(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: BIOPROCESSES ENGINEERING	**2. Course code**
3. Validity of course description: 2018/2019	
4. Level of studies: 1st cycle of higher education	
5. Mode of studies: full time daily studies	
6. Field of study: MACROFACULTY - INDUSTRIAL AND ENGINEERING CHEMISTRY	RCH
7. Profile of studies: -	
8. Programme: PROCESS ENGINEERING FOR GREEN CHEMICAL TECHNOLOGIES	
9. Semester: 6	
10. Faculty teaching the course: Department of Chemical Engineering and Process Design	
11. Course instructor: dr hab. Inż. Katarzyna Szymańska	
12. Course classification:	
13. Course status:	
14. Language of instruction: English	
15. Pre-requisite qualifications: Bioprocess and process engineering**,**	
16. Course objectives: The course aims at building up the knowledge on the fundamentals of bioprocess engineering: aims, principles, methods and tools devised for the processes carried out with microorganisms and enzymes.	

17. Description of learning outcomes:

No	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	Student is familiarized with basic concepts of bioprocess engineering: bioreactor engineering, balancing of mass, enzymatic and microbial kinetics, bioreactors design, modeling and analysis, and process scale up.	Examination/test	Lecture/classes	K2A_W09 ++ K2A_U07+
2.	Student can write mass balances for basic bioprocess/reactor arrangements and has the skills of solving	Examination/test	Lecture/classes	K2A_W11+ K2A_U24+
3.	Student knows the governing principles of microbial growth and enzymatic kinetics and the skills to evaluate it from experimental data.	Examination/test	Lecture/classes	K2A_W12 ++
4.	Student has the knowledge and skills to carry out dimensioning for typical bioreactors.	Examination/test	Lecture/classes	K2A_W14+
5.	Student understands the need for a continual updating of both knowledge and skills and encourages its associates in doing the same. Student understands the need to give the information about the new way of developing biochemistry for the society	observation and discussion	Lecture/classes	K1A_K04+ K1A_K06+
6.				

18. Teaching modes and hours

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

Lecture sem 1 - 30 h/ class 30h

19. Syllabus description:

Lecture: Bioreactors – types, characteristics, mass balance equations, productivity. Elemental balance of microbial growth, concept of yield coefficients. Mass balancing for aerobic and anaerobic processes. Kinetics of biomass/microorganisms growth (Monod and related, structured and physiological/population models). Endogeneous metabolism, it effect and quantification. Kinetics of

enzymatic reactions (Michaelis-Menten, triple complex and bi-bi ping-pong models). Inhibition and inactivation of biocatalysts. Determination of reaction kinetics and its discriminations (Hofstee and Lineweaver-Burk plots). Chemostate/CSTR – properties and application. Model and analysis of the fermentor-settler system. Integrated – macro kinetics for heterogeneous biocatalysts – concept of catalyst efficiency(ies) and its determination.

20. Examination: yes

21. Primary sources:

1. S. Liu, Bioprocess Engineering. Kinetics, Biosystems, Sustainability, and Reactor Design, Elsevier, 2013.

2. J.E. Bailey, D.F. Olis, Biochemical Engineering Fundamentals, Mc-Graw 1994.

3. K.van't Riet, J. Tramper, Basic Bioreaktor Design, Marcel-Dekker 1991.

4. K. Szewczyk, Bilansowanie i kinetyka procesów biochemicznych, Ofic. Wyd. Pol. Warszawskiej (OWPW) 1997 – see also 2 ed.

22. Secondary sources:

1. J. Bałdyga, M. Henczka, W Podgórska, Obliczenia w inżynierii bioreaktorów, OWPW 1996.

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

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30/30
2	Classes	30/30
3	Laboratory	-/-
4	Project	-/-
5	BA/ MA Seminar	-/-
6	Other	15/15
	Total number of hours	75/75

24. Total hours: 150

25. Number of ECTS credits: 5

26. Number of ECTS credits allocated for contact hours: 2

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

26. Comments:

Approved:

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(date, Instructor's signature) (*date , the Director of the Faculty Unit signature)*