STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Systems of Wastewater Treatment**		Code **1010135231010130353**
Field of study **Enviromental Engineering Extramural Second-**	Profile of study (general academic, practical) **(brak)**	Year /Semester **2 / 3**
Elective path/specialty **Water Suply, Water Soil Protection**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **part-time**	
No. of hours Lecture: **30** Classes: **-** Laboratory: **10** 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:

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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 and wastewater technology, mathematics, chemistry, fluid mechanics and general knowledge from environmental engineering.
2	**Skills**	Student should be able to search valuable information and read research articles and reports with understanding. 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. - [K2_W03, K2_W04, K2_W07]
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. - [K2_W03, K2_W04, K2_W07]
3. Student understands basics of experiment in pre-design research of WWTP. - [K2_W03, K2_W04, K2_W07]
4. Student knows the principles of mathematical modelling of wastewater treatment in activated sludge process, Activated Sludge Models, simulation project scheme. - [K2_W03, K2_W04, K2_W07]
5. Student knows selected unit processes used in wastewater treatment and sludge handling. - [K2_W04, K2_W07]

Skills:

1. Student can prepear the design concept of technology for municipal wastewater treatment plant. - [K2_U09, K2_U10]
2. Student can present a concept of sludge handling. - [K2_U01, K2_U12, K2_U18]
3. Student can perform computer simulation of activated sludge biological wastewater treatment plant and properly interpret the results. - [K2_U01, K2_U12,]
4. Student can conduct some experiments concerning wastewater treatment processes and provide interpretation of the obtained results. - [K2_U01, K2_U12,]
5. Student can work in a team (measurements and elaboration of the obtained experimental data). - [K2_U01, K2_U12,]

Social competencies:

1. Student understands the need for teamwork in solving theoretical and practical problems. - [K2_K03]
2. Student understands the need of systematic deepening and broadening his/her competences. - [K2_K01]

Assessment methods of study outcomes

Lecture
- Attendance and lecture activity checkup
- Written finale exam

Laboratory exercises
- Short entrance written test before each laboratory
- Written report of each laboratory exercise
- Written final test regarding all exercises
- Activity evaluation during each laboratory

Design exercises
- Verification of project advancements and independent design work on each project
- Activity evaluation during each consultations
- Written report
- Written final exam regarding basic knowledge of WWTP design

Ćw. projektowe:
- sprawdzanie postępu w realizacji projektu na każdych zajęciach
- ocena aktywności i stanu wiedzy podczas konsultacji
- sprawdzian końcowy z najważniejszych wiadomości dotyczących ćwiczeń

Course description

Lecture

Wastewater transport and treatment systems. Guidelines for wastewater treatment system design. Factors affecting wastewater treatment process choice, Characterization of design quantity and quality of wastewaters. Laboratory and computer model investigation for design WWTP purposes. Process flow sheets, facilities arrangements and devices for wastewater treatment. Nutrient removal systems. Effectiveness of the systems. Reject water treatment systems at WWTP. Sludge handling and disposal systems. Odor control systems at WWTP. Basic information on wastewater treatment modeling. ASM models. WWTP computer simulation.

Design exercises
- The design concept of technology municipal waste water treatment plant.
- Computer simulation of a biological wastewater treatment plant with activated sludge process.

Laboratory exercisess:
- Biological phosphorus removal.
- Gravity sludge thickening.
- Mechanical sludge dewatering.

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)

Additional bibliography:

1. Wastewater Engineering. Treatment and Reuse. Metcalf & Eddy. Inc. Mc Graw Hill, wyd. 4, 2003

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	30
2. Participation in design exercises	15
3. Participation in laboratories	10
4. Project and laboratory consultation with the instructor (Student is assumed to attend 4 consultations)	1
5. Project preparation at home	25
6. Preparation for labs	15
7. Preparation of laboratory report at home	10
8. Preparation for final design test	10
9. Preparation for final lab test	9
10. Preparation for lecture final examination and final exam attendance	15

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	140	6
Contact hours	56	3
Practical activities	25	3