COURSE DESCRIPTION CARD - SYLLABUS

Course name
Exergy analysis [S2ZE1E>AE]

Course

Field of study
Green Energy

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Energy forms, principles of energy analysis, I and II law of thermodynamics, principles of heat exchange and fluid mechanics

Course objective

Introduction to methods of exergy analysis of energy systems.

Course-related learning outcomes

Knowledge:
1. Student knows the causes of irreversibilty of real thermodynamic processes.
2. Student knows the basics of exergy balancing.
3. Student knows the principles of evaluation of internal exergy losses.
4. Student knows the principles of evaluation of external exergy losses.

Skills:
1. Student is able to identify causes of irreversibility of energy processes.
2. Student is able to create exergy model of simple and complex energy systems.

3. Student is able to calculate internal and external exergy losses.
4. Student is able to derive exergy efficiency.

Social competences:
1. Student is able to communicatively formulate conclusions and define problems within the exergy analysis.
2. Student is able to solve tasks in a teamwork.
3. Student is aware of the need of minimaizing of energy and exergy losses being the basis of sustainable development.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture
Credit in the form of oral examination. Closed questions of different kind. 50% of accesable points are required.

Programme content

Lecture:
1. Irreversibility of thermodynamic processes – prawo Gouy'a-Stodoli law
2. Definition of exergy.
3. Principles of exergy balancing.
4. Exergy balance equation - integral and differential form.
5. Definition of exergy efficiency.
6. Examples of exergy balance equation for simple and complex energy systems

Course topics

Irreversibility of thermodynamic processes - case studies; exergy balace of water radiator; exergy balance of water air heater; exergy balance of electric air heater; exergy balance of gas fired air heater; exergy balance of steam turbine; exergy balance of compressor; exergy balance of cogenerated heat and power plant; exergy balance of air handling unit; exergy balance of compressor heat pump; exergy balance of absorption water chiller; exergy balance of geothermal power plant; exergy balance of gas fired microturbine

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples, discussion.

Bibliography

Basic:
1. Mróz T.M. (2022). Energy Management in Built Environment. Tools and Evaluation Procedures. Wydawnictwo Politechniki Poznańskiej.
2. IEA Annex 49 Report (2006). Low Exergy Buildings. iea.org
3. Wall G., Gong W.: On exergy and sustainable development – Part 1: Con-ditions and concepts. Exergy an International Journal 1 (2001), pp. 128-145.
4. Wang S.P. et all, A phenomenological equation of exergy transfer and its application, Energy, (30) 2005, pp. 8.
5. Vats K. Tiwari G.N.: Energy and exergy analysis of a building integrated semitransparent photovoltaic thermal (BISPVT) system. Applied Energy. 2012.
6. Yucer C.T., Hepbasli A.: Thermodynamic analysis of building using exergy analysis method. Energy and Buildings, 43 (2011) pp. 536-542.

Additional:
Articles posted next to each topic and scholarly articles in the topic (Scoups database)

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00