STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Wastewater Disposal**			Code **1010134261010131343**
Field of study **Environmental Engineering Extramural First-**	Profile of study (general academic, practical) **(brak)**		Year /Semester **3 / 6**
Elective path/specialty **-**	Subject offered in: **Polish**		Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **part-time**		
No. of hours Lecture: **18** Classes: **10** Laboratory: **-** Project/seminars: **10**			No. of credits **5**
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 %) **5 100%**

Responsible for subject / lecturer:

dr inż. Marcin Skotnicki
email: marcin.skotnicki@put.poznan.pl
tel. 61 665 24 69
Faculty of Civil and Environmental Engineering
ul. Piotrowo 5 60-965 Poznań

Responsible for subject / lecturer:

dr inż. Karolina Mazurkiewicz
email: karolina.mazurkiewicz@put.poznan.pl
tel. 61 665 24 69
Faculty of Civil and Environmental Engineering
ul. Piotrowo 5 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge acquired within courses delivered earlier during First-cycle studies: Physics, Materials Technology, Fluid Mechanics,
2	**Skills**	Acquaintance of basic terminology in area of environmental engineering. Self-education ability.
3	**Social competencies**	Awareness of the need to constantly update and supplement knowledge and skills

Assumptions and objectives of the course:

Conveying of the basic knowledge and skills in planning, design and operation of simple systems of wastewater disposal from urban catchments

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

Knowledge:

1. Student knows types and characteristic features of wastewater disposal systems (lect.). - [K_W05]
2. Student knows algorithms of sewage quantity computations and methods of runoff evaluation from urban catchments (lect). - [K_W04, K_W07, K_W08]
3. Student knows typical cross-sections of sewers and materials used for their construction (lect.). - [K_W05, K_W06]
4. Student knows classification and algorithms of solutions of basic hydraulic problems meeting in computations of gravitational sewers (class). - [K_W07]
5. Student knows constrains and rules applied in design of wastewater and stormwater networks (lect.) - [K_W07]
6. Student knows functions, types and characteristics of special constructions and devices used in wastewater systems (lect.) - [K_W06]
7. Student knows structures, principles of operation and application limitations of pressure and vacuum sewer systems (lect.). - [K_W06, K_W07]
8. Student knows main technologies applied by construction of sewers including the open-cut and trenchless methods of pipe laying (class). - [K_W05, K_W07]
9. Student knows the basis of sewerage system maintenance (class.). - [K_W06, K_W09]

Skills:

1. Student can compute sewage quantity required for dimensioning sewers (proj.). - [K_U14]
2. Student can determine parameters of rainfall used for runoff computation and dimensioning of objects and storm water systems (class).. - [K_U10, K_U14]
3. Student can evaluate runoff from catchment as a basis for dimensioning storm sewers (proj.). - [K_U12, K_U14]
4. Student can solve hydraulic problems for gravitational sewers using different auxiliary materials (class). - [K_U15]
5. Student can solve problems of wastewater system components dimensioning and /or selection from catalogues (proj.). - [K_U12, K_U13, K_U15]
6. Student can design gravitational sewer and storm water networks (proj.). - [K_U10, K_U12,]
7. Student can evaluate trenchless technology of sewer rehabilitation (class). - [K_U16]

Social competencies:

1. The student sees the need for systematic incresing his skills and competences (proj.). - [K_K01]
2. The student understands the need for teamwork in solving theoretical and practical problems (proj.. - [K_K04]
3. The student has consciousness of engineering activity effect on environment (class). - [K_K02]

Assessment methods of study outcomes

Lectures:
Written final exam (4-5 questions to answer) (effects W1, W2, W3, W5, W6, W7)

The grading scale (the percentage of points/grade):
0-49 2,0
50-59 3,0
60-69 3,5
70-79 4,0
80-89 4,5
90-100 5,0

Classes: Written final exam (4-5 questions to answer) (effects W4, W8, W9, U2, U4, U7, K3)

The grading scale (the percentage of points/grade):
0-49 2,0
50-59 3,0
60-69 3,5
70-79 4,0
80-89 4,5
90-100 5,0

Projects:
Evaluation of simple project of separate sewer systems (effects U1, U3, U5, U6, K1, K2).

Course description

Classification of waste water and wastewater disposal systems.

Sewage systems. Sewage quantity computation. Subcatchment evaluation. Typical cross-sections and materials of sewers. Junctions of sewer pipes.

Hydraulic computations of gravitational sewers: assumptions, computation formulas. Computational problems classification and algorithms of solution. Auxiliary materials.

Basis of sewers design. Design constrains. Self-cleaning velocity and minimal slope. Maximal velocity and slope. Nodes, their classification and interpretation, manholes. Factors determining minimal depth of sewers. Algorithm of sewer profile evaluation.

Layout of sewer network.

Special structures on the network functions, types operation manholes drop shafts, pumping stations, siphons.

Storm water systems. Evaluation of runoff from urban catchment. Rational formula. Rainfall intensity computations (design storms). Recommended formulas. Assumption of rainfall probability and duration.

Basis of storm and combined sewers design. Special structures of storm water networks: storage tanks, CSO, grease and oil traps.

Structure and basis of operation of pressure and vacuum sewer systems.

Construction of sewers. Types and methods of ground excavations. Methods of trenches drainage.

Trenchless construction of sewers review of methods.

Basis of maintenance and inspection of sewer systems.

Basic bibliography:

1. Kotowski A. Podstawy bezpiecznego wymiarowania odwodnień terenu, Tom I i II, Seidel-Przywecki, 2015

2. Imhoff K.; Imhoff K, R. Kanalizacja miast i oczyszczanie ścieków, Pojprzem-EKO, 1996

3. Królikowscy J. i A. Wody opadowe, Wyd. Seidel-Przywecki, 2012

Additional bibliography:

1. Weismann D.: Komunalne przepompownie ścieków. 2000

2. Kuliczkowski A. Technologie bezwykopowe w inżynierii środowiska. 2010.

3. Błaszczyk W. i inni Kanalizacja. Sieci i pompownie, t.1 Arkady 1983

4. M. Skotnicki, M. Sowiński: Ocena zdolności retencyjnej kolektora kanalizacyjnego / Czasopismo Inżynierii Lądowej, Środowiska i Architektury - 2014, T. 31, z. 61, s. 265-283

5. M. Skotnicki, M. Sowiński: Wykorzystanie odpadów syntetycznych w modelowaniu odpływu ze zlewni miejskich / Zeszyty Naukowe Politechniki Rzeszowskiej. Budownictwo i Inżynieria Środowiska / Oficyna Wydaw. Politechniki Rzeszowskiej. - 2012, nr 283, z. 59 (2/12/I), s. 201-218

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures (contact hours)	18
2. Participation in tutorials (contact hours)	10
3. Participation in projects (contact hours, practical activities)	10
4. Participation in consultations related to tutorials and practical exercises (contact hours)	10
5. Preparing reports of the projects (work at home)	15
6. Preparation reports for the tutorials (work at home)	15
7. Preparation for the final test of tutorials (work at home)	15
8. Preparation for the final test of the projects (work at home)	15
9. Preparation for the exam (work at home)	15
10. Presence at the exam (contact hours)	2

Student's workload

Source of workload	hours	ECTS
Total workload	125	5
Contact hours	50	2
Practical activities	10	1