

## MODULE INFORMATION SHEET

<b>Name of Module Unit</b>	<b>Advanced Biological Methods of Wastewater Treatment</b>
Name in polish language	Zaawansowane metody biologicznego oczyszczania ścieków
Module type	<del>compulsory</del> / elective
Form of studying	full-time day courses
Level of study	graduate course (M.Sc. level)
Type of study ( for extra-mural courses)	-
Programme	Environmental Engineering
Speciality	Environment Protection Engineering
Responsible department	Department of Biology
Responsible person	dr hab. inż. Agnieszka Tabernacka, prof. PW

Semester	Lectures(E)	Tutorials	Laboratory	Computer Exercises	Projects	ECTS
4	15	30				3

### Learning outcomes (knowledge, skills, competences)

The objective of this course is to acquaint students with the advanced modern biological methods of wastewater treatment and to broaden the students' knowledge about the current development trends in the field of biotechnology in environmental engineering concerning the methods used in wastewater treatment. Student should obtain a detailed and theoretically founded knowledge concerning the kinetics of biological processes used in wastewater treatment and should be able to use biological processes in the design, modernization and operation of wastewater treatment processes. Student is also able to use the analytical and simulation methods to solve engineering tasks in the field of designing the biological process of wastewater treatment.

Student should also obtain the following competences: he can read the professional press and prepare an oral presentation on selected environmental engineering issues. Student is aware of the importance of non-technical aspects and effects of engineering activities, including its impact on the environment and the related responsibility for decisions.

### Prerequisites

Biological Techniques for Environmental Monitoring

### Rules for integrated grade setting

Integrated grade = Lecture grade (40%) + Tutorials grade (60%)

### Recommended readings

Bitton G.: "Wastewater microbiology", Wiley-Blackwell, New Jersey  
 Doran P. (1995) Bioprocess engineering principles. Londyn: Academic Press  
 Grady C.P.L., Daiger G.T., Lim H.C.: „Biological Wastewater Treatment”, Marcel Dekker Inc., New York, Basel.  
 van Loosdrecht M.C.M., Nielsen P.H., Lopez-Vazquez C.M., Brdjanovic D.: "Experimental Methods in Wastewater Treatment", IWA Publishing, London  
 Scragg A. H. (1991) Bioreactors in biotechnology: a practical approach. Ellis Horwood.  
 Seviour R.J, Nielsen P.H.: "Microbial ecology of activated sludge", IWA Publishing, London.

Wei-Shou H. (2018) Engineering Principles in Biotechnology. John Wiley & Sons Ltd.  
 Scientific publications concerning the advanced modern biological wastewater treatment methods and reactors.

### Contents of lectures (syllabus)

	Topics	Time (hrs.)	Scope (S / Ex)
1	Kinetics of biodegradation processes	3	Ex
2	Wastewater treatment systems with biological nutrient removal (BNR) – EBPR systems.	3	Ex
3	Granular activated sludge.	2	Ex
4	Attached growth processes: biofilm reactors and biofilm kinetics; MBBR and IFAS technology.	3	Ex
5	Anaerobic biological wastewater treatment.	3	Ex
6	Final test	1	
<b>Total</b>		<b>15</b>	<b>hours</b>

S – topics listed in the legal study programme standards from 12.07.2007

Ex – extended topics

### Lecturers

Prof. Agnieszka Tabernacka, Ph. D., D. Sc., Eng., Prof. Adam Muszyński, Ph. D., D. Sc., Eng.

### Assessment method

Final test

### Contents of tutorials

	Topics	Time (hrs.)	Scope (S / Ex)
1	Michaelis-Menten and Monod kinetics. Inhibition of biochemical reactions.	6	Ex
2	The new concepts for nutrients removal: Phoredox, Bardenpho, UCT, Carrousel, Anammox, CANON, Sharon reactors, granular activated sludge technology. Calculations for biomass growth and microbial activity, estimation of stoichiometric and kinetic parameters	10	Ex
3	Modelling of the optimum biofilm thickness in biofilm reactors designed to treat the selected wastewater. Calculation for biomass growth and microbial activity in MBBR and IFAS reactors	6	Ex
4	Microorganisms, biomass growth and microbial activity in reactors designed for anaerobic biological wastewater treatment	8	Ex
<b>Total</b>		<b>30</b>	<b>hours</b>

S – topics listed in the legal study programme standards from 12.07.2007

Ex – extended topics

### Persons responsible for tutorials

Prof. Agnieszka Tabernacka, Ph. D., D. Sc., Eng., Prof. Adam Muszyński, Ph. D., D. Sc., Eng.

### Assessment method for tutorials

Presentations given by students, project/exercise