POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

pl. M. Skłodowskiej-Curie 5, 60-965 Poznań

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Applied Thermodynamics

Course

Field of study	Year/Semester
Industrial and Renewable Energy	1/1
Area of study (specialization)	Profile of study
	general academic
Level of study	Course offered in
Second-cycle studies	Polish
Form of study	Requirements
full-time	compulsory

Number of hours

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

Number of credit points
2

Lecturers

Responsible for the course/lecturer:

prof. dr hab.Eng. E. Tuliszka-Sznitko,
ewa.tuliszka-sznitko@put.poznan.pl,
tel.: 61 6652111

Responsible for the course/lecturer:

Prerequisites
Student should have basic knowledge in mathematics (integration, differentiation) and in physics, also in thermodynamics (first course). 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 deepen the student knowledge on thermodynamics and to prepare him

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to solve more complex problems. The purpose of the subject is also to draw attention to the issue of ecology.

Course-related learning outcomes

Knowledge

1. Student has a knowledge which allows him/her to analyze, design and optimize the thermodynamic processes.

2. Student has a knowledge which allows him/her to describe mathematically and optimize the thermodynamic processes.

3. Student has a knowledge of new energy-saving technology in the field of thermodynamics.

Skills

1. Student knows how to find a source of knowledge which enables him/her to analyze and solve the considered thermodynamic problem.

2. Student knows how to formulate the hypotheses concerning the studied thermodynamic problem.

3. Student knows how to use the results of experimental and numerical investigations to optimize the thermodynamic processes.

Social competences

1. Student is able to critically assess the received information in the field of thermodynamics.

2. Student is prepared to operate effectively in the field of thermodynamics.

3. Student knows his/her role in society and is ready to work effectively in the field of thermodynamics to fulfill expectations.

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.

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

Programme content

The I and II law of thermodynamics. The free enthalpy and free internal energy. The Maxwell's thermodynamic equations. The theoretical and actual combustion processes. The enthalpy of formation and enthalpy of combustion. The behavior of gas mixtures (ideal and real gases). The basic consideration in the analysis of power cycles. The vapor and combined power cycles (energy balance, efficiency, losses). The binary vapor cycles. The basic processes of humid air. The heat exchange: Conduction (in materials with an internal heat source). The free convection (laminar free convection, the effect of turbulence, empirical correlations). The combined free and forced convection. Boiling and condensation (the boiling curve). The force boiling convection, two face flow. Radiation (processes and properties, radiation exchange between surfaces).

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Tutorial classes: solving practical problems (the first and second law of thermodynamics, power cycles, efficiency). Calculations of the air demand in combustion processes, exhaust composition. Calculations of adiabatic dryers

Teaching methods

Lecture: multimedia presentation illustrated with examples on the board.

In the classroom (tutorial), the 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	65	2,0
Classes requiring direct contact with the teacher	35	1,0
Student's own work Lecture: collecting literature, reading literature, preparing for the next lecture, preparing to final test Tutorial classes: preparing for the next class and for final test [1]	30	1,0

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[1] delete or add other activities as appropriate