire and organize the learning process of others.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

- assessment of knowledge and skills demonstrated on the written test - 1.5 hour exam

exercises:

The knowledge acquired as part of the exercises is verified by two 45-minute colloquia carried out during 3 and 7 classes

Laboratories:

- checking the preparation (knowledge) for laboratory classes,

- rewarding practical knowledge acquired during previous laboratory exercises,

- assessment of knowledge and skills related to the performance of measurements and their development in the form of a report.

Programme content

Lecture:

Introduction - basic relationships, thermodynamic factor model. First law of thermodynamics. Perfect gases. Basic relationships for open systems. The second law of thermodynamics. Circulation and transformation efficiency. Typical transformations of perfect gas. Real gases. Basics of combustion processes description. Engine circuits. Left-hand cycles. Steam power cycle. Fundamentals 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 with resistance and thermoelectric thermometers.

3. Pressure measurement and calibration.

4. Energy balance. First law of thermodynamics.

5. Measurement of heat flux.

6. Perfect gas. The process of expansion in perfect gases.

7. Testing the TA60 absorption aggregate.

PART-66

MODULE 2.

PHYSICS

2.3 Thermodynamics

a) Temperature: thermometers and temperature scales: Celsius, Fahrenheit and Kelvin; definition warm; [2]

b) Heat capacity, specific heat; Heat exchange: convection, radiation and conductivity; Volumetric expansion; First and second law of thermodynamics; Gases: ideal gas laws; specific heat in constant volume and constant pressure, work made by expanding gas; Isothermal and adiabatic expansion and compression, engine thermodynamic cycle, constant volume and constant pressure, refrigerated container and heat pump; Latent heat, melting and evaporation, thermal energy, heat of combustion.[2]

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given on the board.

2. Exercises: examples given on the board and performance of tasks given by the teacher - practical exercises.

3. Laboratories: Practical classes on the didactic positions.

Bibliography

Basic

1. Kalinowski E.:Termodynamika, Wyd. P. Wr. 1994

2. Szargut J.: Termodynamika techniczna, Wyd. P. Śl. 1997

3. Szargut J. I inni: Zadania z termodynamiki technicznej, P. Śl. 1995

4. Wiśniewski St.: Termodynamika techniczna, WNT 1995

5. Tuliszka E. Red.: Termodynamika techniczna. Zbiór zadań, Nr 889, Wyd. P.P. 1980

6. Kestin J.: Course in Thermodynamics, New York, Hemisphere 1979

Additional

1. Tuliszka E.: Teoria maszyn cieplnych, Nr 511, Wyd. P.P. 1974

2. M.J. Morano, H.N.Shapiro: Fundamentals of Engineering Thermodynamics, John Wiley & Sons, New York, 1998

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,0
Classes requiring direct contact with the teacher	66	2,5
Student's own work (literature studies, preparation for laboratory classes / exercises, preparation for tests / exam / passing laboratory classes, preparation of laboratory reports) [1]	14	0,5

[1] delete or add other activities as appropriate