

(faculty stamp)

**Syllabus**

<b>1. Name of the subject:</b> Environmental Impact & Thermo-economic Evaluation In Energy Sector			<b>2. Course code:</b>	
<b>3. Valid in academic year:</b> 2016/2017				
<b>4. Course:</b> MSc (second degree programme)				
<b>5. Type of studies:</b> full time stationary course				
<b>6. Field of study:</b> POWER ENGINEERING				
<b>7. Profile of studies:</b> General academic				
<b>8. Programme:</b> CLEAN FOSSIL AND ALTERNATIVE FUELS ENERGY (KIC INNOENERGY)				
<b>9. Semester:</b> 2				
<b>10. Responsible unit:</b> Institute of Thermal Technology (RIE-6)				
<b>11. Lecturer:</b> dr hab. inż. Wojciech Stanek				
<b>12. Group of subjects:</b> Specialization subject				
<b>13. Status:</b> Obligatory				
<b>14. Language of instruction:</b> English				
<b>15. Prerequisites:</b> thermodynamics				
<b>16. Course objectives:</b> Acquisition the knowledge in the field of advanced LCA, exergy analysis, exergy diagnosis and economic analysis of energy intensive systems.				
<b>17. Learning outcomes:<sup>1</sup></b>				
Nr	Description of learning outcome	Method of assessments	Type of classes	Reference to learning outcomes
1	Student is able to conduct an initial economic analysis of undertaken activities Student is able to conduct technical and economic analysis of designed technological systems	Exam	Lecture/ project assessment	K2A_U13; K2A_U16
2	Student is able to conduct extensive analysis of the impact of selected process parameters on process capacity/watt-hour efficiency	Exam	Lecture/project assessment	K2A_W17; K2A_U22
3	Student is familiar with advanced methods of energy assessment of processes in the field of technical and chemical thermodynamics	Exam	Lecture/ project assessment	K2A_W14
4	Student is able to demonstrate broad knowledge of technologies used in conventional and nuclear power engineering	Exam	Lecture	K2A_W10
<b>18. Type of classes and their duration</b> <b>Lecture: 30h      Project: 15h</b>				

<sup>1</sup> 5-8 learning outcomes should be given

**19. Content of the course:**

Fundamentals of energy and energy balances. Energy and exergy efficiencies and their applications. Rules of cumulative energy and exergy calculus. Introduction of exergy cost concept and presentation of methodology of calculation these costs. Algorithm of calculation of partial exergy costs. Introduction to exergy diagnosis. Methodology of calculation of direct and inducted exergy losses. Concept of Thermo-Ecological Cost (TEC) and algorithm of TEC calculation in whole life cycle of product. Methods for evaluation of economic effectiveness of rationalization of energy management.

During the lecture students take part in discussion about humanitarian and social aspects of changes in energy policy including detailed studies of environmental impact of different types of power generation including renewable sources.

The evaluations shown during lectures and made as a part of the project could be treated as a basis for making judgments about different technologies and its environmental impact as well as results in social and economic system.

New innovative solutions will be proposed by students. The aim is to reduce an environmental burden linked with specific parts of power systems under analysis.

Lectures are conducted in an interactive way with use of audiovisual tools. During the lecture problem questions/topics are raised, students take part in the discussion and brainstorm, trying to find solution/answers, assess existing solutions as well as develop critical thinking. Students are encouraged to participate in discussions which are moderated by the tutor.

Students will be able to assess the dynamic nature of complex systems and change over time. They will be able to apply the tools and concepts of system dynamics and systems thinking in their present lives.

Project will be made in groups with elected leader. Tasks will be assigned according to competences as well as leadership skills.

**20. Examination:** yes**21. Basic literature:**

1. Szargut J. (2005). Exergy method, technical and ecological applications. Southampton, Boston: WIT Press
2. Torres C., Valero A. Thermoeconomic Analysis. University of Zaragoza
3. TAESS Software accessible at Exergo-Ecology Portal [www.exergoecology.com](http://www.exergoecology.com)

**22. Other reading:** Scientific journals available in university network (Scopus, Science direct etc.)**23. Work load of the student necessary to achieve the learning outcomes**

Lp.	Type of classes	Number of contact hours / student work
1	Lectures	30/30
2	Recitations	
3	Lab	
4	Project	15/15
5	Seminar	
6	Other (participation in consultations associated with project execution)	
	number of hours (subtotal)	45/45

**24. Total number of hours:****25. Number of ECTS credits:<sup>2</sup> 4****26. Number of ECTS credit points gained during classes (contact hours): 2****27. Number of ECTS credits gained during practice oriented classes (labs, projects): 2**

<sup>2</sup> 1 ECTS point – 30 hours workload

## 26. Remarks:

Teaching tools: **learning by doing, project based learning**

**The overall assessment consist of two steps:**

1. Check of fulfilling of module LO consequently OLOs criteria.
2. Assessment and grading of the quality of students work and reached LO.

EIT OLOs assessed in the subject :

- Value judgments and sustainability competencies (EIT OLO 1)
- Entrepreneurship skills and competencies (EIT OLO 2)
- Creativity skills and competencies (EIT OLO 3)
- Research skills and competencies (EIT OLO 5)
- Intellectual transforming skills and competencies (EIT OLO 6)

The Method of assessments indicated in point 17 includes assessment of learning outcomes and OLOs

### **Grading:**

Grading formula:  $FG = PMWF_{lec} * PMG_{lec} + PMWF_{proj} * PMG_{proj}$

Where:

- FG-final grade
- $PMWF_{lec}$  – Lecture part weighting factor – 0,6
- $PMG_{lec}$  – Grade of achieved LOs relevant to lecture
- $PMWF_{proj}$  – Project part weighting factor – 0,4
- $PMG_{proj}$  – Grade of achieved LOs relevant to project

All LO weighting factors associated with part of the module (PM) equal 1.

Accepted:

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(Date and signature of the responsible instructor)

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(date and signature of teh director of the institute, chair, Director of Foreign Language College/head or director of inter-faculty unit)