

(faculty stamp)

Syllabus

1. Name of the subject: Gasification and Pyrolysis			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 FUELS AND ALTERNATIVE FUELS ENERGY (KIC INNOENERGY)				
9. Semester: 2				
10. Responsible unit: Institute of Thermal Technology (RIE-6)				
11. Lecturer: dr inż. Adam Klimanek				
12. Group of subjects: Selective subject				
13. Status: Obligatory				
14. Language of instruction: English				
15. Prerequisites: basics of thermodynamics, fluid dynamics, heat and mass transfer				
16. Course objectives: The aim of this course is to deliver the knowledge on solid fuels gasification chemistry and technology including fixed bed, fluidized bed and entrained flow gasifiers				
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 gasification process and discuss gasification technologies	Written exam, project assessment	Lecture, project	K2A_W08, K2A_W10, K2A_W11
2	Student is able to evaluate the advantages and disadvantages of using gasifier in a given process	Written exam, project assessment	Lecture, project	K2A_W08, K2A_W10, K2A_W11
3	Student is able to determine composition of produced gas Students is able to demonstrates specialist knowledge which enables to solve problems of gasification and pyrolysis		Project	K2A_U15, K2A_U17; K2A_W17

¹ 5-8 learning outcomes should be given

4	Student is able to estimate influence of the operating conditions on amount the produced gas and its quality	Written exam, project assessment	Lecture, project	K2A_W08, K2A_W10, K2A_U15, K2A_U17;
5	Student is able to demonstrate her/his knowledge of fossil fuel resources and this physical and chemical properties, as well as processes of their use	Project assessment	Project	K2A_W15 K2A_U15, K2A_U17
6	Student is able to assess usability of new achievements (techniques and technologies) and assess effects of technological solutions in the field of power engineering			K2A_U11; K2A_U16;

18. Type of classes and their duration

Lecture:15h Project: 15h

19. Content of the course:

The course consists of lectures and project. During the lectures the following problems are discussed:

- Stoichiometry of gasification which allows determination of gas composition under simplifying assumptions such as chemical equilibrium. Main parameters which characterize gasification are defined as well.
- Gasification chemistry which covers the area of fuel devolatilization and heterogeneous reaction at the fuel surface. The special attention is laid on the difference between gasification in air and in oxygen.
- Gasification technologies which deliver the knowledge on main types of gasifiers constructions including fixed bed, fluidized bed and entrained bed.

The second part of the course consists of individual student work supervised by the teacher. During the classes students should prepare project of gasification process, which includes: technology selection, mass and energy balance, gas composition prediction, as well as selection of commercially available devices which are suitable for analyzed case.

20. Examination: Written exam evaluating knowledge from the lectures, assessment of the projects

21. Basic literature:

1. Lecture notes
2. C. Higman, M. van der Burt, Gasification, Gulf Professional Publishing, 2008
3. A. Williams, Combustion and Gasification of Coal, 2000
4. J. Tomczek, Zgazowanie węgla, Wydawnictwo Politechniki Śląskiej, 1991

22. Other reading:

1. M. Ściążko, H. Zieliński, Termochemiczne przetwórstwo węgla i biomasy, Wydawnictwo PAN, 2003
2. T. Chmielniak, J. Skorek, J. Kalina, S. Lepszy, Układy energetyczne zintegrowane ze zgazowaniem biomasy, Wydawnictwo Politechniki Śląskiej, 2008
3. M.L. de Souza-Santos, Solid Fuels Combustion and Gasification: Modeling, Simulation, and Equipment Operations Second Edition, Dekker Mechanical Engineering, 2010
4. J.T. Bartis, Producing Liquid Fuels from Coal: Prospects and Policy Issues, RAND, 2008
5. K. Stańczyk, Czyste technologie użytkowania węgla, Wydawnictwo GIG, 2008
6. J. Szuba, L. Michalik, Paliwa ciekłe z węgla, WNT, Warszawa 1992
7. J. Rezaiyan, N.P. Cheremisinoff, Gasification Technologies: A Primer for Engineers and Scientists, CRC Press, 2005

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	/
4	Project	15/15
5	Seminar	
6	Other (participation in consultations associated with project execution)	
	number of hours (subtotal)	30/30

24. Total number of hours: 60**25. Number fo ECTS credits:² 2****26. Number of ECTS credit points gained during classes (contact hours):****27. Number of ECTS credits gained during practice oriented classes (labs, projects): 1**

² 1 ECTS point – 30 hours workload

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)
- 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)