

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Technologies of Wastewater		Code 1010101251010131344
Field of study Environmental Engineering First-cycle Studies	Profile of study (general academic, practical) (brak)	Year /Semester 3 / 5
Elective path/specialty -	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) full-time	
No. of hours Lecture: 30 Classes: - Laboratory: 15 Project/seminars: 15		No. of credits 4
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		ECTS distribution (number and %) 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		Responsible for subject / lecturer: dr hab. inż. Zbysław Dymaczewskii email: zbyslaw.dymaczewski@put.poznan.pl tel. 616653662 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 water technology, mathematics, chemistry, fluid mechanics and general knowledge from environmental engineering
2	Skills	Student should be able to perform mathematical calculations, physical, chemical, mechanics of the fluids and calculation of equipment and facilities of water and wastewater treatment plants
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 prepare 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 W1,W2,W3,W4, 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)

Laboratory exercises (effects K1,K2,K3,K4, U4, U11, U16).

1. Short entrance written test before each laboratory
2. Written report of each laboratory exercise
3. Written final test regarding all exercises
4. Activity evaluation during each laboratory

Project (effects W1,W2,W3,W4, K1)

1. Verification of project advancements and independent design work after each step
2. Written exam after each of 3 project part. Verification of progress in realization of project balance of amount and qualities of screens, grid chambers, preliminary sedimentation tanks, biological reactors, secondary sedimentation tanks, part amount sewage sludge (characteristics of sludge, thickening, anaerobic digesters, dewatering of sludges). Scheme of designed sewage treatment plant. All of mentioned part is evaluated (account and graphic part). Besides, after all of 3 project written part (Part 1 primary treatment process, Part 2 biological treatment, Part 3 sludge handling) is written exam. All of part must be included on positive estimate.

Written Test - 3 open questions (W4, W7, K1). For each question maximum number of points 5. Assessment criteria depending on the score obtained:

Number of points - estimate

- 14 -15 very good (5.0)
- 12.5 - 13.5 good plus (4.5)
- 11 - 12 good (4.0)
- 9.5 - 10.5 sufficient plus (3.5)
- 8-9 satisfactory (3.0)
- Less than 8 points - insufficient (2.0)

Course description

<p>-Lecture</p> <p>Ecology in water and wastewater management. Type and characteristics of wastewater. Flow rates (quantity characteristic). Composition of wastewater. Wastewater characteristics (quality characteristic). Loading of contaminants. Unit loads. Population equivalent (p.e.). Regulation for effluent wastewater to sewer systems and recipients. Efficiency of treatment process at wastewater treatment plants (WWTP). Types of WWTPs ? process flowsheets, processes used, pollutants removed, devices and facilities used, effectiveness. Mechanical WWTP (screening, grit chambers, grease tank, primary settling tanks). Chemical WWTP. Biological WWTP (trickling filters, activated sludge). Integrated biological processes for BOD removal (organic components) and Nutrient Removal (nitrogen and phosphorus). Types of solid and sludge wastes at WWTP. Sludge characteristic. Processes and devices used for treatment and disposal of sludge wastes: thickening, stabilization (anaerobic digestion, aerobic digestion, alkaline stabilization), dewatering. Sludge waste disposal - utilization and landfilling.</p> <p>Laboratory subjects:</p> <ol style="list-style-type: none"> 1. Hydraulic efficiency of settling tanks. 2. Effectiveness of aeration facilities 3. Activated sludge process. <p>Project subjects:</p> <ol style="list-style-type: none"> 1. Balance of rates (quantity characteristic) and composition of wastewater (quality characteristic). Loading of contaminants. Population equivalent (p.e.). Technological calculations of mechanical WWTP (screening, grit chambers, primary settling tanks) 2. Technological calculations of biological WWTP with nutrient removal (activated sludge, final settling tanks) 3. Technological calculations of devices used for treatment of sludge wastes (gravity and mechanical thickening, anaerobic conventional German digesters with reinforced concrete construction, devices for dewatering). <p>Education methods:</p> <p>Lecture - lecture with the use of multimedia presentation and the elements of seminar lecture and problem-focused lecture.</p> <p>Laboratory - laboratory experience</p> <p>Project - practical project executed alone</p>	
<p>Basic bibliography:</p> <ol style="list-style-type: none"> 1. Poradnik eksploatatora oczyszczalni ścieków. (praca zbiorowa pod red. Zbysława Dymaczewskiego; aut: Z. Dymaczewski, T. Jaroszyński, J. Jeż-Walkowiak, M. Komorowska-Kaufman, M. Michałkiewicz, W. Niedzielski, M.M. Sozański). Wyd. 3, rozszerz., zmienione i uaktualnione, Poznań 2011, PZITS 2. Heidrich Z., Witkowski A.: Urządzenia do oczyszczania ścieków - Projektowanie, przykłady obliczeń. Wyd. Seidel-Przywecki Sp. z o.o., Warszawa 2010 3. Byłka H., Dymaczewski Z., Harasymowicz E., Jaroszyński T., i inni : Wodociągi i kanalizacja w Polsce ? tradycja i współczesność. Poznań ? Bydgoszcz 2002. 4. 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 5. Jaroszyński T.: Materiały pomocnicze do ćwiczeń projektowych. Maszynopis w formacie pdf. Poznań 2017 6. Dymaczewski Z.: Materiały pomocnicze do ćwiczeń laboratoryjnych. Poznań 2017 7. Katalogi obiektów i urządzeń (System Uniklar-77, prospekty firm) 	
<p>Additional bibliography:</p> <ol style="list-style-type: none"> 1. Wastewater Engineering. Treatment and Reuse. Metcalf & Eddy. Inc. Mc Graw Hill, Fourth edition, 2003 2. Jaroszyński T.: Kraty w technologii oczyszczania ścieków. Wodociągi i Kanalizacja. 2006, 9, s. 32-35 3. Jaroszyński T.: Sita i mikrosita w technologii oczyszczania ścieków. Wodociągi i Kanalizacja. 2006, 10, s. 32-34 	
<p>Result of average student's workload</p>	
<p>Activity</p>	<p>Time (working hours)</p>

1. Lecture participation (contact hours)	30
2. Laboratory participation (contact hours)	15
3. Preparation for training exercises (work at home)	3
4. Preparation of the laboratory report at home (work at home)	3
5. Project participation (contact hours, practical activities)	15
6. Project preparation at home (work at home)	10
7. Project and laboratory consultation with the instructor (Student is assumed to attend 5 consultations)	5
- (contact hours)	3
8. Preparation for project examination (work at home)	14
9. Preparation for the exam (work at home)	2
10. Presence at the exam (contact hours)	
Student's workload	
Source of workload	hours
ECTS	
Total workload	100
Contact hours	62
Practical activities	38