Załącznik Nr 5 do Zarz. Nr 33/11/12

(faculty stamp) **Syllabus**

1. Name of the subject: Optimization of Combustion Processes	**2. Course code:**
3. Valid in academic year: 2016/2017	
4. Course: MSc (second degree programme)	
5. Type of studies: full time stationery course	
6. Field of study: POWER ENGINEERING	
7. Profile of studies: General academic	
8. Programme: CLEAN FOSSIL AND ALTERNATIVE FUELS ENERGY (KIC INNOENERGY)	
9. Semester: 1	
10. Responsible unit: Institute of Thermal Technology (RIE-6)	
11. Lecturer: dr inż. Adam Klimanek	
12. Group of subjects: Specializations subject	
13. Status: Obligatory	
14. Language of instruction: English	
15. Prerequisites: Basic knowledge of thermodynamics, heat and mass transfer, chemistry and fluid mechanics	
16. Course objectives: The aim of the curse is to deliver knowledge on noxious substances formation and primary and secondary methods of emission abatement	
17. Learning outcomes:[1]	

Nr	Description of learning outcome	Method of assessments	Type of classes	Reference to learning outcomes
1	Student is able to explain noxious substances formation	Written exam on problems discussed during lectures and assessment of projects and laboratory reports	lectures, lab, project	**K2A_W06**, **K2A_W15, K2A_W17**, **K2A_K02**
2	Student is able to compare methods of primary and secondary emission reduction and assesses effects of technological solutions	Written exam on problems discussed during lectures and assessment of projects and laboratory reports	lectures, lab, project	**K2A_W10, K2A_W11**, **K2A_W17**, **K2A_U26**

[1] 5-8 learning outcomes should be given

3	Student is able to identify conditions (type of boiler, fuel, operating conditions) which cause a risk of pollutants formation	Written exam on problems discussed during lectures and assessment of projects and laboratory reports	lectures, lab, project	**K2A_W17**, **K2A_W06**, **K2A_U07**, **K2A_K02**
4	Student is able to select and design primary and secondary technologies for emission reduction of noxious substances typical for energy sector	Evaluation of the reports from laboratories and assessment of projects	lab, project	**K2A_U07**, **K2A_U17, K2A_U16, K2A_W06**,
5	Student can demonstrate her/his ability to take responsibility and collaborate with others when working in a team	Written exam on problems discussed during lectures and assessment of projects and laboratory reports	lecture, lab, project	**K2A_K02**, **K2A_U07**

18. Type of classes and their duration

Lecture: 15h Lab: 15h Project: 15h

19. Content of the course:

The course consists of lectures, labs and projects. The following subjects are discussed during the lectures:

- Ecological noxiousness of combustion, importance of combustion, primary and secondary contamination, main pollutants and emission sources, emission factors, regulations
- Mechanisms leading to formation and emission of nitrogen oxides, sulphur oxides, carbon monoxide, hydrocarbons, dioxins, furanes and particulate matter in the course of combustion
- In-situ methods of emission reduction of noxious substances
- Secondary methods of reduction of nitrogen oxides, sulphur oxides and particulate matter

Written exam is conducted to assess the acquainted knowledge.

During the project students are instructed by assistant professor on how to select and design devices of noxious substances reduction. Then students are expected to undertake a number of small individual projects. The projects are assessed.

The laboratory exercises are based on a series of experiments carried out by students. The experiments are carried out in small groups. Students need to acquire knowledge of the processes, experimental facilities and procedures prior to the lab, based on materials prepared by the instructors. Then students are expected to prepare reports from each experiment.

20. Examination: yes

21. Basic literature:

1. R.K. Wilk, Low emission combustion, Wyd. Pol. Śl., Gliwice 2002
2. L.D. Smoot, Fundamentals of coal combustion for clean and efficient use, Elsevier, 1993

22. Other reading:

1. S.R. Turns, An Introduction to Combustion: Concepts and Applications, 2nd Edition, Mc Graw Hill, 2000

23. Work load of the student necessary to achieve the learning outcomes

Lp.	Type of classes	Number of contact hours / student work
1	Lectures	15/15
2	Recitations	/
3	Lab	15/30
4	Project	15/30
5	Seminar	
6	Other (participation in consultations associated with project execution)	
	number of hours (subtotal)	45/75

24. Total number of hours: 120

25. Number fo ECTS credits:[2] 4

26. Number of ECTS credit points gained during classes (contact hours):

27. Number of ECTS credits gained during practice oriented classes (labs, projects):

26. Remarks:

Teaching tools: **learning by doing**

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)
- 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: $FG=PMWF_{lec}*PMG_{lec}+ PMWF_{lab}*PMG_{lab}+ PMWF_{proj}*PMG_{proj}$
Where:

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

[2] 1 ECTS point – 30 hours workload

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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)*