(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: BIOPROCESSES FOR ENVIROMENTAL PROTECTION	**2. Course code**
3. Validity of course description: 2013/2014	
4. Level of studies: 2nd cycle of higher education	
5. Mode of studies: intramural studies	
6. Field of study: MACROFACULTY - INTEGRATED STUDIES - INDUSTRIAL AND ENGINEERING CHEMISTRY	RCH
7. Profile of studies: -	
8. Programme: PROCESS ENGINEERING FOR GREEN CHEMICAL TECHNOLOGIES	
9. Semester: 2	
10. Faculty teaching the course: Department of Chemical Engineering and Process Design	
11. Course instructor: prof. Andrzej Jarzębski	
12. Course classification:	
13. Course status: compulsory	
14. Language of instruction: English	
15. Pre-requisite qualifications: basic knowledge of bioprocess engineering principles and objectives: tools, operation, modeling and analyses	
16. Course objectives: knowledge building on application of microorganisms and process engineering tools to pollution abatement of human environment	
17. Description of learning outcomes:	

No	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	Understands importance of pollution abatement and the principles of key bioprocess eng.- based technologies	Conversation/Exam	Lecture	K_W03+++ K_U09+ K_K07+
2.	Knows basic bioprocesses of waste water, air (VOC) and solid wastes (bio)treatment and is familiar with processes' kinetics and modeling	Conversation/Exam	Lecture	K_W06++ K_U20+
3.	Knows how to formulate environmental problems in bioprocess engineering categories.	Conversation/Exam	Lecture	K_W03+++ K_U16+ K_U20+
4.	Has the knowledge and skills to perform basic calculations for scale-up and optimization of abatement technologies	Exam/Conversation	Lecture	K_W04++ K_U16+
5.	Understands the need of permanent updating personal knowledge and skills, motivates coworkers to upgrade the knowledge, and further its transfer to the people	Exam/Conversation	Lecture	K_K02+
6.				

18. Teaching modes and hours

Lecture / BA /MA Seminar / Class / Project / Laboratory

Lecture sem 1 - 30 h

19. Syllabus description:

Lecture: Curriculum covers the principal topics of bioprocesses for environment protection, viz.: principal chemical loads on environment, treatment of municipal sewages and industrial waste waters in aerobic and anaerobic conditions – advantages and shortcomings of various methods. Nitrogen and phosphorus removal under anoxic conditions – typical process arrangements. Treatment of agricultural wastes and sludge – restraints and typical arrangements. Biogas formation, UASB process and other biogas reactors. Composting of solids and agriculture wastes. Removal of VOC using wet and semi-dry systems. Kinetics of

bioconversion and its dependence on process parameters – temperature and pH. Bioreactors applied for peculiar applications and scaling. Aeration and aerators. Bioreactor-settler system with biomass recycling – model and analysis.

20. Examination: yes

21. Primary sources:

H.-J. Rehm, G. Reed (Eds) Biotechnology, Vol 11a, Environmental processes, VCH 1999

22. Secondary sources:

Jens Nielsen, John Villadsen, Bioreaction Engineering Principles, Plenum Press, London 1994.

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30/20
2	Classes	-/-
3	Laboratory	-/-
4	Project	-/-
5	BA/ MA Seminar	-/-
6	Other	-/10
	Total number of hours	30/30

24. Total hours: 60

25. Number of ECTS credits: 2

26. Number of ECTS credits allocated for contact hours: 1

27. Number of ECTS credits allocated for in-practice hours (laboratory, classes, projects): -

26. Comments:

Approved:

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(date, Instructor's signature)

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(*date , the Director of the Faculty Unit signature)*