COURSE DESCRIPTION CARD - SYLLABUS

Course name

Combined Heat and Power

Course

Field of study

Power Engineering

Year/Semester

3/5

Area of study (specialization)

- common courses

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

Other (e.g. online)

Tutorials

15

Projects/seminars

Number of credit points

5

Lecturers

Responsible for the course/lecturer:

dr hab. inż. Bartosz Ceran

email: bartosz.ceran@put.poznan.pl

tel.616652523

The Faculty of Environmental Engineering and Energy

ul. Piotrowo 3A, 60-965 Poznań

Responsible for the course/lecturer:

dr inż. Radosław Szczerbowski

The Faculty of Environmental Engineering and Energy

e-mail: radosław.szczerbowski@put.poznan.pl

Prerequisites

1. Student has basic knowledge of thermodynamics, fluid mechanics, technologies and energy machines, fuels and their use.

2.Solving the problems of mass and energy balance in simple thermal cycles of a power plant.

3. Student is aware of the need to expand their competences, is ready to cooperate as part of the team.

Course objective

Acquiring the ability to carry out energy and economic analysis of complex technological systems of combined heat and electricity generation with the use of various types of primary energy.

Course-related learning outcomes

Knowledge

1. Student has an ordered and theoretically founded knowledge of the basics of combined heat and electricity production.

2. Student knows and understands the phenomena, processes and technological systems that allow the conversion of energy from renewable sources into electricity and heat.

Skills

1.Student can recognize and explain diagrams for various cogeneration technologies.

2. Student can evaluate the technologies of combined electricity and heat production in terms of their efficiency and environmental impact.

3. Student can identify and justify prospective cogeneration technologies..

Social competences

1. Students aware of the social effects of rational use of energy resources in order to meet the energy needs of the country.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture

- assessment of the knowledge and skills demonstrated in the problem-based written exam,

- continuous assessment of skills and competences during each class by conducting discussions on current problems related to the development of cogeneration.

Tutorials

- a written test on accounting tasks on the basis of current checking

Programme content

Lecture

Thermal systems and operating parameters of a combined heat and power plant. Counter-pressure and pressure-relief heating turbine sets. Gas and gas-steam combined heat and power plants. Distributed cogeneration with the use of low-power gas turbines and reciprocating internal combustion engines. Innovative technologies: fuel cells, Sterling engines, ORC systems. Technical and economic rationale for the choice of a technological solution for a combined heat and power plant. Energy analysis of heat and power plant operation and costs of combined heat and electricity production. Profitability assessment of the construction of a heat and power plant. Heat storage. Modern technologies of heat transfer. Heating electrification. Basics of energy planning in the field of electricity and heat supply

Tutorials

The content of the exercises is closely related to the topic of the lectures.

Teaching methods

Lecture

Lecture with multimedia presentation supplemented with examples given on the board.

Tutorials

Tasks counted on the board.

Bibliography

Basic

1. J.Szargut, A.Ziębik, Podstawy energetyki cieplnej, PWN, 2000

2. J. Skorek, J. Kalina, Gazowe układy kogeneracyjne, WNT, Warszawa 2005

3. J. Marecki, Gospodarka skojarzona cieplno-elektryczna, WNT, W-wa 1991

Additional

1. R. Bartnik, Elektrownie i elektrociepłownie gazowo-parowe, WNT 2012, 2017

2. K.Buczek, Skojarzone wytwarzanie ciepła i energii elektrycznej w małych elektrociepłowniach, Wydawnictwo i Handel Książkami; Krosno.2001

3. B, Kolanowski, Small Scale Cogeneration Handbook, Fairmont Press, 2011

4. M.Pawlik, F.Strzelczyk, Elektrownie, WNT W-wa 2012, 2017

5. R. Turschmid, Kotłownie i elektrociepłownie przemysłowe, Arkady, W-wa 1988

6. Szczerbowski R. Energetyka węglowa i jądrowa Wybrane aspekty. Wydawnictwo Fundacja na rzecz Czystej Energii. Rok wydania 2017.

Breakdown of average student's workload

	Hours	ECTS
Total workload	92	5,0
Classes requiring direct contact with the teacher	47	2,5
Student's own work (literature studies, preparation for tutorials, preparation for exam) [1]	45	2,5

[1] delete or add other activities as appropriate