INDBIOT-03	**BIOCATALYSTS AND BIOTRANSFORMATION**
GENERAL INFORMATION	
Course Coordinator(s)	Marina Tišma, PhD, assoc. prof.
Associate(s)	-
Study Programme	Interdisciplinary Graduate Study Programme in English: Biotechnology
Course Status	Obligatory
Year of Study, Semester	2nd Year / 3rd Semester
Credits (ECTS)	**4.5**
Teaching Method (number of classes)	Lectures 30; Seminars 10; Exercises 15
Expected Number of Students in the Course	25-30
COURSE DESCRIPTION	
Course Aims	
This course aims to provide knowledge on application of enzymes and whole cells in industrial biotechnology with the aim of sustainable development (to change chemical processes with ecologically and economically friendlier processes).	
Prerequisites for Enrolment and the Entry Competencies Required for the Course	
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Learning Outcomes at the Programme Level Contributed by the Course	
INDBIOT-2; INDBIOT-4; INDBIOT-6	
Learning Outcomes at the Course Level	
After successful completion of this course students are expected to be able to: 1. Compare differences between homogeneous and heterogeneous biocatalysis. 2. Compare different bioreactor types used in biotransformation. 3. Critically argue advantages and disadvantages of heterogeneous biocatalysts. 4. Predict applications of immobilized enzymes or immobilized whole cells. 5. Estimate enzyme kinetics parameters. 6. Select appropriate bioseparation steps for the isolation of desired product. 7. Compare industrially important biotransformation.	
Course Content	
Lectures. Definition of homogeneous and heterogeneous biocatalysis. Types of reactors for enzymatic catalysed reactions. Application of homogeneous and heterogeneous biocatalysis in industry. Development of mathematical model for enzymatic catalysed process. Integral and differential methods for kinetic parameter estimation. Kinetics of microorganism's growth. Estimation of kinetic parameters. Bioseparation processes (separation of microbial cells, intracellular and extracellular products, concentration and purification of bioproducts). Examples of industrially important biotransformation. **Seminars**. PowerPoint presentation in the field of industrial biotransformation. **Laboratory exercises.** Phenolic compounds oxidation catalysed by laccase.	
Teaching Methods	
Lectures; seminars; laboratory exercises	
Students' Obligations	
Attendance at all forms of classes is mandatory and the students are obligated to attend all knowledge tests. The students may be absent from 30% (full-time students) and 50% (part-time students) of each of the forms of classes, provided that the absence is justified. An exercise or a seminar which has not been completed must be made up through a midterm exam.	
Monitoring the Activity of the Students *(Connecting Learning Outcomes, Teaching Methods, and*	

Grading)

Class-related activity	ECTS	Learning outcome	Student activity	Evaluation method	Grade points	
					Min.	Max.
Attending classes	0.5	1-7	Attendance at classes	Keeping records	2	10
Seminars	1	7	Seminar work preparation	Presentation of seminar work	10	20
Laboratory exercises	0.5	5-6	Practical work	Laboratory exercises report	8	10
Final exam	2.5	1-5	Studying for the final exam	Written exam	30	50
Total	**4.5**				**50**	**100**

Evaluation of the written part of the final exam

Percentage of correct answers (%)	Grade
>95.00	50
90.00-94.99	47
85.00-89.99	45
80.00-84.99	40
75.00-79.99	38
70.00-74.99	35
65.00-69.99	33
60.00-64.99	30

Forming the final grade:
The points granted for the final exam are added to the grade points awarded during class attendance. The grading process is conducted by absolute distribution, i.e. based on total achievements, and compared to the numerical system in the following manner:
A – Excellent (5): 90-100 grade points; B – Very Good (4): 80-89.99 grade points; C – Good (3): 65-79.99 grade points; D – sufficient (2): 50-64.99 grade points

Mandatory Literature (available in the library and via other media)

Title	Number of copies in the library	Availability via other media
Straathof AJJ, Adlercreutz P: Applied Biocatalysis, Harwood Academic Publisher, 2nd Ed., 2000.		

Additional Literature

Liese A, Seelbach K, Wandrey C: Industrial biotransformation, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Springer, 2006.
Buchholz K, Kasche V, Bornscheuer, UT: Biocatalysts and Enzyme Technology, Wiley, 2012.

Quality Assurance Procedures Designed to Ensure the Acquisition of Outcomes and Competencies

Anonymous, quantitative, standardised student survey on the course and the teacher's work implemented by the Quality improvement office of the Faculty of Food Technology Osijek and/or the Faculty of Medicine Osijek.

Note

E-learning is not included in the class quota, but it is used in teaching and it contains links to various sites and video and audio materials available on websites.