STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Connected production of thermal and electrical energy**		Code **1010311451010316012**
Field of study **Power Engineering**	Profile of study (general academic, practical) **(brak)**	Year /Semester **3 / 5**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **30** Classes: **30** Laboratory: **-** Project/seminars: **-**		No. of credits **5**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **5 100%** **5 100%**

Responsible for subject / lecturer:

Krzysztof Sroka
email: krzysztof.sroka@put.poznan.pl
tel. 61 665 22 75
Elektryczny
ul. Piotrowo 3A, 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of thermodynamics, fluid mechanics, energy technology and equipment, fuels and their utilization
2	**Skills**	Solving tasks of the balance of mass and energy in simple circuits of thermal power plants
3	**Social competencies**	Is aware of the need to broaden their competence, willingness to work together as a team

Assumptions and objectives of the course:

Acquire skills to carry out energy and economic analysis of complex combined heat and power (CHP) technological systems with the use of different types of primary energy.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. He has structured and theoretically founded knowledge in the basics of combined heat and power - [K_W13+++]
2. He knows and understands the phenomena, processes, and technological systems that are capable of converting energy from renewable sources to electricity and heat - [K_W09++]

Skills:

1. Able to recognize and explain patterns for various cogeneration technologies - [K_U22+++]
2. Able to evaluate CHP technologies in terms of their efficiency and environmental impact - [K_U07++K_U16++]
3. Able to identify and justify prospective cogeneration technologies - [K_U01+]

Social competencies:

1. Is aware of the social effects of the rational use of energy resources to satisfy the energy needs of the country - [K_K02++]

Assessment methods of study outcomes

Lectures:

- evaluation of the knowledge and skills listed on the written exam,
- continuous evaluation for each class skills and expertise by conducting discussions on current issues related to the development of cogeneration.

Classes:

- credit on the basis of the current check messages and two written tests of the accounting tasks

Course description

Heating systems and CHP-plant parameters. Backpressure and heat extraction-backpressure turbine sets. Gas power plants and gas-steam power plants. Distributed cogeneration using low-power gas turbines and internal combustion piston engines. Innovative technologies - fuel cells, Stirling engines, ORC systems. Technical and economic grounds selection of technological solution of CHP-plant. Energy analysis of CHP plant operation and costs of combined heat and power. Evaluation of cost-CHP. Certificates of origin as instruments of promotion of cogeneration. Methodology for determining the electricity generated in cogeneration. Content of accounting practice is closely related to the lectures.

Basic bibliography:

1. J.Szargut, A.Ziębik - Skojarzone wytwarzanie ciepła i elektryczności ? elektrociepłownie, Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego, 2007
2. J. Marecki ? Gospodarka skojarzona cieplno-elektryczna, WNT, W-wa 1991

Additional bibliography:

1. K.Buczek - Skojarzone wytwarzanie ciepła i energii elektrycznej w małych elektrociepłowniach, Wydawnictwo i Handel Książkami "KaBe" Krosno.2001
2. R. Turschmid ? Kotłownie i elektrociepłownie przemysłowe, Arkady, W-wa 1988
3. D.Laudyn, M.Pawlik, F.Strzelczyk ? Elektrownie, WNT W-wa 2000

Result of average student's workload

Activity	Time (working hours)
1. participation in the lectures	30
2. participation in the auditorium exercises	30
3. preparation to the auditorium exercises	30
4. participation in the consulting on the auditorium exercises and lectures	5
5. preparation to the exam	24
6. participation in the exam	3

Student’s workload

Source of workload	hours	ECTS
Total workload	122	5
Contact hours	68	3
Practical activities	0	0