University of Zagreb

1. GENERAL INFORMATION				
1.1 Course teacher	Prof. Ana Vrsalović Presečki, PhD Prof. Zvjezdana Findrik Blažević, PhD		1.6 Year of the study	2nd year, 3rd semester
1.2 Name of the course	Enzymatic Technologies		1.7 ECTS credits	5
1.3 Associate teachers	Dino Skendrović, mag. ing. oecoing.		1.8 Type of instruction (number of hours L + E + S + e-learning)	Total: 60 (L:30, E: 15, S:15)
1.4 Study programme (undergraduate, graduate, integrated)	graduate		1.9 Expected enrolment in the course	10
1.5. Status of the course	☐ mandatory	☒ elective	1.10 Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	2
2. COUSE DESCRIPTION				
2.1. Course objectives	To introduce students with theory and relevant knowledge of the principles of enzymology that includes the basic properties of enzymes, catalytic mechanisms of enzymes and enzyme kinetics. Students will also be introduced with the techniques of preparation and industrial production of enzymes.			
2.2. Enrolment requirements and/or entry competences required for the course				
2.3. Learning outcomes at the level of the programme to which the course contributes	• Compile and apply advanced knowledge of natural and technical sciences, particularly chemical engineering and environmental engineering in solving scientific, professional and general social problems. • Solve engineering problems using the scientific method combining expert knowledge from chemistry, environmental, and chemical engineering as well as material science and engineering. • Utilise advanced laboratory procedures and instruments for synthesis of new products, create sustainable processes, and solve problems of water, air and soil pollution. • Apply different analytical techniques, analytical and numerical methods, as well as software tools in creative problem solving of engineering challenges, proposing sustainable technological solutions. • Independently organise and plan timelines, apply a general methodology for project planning and management in a business environment • Create a critical analysis, evaluation and interpretation of personal results, and compare them with existing data in scientific and expert literature • Demonstrate independence and reliability in independent work, as well as effectiveness, reliability and adaptability in team work • Outline results of independent and teamwork in a written and oral form to non-experts and experts in a clear and coherent way. • Develop work ethic, personal responsibility and tendency for further skill and knowledge acquisition, according to standards of engineering practice			

2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	• Apply knowledge from biotechnology and chemistry to design an environmentally sustainable enzyme process for industrial production of chemicals. • To differentiate the reaction mechanisms of enzymatically catalyzed reactions for different basic enzyme classes. • To evaluate the kinetic parameters of the enzyme reaction. • To identify the advantages and disadvantages of various reaction media for enzyme reactions and decide on favorable reaction conditions for specific cases. • To compare methods of production, purification, characterization and immobilization of enzymes.		
2.5. Course content (syllabus)	**WEEK 1.** Enzyme Properties, nomenclature of enzymes, characteristics and mechanisms. **WEEK 2.** Enzyme classes I **WEEK 3.** Enzyme classes II **WEEK 4.** Enzyme kinetics **WEEK 5.** Characterization of enzymes. **WEEK 6.** Methods of enzyme production **WEEK 7.** Methods of enzyme purification **WEEK 8.** Partial exam **WEEK 9.** Industrial production of enzymes. **WEEK 10.** Kinetic resolution and enantioselectivity of enzymes. **WEEK 11.** Reaction media in biocatalysis. **WEEK 12.** Heterogeneous biocatalysis. **WEEK 13.** Industrial application of enzymes **WEEK 14.** Industrial biotransformations. **WEEK 15.** Partial exam		
2.6. Format of instruction:	☒ lectures ☒ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☐ multimedia and the internet ☒ laboratory ☐ work with mentor ☐ (other)	2.7. Comments:
2.8. Student responsibilities	Students are obligated to attend lectures, seminars and laboratory exercises (min 75 %). Students should deliver a lab report, seminar work and give a presentation of their seminar work. Students can pass the exam by taking partial test, or regular written exam.		

2.9. Monitoring student work	Class attendance	YES		Research	YES		Oral exam		NO
	Experimental work	YES		Report	YES		(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary exam	YES		Practical work	YES		(other)		
	Project		NO	Written exam	YES		ECTS credits (total)		

2.10. Required literature (available in the library and/or via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Teaching materials prepared by the course teacher and available through the course website		www.fkit.unizg.hr
	Industrial Biocatalysis, Peter Grunwald Ed. Pan Stanford Publishing, 2015.	2	NO
	Industrial Biotransformations, Andreas Liese, Karsten Seelbach, Christian Wandrey Eds, Wiley VCH, 2nd Edition, 2005.	1	

2.11. Optional literature	Biochemical Engineering, 2nd Edition, Douglas S. Clark, Harvey W. Blanch Eds., CRC Press, 1995.
2.12. Other (as the proposer wishes to add)	