STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Advanced wastewater treatment technologies**		Code **1010134271010137724**
Field of study **Environmental Engineering Extramural First-**	Profile of study (general academic, practical) **general academic**	Year /Semester **4 / 7**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **elective**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **part-time**	
No. of hours Lecture: **15** Classes: **10** Laboratory: **10** Project/seminars: **-**		No. of credits **4**
Status of the course in the study program (Basic, major, other) **other**	(university-wide, from another field) **university-wide**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **4 100%** **4 100%**

Responsible for subject / lecturer:

dr inż. Tymoteusz Jaroszyński
email: tymoteusz.jaroszynski@put.poznan.pl
tel. 616652436
Faculty of Civil and Environmental Engineering
ul. Piotrowo 5 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Student should have a basic knowledge about wastewater technology and basic knowledge about mathematics, chemistry, fluid mechanics included in first step of study.
2	**Skills**	Student should be able to perform mathematical calculations, physical, chemical, mechanics of the fluids and calculation of equipment and facilities of wastewater treatment plants included in first step of study.
3	**Social competencies**	Awareness to constantly update and supplement knowledge and skills.

Assumptions and objectives of the course:

- The objective of the course is to broaden the knowledge and skills scopes of wastewater technology necessary for the selection of technology methods of basic pollutants removal from municipal wastewater.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student knows the technological systems of wastewater treatment depending on the wastewater characterization on influent and effluent - [K_W03, K_W04]
2. Student knows the design methods of basic technological processes and technological systems of wastewater treatment and sludge handling and disposal systems for waste and sludge produced at WWTP - [K_W04, K_W05,K_W07]
3. Student understands basics of experiment in pre-design research of WWTP - [K_W04, K_W07]

Skills:

1. Student can prepear the design concept of technology for municipal wastewater treatment plant - [K_U03, K_U04,K_U09, K_U11]
2. Student can work in a team (measurements and elaboration of the obtained experimental data) - [K_U04, K_U11,K_U16]

Social competencies:

1. Student understands the need for teamwork in solving theoretical and practical problems - [K_K01, K_K03, K_K06]
2. Student understands the different roles in teamwork and the need for information and knowledge exchange in a group work - [K_K02, K_K04, K_K05]
3. Student understands the need for a systematic deepening and broadening his/her competences - [K_K03, K_K04, K_K05]

Assessment methods of study outcomes

-Lecture

1. Attendance and lecture activity checkup

2. Written finale exam - 10 questions to answer) (effects W3,W4,W7,K1).

Maximum amount of point for each question 10. Criteria of estimates depending on get amount of point number

Points - estimate

91 - 100 very good (5,0)

81 - 90 Good plus (4,5)

71 - 80 Good (4,0)

61 - 70 Sufficient plus (3,5)

50 - 60 Sufficient (3,0)

50 points below - insufficient (2,0)

Training participation (effects U1,U9,U10,U12,K1,K2,K4)

Checking progress in the implementation of the exercise topic. Written test in the last class. Final grade from the exercises - arithmetic mean of all grades obtained during the exercises and the final test (each part and the colloquium must be considered positive).

Colloquium - 5 open questions (W1, W2, W3, W4, K1). For each question maximum number of points 20. Assessment criteria depending on the number of points obtained:

Number of points - rating

91 -100 very good (5.0)

81 - 90 good plus (4,5)

71 - 80 good (4.0)

61 - 70 sufficient plus (3,5)

50 - 60 satisfactory (3.0)

Below 50 points - insufficient (2.0)

Course description

- Lecture

High efficient technologies for primary and biological municipal wastewater treatment processes, and sludge (biosolids) processing. Reactors types applied in biological wastewater treatment. Description of selected technologies. New trends in biotechnological principles of nitrogen and phosphorus removal from wastewater. Intensification of aerobic and anaerobic sludge stabilization processes.

- Training participation

Analysis of technological line of wastewater treatment plant in terms of legal regulations. Bioreactors design methods.

Education methods:

Lecture - lecture with the use of multimedia presentation and the elements of seminar lecture and problem-focused lecture.

Classes - based on training method completed by visual cases study and classic lecture (with multimedia presentation).

Laboratory - laboratory experience

Basic bibliography:

1. Henze M., Oczyszczanie ścieków. Procesy biologiczne i chemiczne. Wydawnictwo PŚK, Kielce 2000

2. Sadecka Z., Podstawy biologicznego oczyszczania ścieków. Wyd. Seidel-Przywecki, 2010

3. Jaroszyński Ł., Jaroszyński T.: Dobór procesów do oczyszczania ścieków i przeróbki osadów ściekowych w komunalnych oczyszczalniach ścieków. Forum eksploatatora. 3/2017 (90), s. 40-43

4. Jaroszyński T., Jaroszyński Ł.: Aktualne tendencje w technologii oczyszczania ścieków. XI Konferencja Naukowo Techniczna: Woda Człowiek Środowisko : Innowacyjność i Praktyczne Zastosowanie Metod i Technologii Stosowanych w Rozwiązaniach Współczesnych Systemów Wodociągów i Kanalizacji. Materiały. Września Licheń, 2013, s. 95-110

Additional bibliography:

1. Wastewater Engineering. Treatment and Reuse. Metcalf and Eddy. Inc. Mc Graw Hill, 5-th Edition, 2014
2. Wastewater Treatment Plant Design. Edited P. Aarne Vesilind, R.L. Rooke; Copyright Water Environment Federation, 2009
3. Jaroszynski L.W., Jaroszynski T.: Continuous Flow Two-Reactor Configuration as a Powerful Tool for Stable and Robust Partial Nitritation Anammox Process for Nitrogen Removal from Reject Waters. 12th IWA Specialised Conference on Design, Operation and Economics of Large Wastewater Treatment Plants. Prague 2015, Czech Republic.

Result of average student's workload

Activity	Time (working hours)
1. . Lecture participation (contact hours)	15
2. Training participation (contact hours)	10
3. Preparation for training exercises (work at home)	20
4. Preparation for training exercises final examination (work at home)	15
5. Laboratory participation (contact hours)	10
6. Preparation for training exercises and preparation of the laboratory report at home (work at home)	5
7. Preparation for the exam (work at home)	23
8. Presence at the exam (contact hours)	2

Student's workload

Source of workload	hours	ECTS
Total workload	100	4
Contact hours	32	1
Practical activities	28	1