# COURSE DESCRIPTION CARD - SYLLABUS

Course name

Circular systems in municipal wastewater treatment

## Course

Field of study

Circular System Technologies

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

3/5

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

## Number of hours

Lecture

30

Laboratory classes

15

Other (e.g. online)

Tutorials

Projects/seminars

## Number of credit points

3

## Lecturers

Responsible for the course/lecturer:

Katarzyna Jaszczyszyn, PhD

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Faculty of Environmental Engineering and Energy

Berdychowo 4, 61-131 Poznań

Responsible for the course/lecturer:

## Prerequisites

Knowledge: Basic knowledge in chemistry, biology and ecology.

Capability to carry out lab work - use basic laboratory quipment, work individually or in group with respecting Health and Safety rules. Write reports on laboratory exercises.

Social competences: Awareness of the need for continuous training and update knowledge and skills.

## Course objective

Gaining knowledge about the basic processes and devices applied in municipal wastewater treatment technology and sludge management. Particular attention is paid to closing water cycles (circular systems) in relation to the circular economy concept, which aims to optimize the use of raw materials and turning waste into resources, which minimize the negative impact on the environment by reducing the amount of waste generated.

## Course-related learning outcomes

### Knowledge

Basic knowledge of the processes and devices applied for wastewater treatment and for neutralization and recovery of raw materials from sewage sludge (lecture, laboratory)[K_W03, K_W06, K_W07].

Student knows and describes the technological solutions and operation principles of devices used in circular systems in wastewater treatment technology and sludge management (lecture, laboratory) [K_W03, K_W21, K_W24].

### Skills

Student is able to provide a general concept of municipal wastewater treatment and the sludge management (lecture, laboratory) [K_U01, K_U04, K_U05].

Student can take part in a discussion, presenting and assessing opinions on the circular systems in municipal wastewater treatment, and can propose an appropriate technological solution with regard to the rational use of raw materials generated in a wastewater treatment plant (lecture, laboratory) [K_U05, K_U07, K_U11].

Student is capable to carry out lab work and perform basic measurements in wastewater and sediments/sludge (pH, redox potential, dissolved oxygen concentration, total suspended solids, etc.) and can analyze the results and formulate a summary and conclusions on this basis (laboratory) [K_U01, K_U03, K_U04, K_U05].

### Social competences

Student is aware of the need of circular systems in wastewater treatment technology [K_K09, K_K10].

Student shows independence and invention in individual work and is able to cooperate and work in a group, assuming different roles in it (lecture, laboratory) [K_K01, K_K04, K_K05, K_K07].

Student is aware to observe the principles of engineering ethics (lecture, laboratory) [K_K01, K_K08].

Student understands the need for further training and improving professional and personal competences (lecture, laboratory) [K_K05, K_K09].

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures: writing test (min. 50% to pass).

Laboratory exercises: checking the preparation for classes through written entrance tests before each exercise, oral answers; prepare a report on each exercise.

Promoting activity (lecture, laboratory).

## Programme content

Sustainable water management. Water reuse. Municipal wastewater treatment - types of pollutants, methods and stages of treatment. Carbon cycle. The potential and importance of nutrient recovery. Biosolids management. Energy potential of wastewater. Circular systems in wastewater treatment. Low or zero energy consuming technologies. Multi-objective optimization of wastewater systems.

## Teaching methods

Lecture: lecture with multimedia presentation, informative and interactive lecture with elements of a conversation and problem lecture.

Laboratory: laboratory work, practice method, problem method, measurement, observation, experiment, case study.

## Bibliography

Basic

Dymaczewski, Z. (2011). Poradnik eksploatatora oczyszczalni ścieków, wyd. PZiTS, Poznań (in Polish)

Heidrich, Z., Witkowski, A. (2010). Urządzenia do oczyszczania ścieków - Projektowanie, przykłady obliczeń., wyd. Seidel-Przywecki. Sp. z o.o., Warszawa (in Polish)

Łomotowski, J., Szpindor, A. (2008). Nowoczesne systemy oczyszczania ścieków, Arkady, Warszawa

Additional

Anielak, A. (2000). Chemiczne i fizykochemiczne oczyszczanie ścieków. Wyd. naukowe PWN, Warszawa 2000 (in Polish)

Nollet, L.M.L., de Gelder, L.S.P. (2014) Handbook of Water Analysis (3rd Edition). Taylor & Francis Group, CRP Press

Miksch, K., Sikora, J. (2010). Biotechnologia ścieków, Wyd. Naukowe PWN, Warszawa (in Polish)

Current legal acts and environmental studies concerning municipal wastewater treatment and the circular economy in Poland and the EU

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 75 | 3,0 |
| Classes requiring direct contact with the teacher | 50 | 2,0 |
| Student's own work (literature studies, preparation for laboratory classes, preparation for tests) [1] | 25 | 1,0 |

[1] delete or add other activities as appropriate