INDBIOT-E03:	**WASTEWATER TREATMENT**
GENERAL INFORMATION	
Course Coordinator(s)	Natalija Velić, PhD, assoc. prof.
Associate(s)	-
Study Programme	Interdisciplinary Graduate Study Programme in English: Biotechnology
Course Status	Elective
Year of Study, Semester	2nd Year / 4th Semester
Credits (ECTS)	**4**
Teaching Method (number of classes)	Lectures 20; Seminars 10; Exercises 5; Field Exercises 10
Expected Number of Students in the Course	25-30
COURSE DESCRIPTION	
Course Aims	
Introducing students to different methods and processes used for the treatment of industrial wastewaters with the aim of protecting aquatic ecosystems (natural recipients) into which treated wastewaters are discharged.	
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-4; BIOTECH-7; BIOTECH-8	
Learning Outcomes at the Course Level	
After attending lectures and successfully completing seminars and exercises, learning independently, and passing the exam, the students will be able to: 1. Interpret and compare national and international (EU) water legislation. 2. Classify wastewaters by origin and quality indicators. 3. Compare wastewater treatment processes (primary, secondary and tertiary). 4. Differentiate microbiological processes underlying biological wastewater treatment. 5. Compare different technologies and equipment used for wastewater treatment and monitoring. 6. Suggest the appropriate wastewater treatment methods based on the available data on the wastewater quality indicators, origin, volume and other available and relevant information.	
Course Content	
Lectures. Overview of national and international water legislation. Wastewater - classification and characterisation by origin. Physico-chemical methods of wastewater treatment. Preliminary and primary wastewater treatment. Biochemistry, microbiology and kinetics of biological wastewater treatment processes. Aerobic wastewater treatment. Biological and chemical removal of nutrients, nitrogen (nitrification, denitrification) and phosphorus (EBPR). Anaerobic wastewater treatment, anaerobic sludge stabilisation. Biological removal/degradation of xenobiotics. Tertiary treatment. Sludge disposal. Monitoring, modelling, design and optimization of wastewater treatment processes. **Seminar.** Biological removal/degradation of xenobiotics from wastewater. Application of genetically modified microorganisms in biological wastewater treatment. **Exercises.** Experimental methods for wastewater analysis. **Field exercises.** Visits to communal and industrial wastewater treatment plants.	
Teaching Methods	
Lectures; seminars, exercises, field course	
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 hich 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.
Classes, seminars	0.3	1-5	Attendance at classes	Attendance records	2	5
Seminar work	1.2	6	Writing a seminar paper	Oral presentation of a seminar	13	30
Exercises	0.5	2-3, 5-6	Attendance at exercises	Exercises report	5	15
Final exam	2	1-6	Studying for the final exam	Written exam	30	50
Total	**4**				**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
Burton FL, Tchobanoglous G, Tsuchihashi R, Stensel HD: Wastewater Engineering:Treatment and Resource Recovery, 5th Ed., Mcgraw-Hill Education: Metcalf & Eddy, Inc., 2013	-	-
van Loosdrecht MCM, Nielsen PH, Lopez-Vazquez CM, Brdjanovic D: Experimental Methods in Wastewater Treatment, IWA Publishing, London, 2016.		yes

Additional Literature
Bitton G*:* Wastewater microbiology, 4th Ed., Wiley-Blackwell, New Jersey, 2011. Cheremisinoff NP: Handbook of Water and Wastewater Treatment Technologies, Butterworth-Heinemann, Woburn, MA, 2002. Scientific papers (available on-line)
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.