STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Technologies of Wastewater		**1010101251010131344**
Field of study	Profile of study (general academic, practical)	Year /Semester
Environmental Engineering First-cycle Studies	**general academic**	**3 / 5**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**
Cycle of study:	Form of study (full-time,part-time)	
First-cycle studies	**full-time**	

No. of hours					No. of credits
Lecture: **30**	Classes: **-**	Laboratory: **15**	Project/seminars: **15**		**4**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**university-wide**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**4 100%**
Technical sciences	**4 100%**

Responsible for subject / lecturer:

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Responsible for subject / lecturer:

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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 engineerin
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 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 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. Werification 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

--Lecture

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.

Laboratory subjects:

1. Hydraulic efficiency of settling tanks.
2. Effectiveness of aeration facilities
3. Activated sludge process.

Project subjects:

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).

Education methods:

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

Laboratory - laboratory experience

Project - practical project executed alone

Basic bibliography:

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. Bylka H., Dymaczewski Z., Harasymowicz E., Jaroszynski 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 2018
6. Dymaczewski Z.: Materiały pomocnicze do ćwiczeń laboratoryjnych. Poznań 2018
7. Katalogi obiektów i urządzeń (System Uniklar-77, prospekty firm)

Additional bibliography:

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

Result of average student's workload

Activity	Time (working hours)
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) - (contact hours)	5
8. Preparation for project examination (work at home)	3
9. Preparation for the exam (work at home)	14
10. Presence at the exam (contact hours)	2

Student's workload

Source of workload	hours	ECTS
Total workload	100	4
Contact hours	62	2
Practical activities	38	2