



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Technologies of Wastewater [N1IŚrod1>TŚ]

### Course

Field of study

Environmental Engineering

Year/Semester

3/6

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

polish

Form of study

part-time

Requirements

compulsory

### Number of hours

Lecture

20

Laboratory classes

20

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

### Number of credit points

7,00

### Coordinators

dr hab. inż. Zbysław Dymaczewski prof. PP  
zbyslaw.dymaczewski@put.poznan.pl

### Lecturers

### Prerequisites

1.Knowledge: In mathematics, physics, chemistry, environmental biology, fluid mechanics and other areas, useful for formulating and solving simple exercises in the field of environmental engineering 2.Skills : Acquiring information from literature, databases and other properly selected sources, also in English or another foreign language recognized as a language of international communication in the field of environmental engineering. Solving exercises of fluid mechanics 3.Social competencies: Awareness of the need to constantly update and supplement knowledge and skills. Teamwork

### Course objective

-The objective of the course is to broaden the knowledge and skills in the field of wastewater technology necessary for the selection and design facilities and processes for removal of organic and biogenic pollutants from municipal wastewater

### Course-related learning outcomes

Knowledge:

1. Student knows the basic types of indicators of wastewater and sewage sludge pollution and the requirements for wastewater discharged into the sewage system and surface waters

2. Student knows and understands the methods of wastewater treatment in terms of removing from them the basic physical, chemical and biogenic pollutants and the treatment of sewage sludge generated in wastewater treatment plants.
3. Student knows and understands the principles of operation and calculation methods of basic wastewater treatment plant devices and facilities.

#### Skills:

1. Student is able to give a general concept of municipal wastewater treatment and management of sewage sludge generated in treatment plants.
2. Student is able to perform design calculations of devices and facilities for wastewater treatment and sewage sludge treatment.
3. Student is able to perform basic measurements in sewage and activated sludge (pH, redox potential, dissolved oxygen concentration, concentration of total suspended solids, sludge volume index, etc.), and perform calculations determining the basic technological parameters of activated sludge.

#### Social competences:

1. Student sees the need for continuous and systematic extending of their competences.
2. Student is aware of the critical assessment of the solutions obtained resulting from the assumptions made and the large number of indicators of pollution in treated wastewater.
3. Student understands the need for teamwork in solving design and operational problems of wastewater treatment plants.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

#### Lecture

1. Attendance and lecture activity checkup
2. Written final exam - open and closed questions.

Number of points - rating

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)

below 50 - Insufficient (2,0)

#### Project

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. For each question maximum number of points 5. Assessment criteria depending on the score obtained:

Number of points - rating

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)

#### Laboratories

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 (promoting activity)

Final test - No possibility to use smartphones, calculators etc.

Final test: umber of points - rating

- 11.01 - 12.00 very good (5.0)
- 9.76- 11.00 good plus (4.5)
- 8.51 - 9.75 good (4.0)
- 7.26 - 8.50 sufficient plus (3.5)
- 6.01 - 7.25 sufficient (3.0)
- 6.00 and less - insufficient (2.0)

## Programme content

-Lecture

History of wastewater treatment. 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 wastewater effluent discharge. Efficiency of treatment process at wastewater treatment plants (WWTP). Types of WWTPs, process flowsheets, processes used, pollutants removed, devices and facilities used, effectiveness. Mechanical treatment (screening, grit chambers, grease tank, primary settling tanks). Chemical WWTP. Biological treatment (trickling filters, activated sludge). Integrated biological processes for organics and nutrients removal (nitrogen and phosphorus). Types of solid and sludge wastes at WWTP. Sewage sludge characteristics. Processes and devices used for treatment and disposal of sewage sludge: thickening, stabilization, dewatering. Sewage sludge disposal.

Laboratory subjects area:

Hydraulic flow through a settling tank

Aeration

Activated sludge process examination

Biological phosphorus removal

Biological nitrogen removal

Mechanical sludge dewatering

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 sewage sludge (gravity and mechanical thickening, anaerobic digestion, devices for sludge dewatering).

## Teaching methods

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

Laboratory exercises - exercise, problem method, case study, measurement, observation, experiment

Project - practical project carried out alone (independently)

## Bibliography

Basic:

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. 2, 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. Catalogues (prospects, web pages of manufacturers)

Additional:

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

## Breakdown of average student's workload

	Hours	ECTS
Total workload	175	7,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	115	4,50