COURSE DESCRIPTION CARD - SYLLABUS

Course name
Applied Thermodynamics

Course

Field of study
Energy production

Year/Semester
1/2

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

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
prof. dr hab. Eng. E. Tuliszka-Sznitko,
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Responsible for the course/lecturer:
dr inż. M. Joachimiak,
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Prerequisites

Student should have basic knowledge in mathematics (integration, differentiation) and in physics. Should be able to obtain information from the library and internet, should be ready to cooperate in a team.

Course objective

The purpose of the course is to acquaint the student with the basic laws of thermodynamics and with their practical application in energetics. The purpose of the subject is also to draw attention to the issue of ecology.

Course-related learning outcomes

Knowledge

1.Student has basic knowledge in the field of thermodynamics, including knowledge necessary to understand the basic physical phenomena occurring in thermal engineering systems.

2.Student knows the basic principles of thermodynamics; has knowledge of thermal cycles and thermal effects of chemical reactions.

3.Student has knowledge on the conversion of primary energy into work and heat.

4.Student is aware of the influence of energy conversion on the natural environment.

Skills

1.Student is able to obtain information from literature; is able to integrate obtained information and to interpret it, as well as to formulate and justify opinions in the field of thermodynamics.

2.Student can work individually and in a team in the field of thermodynamics; knows how to estimate the time needed to complete the task; is able to develop and implement a work schedule ensuring meeting deadlines.

Social competences

1.Student understands the need and knows the possibilities of continuous raising his professional qualifications in thermodynamics; the student is ready to critically assess his knowledge.

2.Student understands the non-technical aspects of the activities of an energy engineer, including the impact of this activity on the environment.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Knowledge acquired during the lecture is verified by a 90-minute colloquium . The test consists of 15 questions. A list of 30 questions, of which 15 are selected for the test, is sent by e-mail to all students 2 weeks in advance.

In tutorial class the knowledge is verified by a final test.

Programme content

Basic concepts, definitions and units. Thermodynamic equilibrium, stationary and unsteady processes. Relationships between state parameters. The ideal gas equation. Van der Waals equation. Definition of work. Internal energy and enthalpy (ideal and real gas). The first law of thermodynamics (the closed and opened systems). Specific heat. Mixture of perfect gases. Spontaneous processes, irreversibility of processes, dissipation heat. The second law of thermodynamics. Analysis of basic thermodynamic processes: isothermal process, adiabatic process, isochoric process, isobaric process and reversible process, polytropic process. Efficiency of compression and expansion processes. Thermal efficiency of the gas power cycles (Carnot, Brayton-Joule). Theoretical and actual combustion processes. Flue gas composition. Free enthalpy and free energy. Kirchhoffa and Hessa law. Heat of combustion. Water vapor, property diagrams for phase changes processes. Maxwell thermodynamic equations and their applications. Vapor cycles and their thermal efficiency. The basic processes of humid air. Tutorial class: solving simple practical problems (the first and second law of thermodynamics). Calculation of the air demand in combustion processes.

Teaching methods

Lecture: multimedia presentation illustrated with examples on the board.

In the tutorial, the simple practical problems are solved on the board.

Bibliography

Basic

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

2. Demichowicz-Pigoniowa, J., Obliczenia fizykochemiczne, PWN, Warszawa, 1984.

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

4. Szargut, J., Guzik, A., Górniak, H., Zadania z termodynamiki Technicznej, Wyd. Politechniki Ślaskiej, Gliwice, 2011.

5. 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

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

Breakdown of average student's workload

	Hours	ECTS
Total workload	88	3,0
Classes requiring direct contact with the teacher	53	2,0
Student's own work (collecting literature, reading literature, preparing for the next lecture, preparing to final test) [1]	35	1,0

[1] delete or add other activities as appropriate