

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Systems of Wastewater Treatment		Code 1010102221010130353
Field of study Environmental Engineering Second-cycle	Profile of study (general academic, practical) (brak)	Year /Semester 1 / 2
Elective path/specialty Water Supply, Water and Soil Protection	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: Second-cycle studies	Form of study (full-time, part-time) full-time	
No. of hours Lecture: 45 Classes: 15 Laboratory: 15 Project/seminars: 15		No. of credits 6
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 6 100% 6 100%
Responsible for subject / lecturer: dr hab. inż. Zbysław Dymaczewski email: zbyslaw.dymaczewski@put.poznan.pl tel. 61 665 3662 Wydział Budownictwa i Inżynierii Środowiska ul. Piotrowo 5 60-965 Poznań		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Student should have the basic knowledge of Water and Wastewater Technology as well as mathematics, chemistry, fluids mechanics in the range presented on the 1st cycle study.
2	Skills	Student should be able to perform calculations in the field of mathematics, chemistry, fluid mechanics in the range presented on the 1st cycle study. and should be able to do calculations for facilities of water and wastewater treatment plants in the range presented on the 1st cycle study.
3	Social competencies	Ability for continuous self-improvement. Team work.
Assumptions and objectives of the course: Aim: Enhancement of knowledge and skills in the field of wastewater treatment technology necessary for designing and maintenance of WWTP facilities.		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. Student knows technological systems of wastewater treatment. - [K2_W03, K2_W04, K2_W07]		
2. Student knows methods of designing fundamental processes and technological systems of wastewater treatment and sludge management - [K2_W03, K2_W04, K2_W07]		
3. Student understands the role of experiment in pre-design research - [K2_W03, K2_W04, K2_W07]		
4. Student knows bases of mathematical modelling of activated sludge systems - [K2_W03, K2_W04, K2_W05, K2_W07]		
5. Student knows selected unit processes of wastewater treatment and sludge management - [K2_W04, K2_W07]		
Skills:		
1. Student can prepare a conception design of a municipal wwtp - [K2_U09, K2_U10]		
2. Student can prepare a conception for sludge management - [K2_U01, K2_U12, K2_U18]		
3. Student can perform a computer simulation of an activated sludge wwtp and give interpretation of the results - [K2_U01, K2_U08, K2_U09, K2_U10, K2_U12, K2_U15]		
4. Student can perform lab experiments and give interpretation of the results - [K2_U01, K2_U08, K2_U09, K2_U12,]		
Social competencies:		
1. Student understands the need of a team work in solving theoretical and practical problems - [K2_K03, K2_K04]		
2. Student understands the need of a systematic improvement of his competence - [K2_K01]		

Assessment methods of study outcomes

Lectures:

- checking presence and activity,
- written final exam

Exercices:

- final test,

Labs:

- written or oral short test at the beginning of each lab.,
- report after each lab.,
- continuous evaluation each lab.,
- final written test.

Designs:

- checking progress of work,
- evaluation of activity and knowledge on consultations,
- final written test
- report of the simulation project and it's defence.

Course description

Lectures

- Objects of wwtp. Preparing technological scheme of wwtp.
- Factors affecting the choice of treatment method. Determination of influent flow and characteristics. Laboratory analyses and modelling for the needs of wwtp designing.
- Technological schemes of wwtps.
- Systems for nutrients removal. Effectiveness of different wwtp systems.
- Systems for supernatant treatment.
- Systems for sludge management.
- Systems for odours removal.
- Computer simulation of wwtp: Activated Sludge Models ASM 1, 2, 2d, 3, optimisation of activated sludge wastewater treatment process using computer simulation.

Exercices

- Calculation of hydraulic loss for selected units of wwtp.

Designs

- Technological conception for municipal wwtp.
- Computer simulation of an activated sludge wwtp.

Laboratories

- Biological phosphorus removal
- Gravitationnal sludge thickening
- Mechanical sludge dewatering

Methods of learning: lecture: inform., problem, program text, method: problem, exercise, design, case study, laboratory, demonstration

Basic bibliography:

1. Łomotowski J., Szpindor A.: Nowoczesne systemy oczyszczania ścieków. Arkady, Warszawa 1999 r.
2. Bartoszewski K., Kempa E., Szpadt R.: Systemy oczyszczania ścieków. Skrypt Politechniki Wrocławskiej, Wrocław 1981 r.
3. Praca zbiorowa pod redakcją Z. Dymaczewskiego: Poradnik eksploatatora oczyszczalni ścieków. wyd.3, PZITS, Poznań 2011
4. Heidrich Z., Witkowski A.: Urządzenia do oczyszczania ścieków. Projektowanie, przykłady obliczeń. Wyd. ?Seidel-Przywecki? Sp. z o.o., Wyd. 1, Warszawa 2005 (wyd. 2, 2010)
5. Łomotowski J., Szpindor A.: Nowoczesne systemy oczyszczania ścieków. Arkady, Warszawa 1999 r.
6. Bartoszewski K., Kempa E., Szpadt R.: Systemy oczyszczania ścieków. Skrypt Politechniki Wrocławskiej, Wrocław 1981 r.
7. Praca zbiorowa pod redakcją Z. Dymaczewskiego: Poradnik eksploatatora oczyszczalni ścieków. wyd.3, PZITS, Poznań 2011
8. Heidrich Z., Witkowski A.: Urządzenia do oczyszczania ścieków. Projektowanie, przykłady obliczeń. Wyd. ?Seidel-Przywecki? Sp. z o.o., Wyd. 1, Warszawa 2005 (wyd. 2, 2010)
9. 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

Additional bibliography:

1. Wastewater Engineering. Treatment and Reuse. Metcalf & Eddy. Inc. Mc Graw Hill, wyd. 4, 2003
2. Wastewater Engineering. Treatment and Reuse. Metcalf & Eddy. Inc. Mc Graw Hill, wyd. 4, 2003
3. Praca zbiorowa: Inteligentne systemy w inżynierii i ochronie środowiska. Seria: Inżynieria na rzecz ochrony środowiska. Jaroszyński T.: Badania składu ścieków dla potrzeb modelowania matematycznego. s. 49 - 57. Wyd. PZITS Oddz. Wielkopolski, Poznań 2007
4. Jaroszyński T., Jaroszyński Ł.: Usuwanie związków biogenych z cieczy osadowych. Materiały konferencyjne: Woda ? Człowiek ? Środowisko: rozwój, modernizacja, eksploatacja systemów zaopatrzenia w wodę i odprowadzania ścieków: VII konferencja nauk. ? techn.: materiały. Września ? Licheń, 2009 r., s. 113-128

Result of average student's workload

Activity	Time (working hours)	
1. Lectures	45	
2. Laboratories	15	
3. Preparing for laboratories	5	
4. Exercises	15	
5. Design	15	
6. Laboratory protocols	12	
7. Design preparation at home	20	
8. Consultations of material of lab and design (assumpt. 2 consult., 30min. each)	1	
9. Preparation for final design defence	4	
10. Preparation for exam and presence on the exam	18	
Student's workload		
Source of workload	hours	ECTS
Total workload	150	6
Contact hours	76	3
Practical activities	105	4