# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Industrial Water and Wastewater

## Course

Field of study
Environmental Engineering Second-cycle Studies
Area of study (specialization)
Water Supply, Water and Soil Protection
Level of study
second-cycle studies
Form of study
full-time

Year/Semester
1/2
Profile of study
general academic
Course offered in
polish
Requirements
compulsory

## Number of hours

Lecture
30
Tutorials

Laboratory classes
30
Projects/seminars
30

## Number of credit points

6

## Lecturers

Responsible for the course/lecturer:
dr inż. Małgorzata Komorowska-Kaufman

email: malgorzata.komorowska-kaufman@put.poznan.pl

tel.61 665 24 16

Faculty of Environmental Engineering and Energy

ul. Berdychowo 4, 61-131 Poznań

Responsible for the course/lecturer:
dr hab. inż. Alina Pruss

email: alina.pruss@put.poznan.pl

tel.61 665 34 97

Faculty of Environmental Engineering and Energy

ul. Berdychowo 4, 61-131 Poznań

## Prerequisites

Knowledge:

The student should have a basic knowledge about water and wastewater treatment technology, mathematics, chemistry, fluid mechanics and general knowledge from environmental engineering obtained in first-cycle studies

Skills:

The student should be able to search for valuable information and read research articles and reports with understanding. The student should be able to perform mathematical, physical, chemical, and fluid mechanics calculations. The student should be able to choose and design basic equipment used for drinking water and municipal wastewater treatment ( the skills acquired during the first-cycle studies)

Social competencies:

Awareness to constantly update and supplement knowledge and skills.

## Course objective

The objective of the course is to broaden the knowledge and skills necessary for the selection of technology methods of basic pollutants removal from industrial water and wastewater.

Familiarisation with advanced technologies of industrial water and wastewater treatment.

## Course-related learning outcomes

### Knowledge

1. The student has theoretically based detailed knowledge concerning physico-chemical processes of water and wastewater treatment and principles of analysing the physical and chemical composition of water and sewage as well as balancing pollution loads.

2. The student has knowledge of development trends and the most relevant new achievements in the field of industrial water and wastewater treatment.

3. The student knows basic technological processes and equipment used in the industrial water and wastewater treatment technology.

4. The student has detailed knowledge of life cycle of devices, objects and technical systems applied in industrial water and wastewater systems.

### Skills

1. The student is able to use advanced information and communication technologies (ICT), appropriate to perform typical engineering tasks.

2. The student is able to plan and carry out experiments, including measurements, in the field of industrial water and wastewater treatment.

3. The student in order to formulate and solve engineering tasks and simple research problems in environmental engineering, is able to apply analytic and experimental methods.

4. The student is able to design a water softening station for boiler purposes.

5. The student is able to critically analyse the performance and evaluate the existing technical solutions, especially devices, objects, systems, processes, services utilised in industrial water and wastewater treatment.

Social competences

1. The student is aware of non-technical aspects and effects of engineering activity, including its environmental impact.

2. The student is aware of negative effects of activities exceeding the engineer's competence, and understand the need of expertise.

3. The student is aware of the responsibility for taking decisions.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

LECTURE

Written exam consisting of two parts: Part 1 Industrial water treatment, Part 2 Industrial wastewater treatment, 5 open questions from each part. For each question the maximum number of points is 10. Criteria of evaluation depending on the number of points obtained:

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 satisfactory (3.0)

Less than 50 points - insufficient (2.0)

LABORATORIES

- verification of knowledge and skills necessary for the exercise,

- reporting,

- activity when exercising,

- final test (at the end of the semester)

PROJECT

- checking the progress of the project in each activity,

- putting the project (date of donation given on the thematic card),

- verbal defence of the project (verification of independent design work and acquired skills).

Evaluation of the project (70% of the defence rating + 30% of the project)

## Programme content

LECTURE :

**Industrial water:**

Basic indicators for determining the quality of the water in the heating and boiler (water stability, stability indices, water corrosivity). Processes and equipment used in industrial water treatment. Water softening methods (thermal and chemical, reagents, water treatment equipment,process parameters), Ion exchange (range of applications, rules for the operation of equipment for water treatment methods), membrane technology (microfiltration, ultrafiltration, nanofiltration, reverse osmosis,

electrodialysis), degassing of water (mechanical, thermal and chemical methods). Water treatment technology for energy purposes. Water quality requirements for energy purposes. Examples of industrial installations: treatment of water for the purposes of district heating, boiler and refrigeration.

**Industrial wastewater:**

Models of water and wastewater management in municipal-industry agglomerations and industrial plants. Criteria and standards of industrial wastewater treatment. General principle to create technological systems of industrial wastewater treatment depending on the wastewater characterization. Processes used in industrial wastewater treatment (physical-chemical processes: neutralisation, oxidation, reduction, AOP, chemical precipitation and coagulation;sedimentation, flotation, adsorption; biological processes: anaerobic, aerobic). Characterization of quantity and quality of industrial wastewater in different industrial plants (slaughter-house and meal industry, dairy industry, metalworking industry etc) . The creation of appropriate technological systems of water treatment plant with the justification of the solution.

PROJECT: Technological design of water softening station to power boilers.

LABORATORY:

1. Introduction, health and safety instructions, description of the conditions for passing, description of the rules of using the laboratory (2h)

2.Water softening. Chemical precipitation. (4h)

3.Wastewater neutralisation (4h)

4.Ion-exchange processes in industry (4h)

5. The use of adsorption to treat colored wastewater (4h)

6. Technical trips to objects related to the course subject (introduction, fieldwork, multimedia presentation of reports, discussion) - (12h)

## Teaching methods

LECTURE: lecture with multimedia presentation, discussion with students

PROJECT: multimedia presentation,individual work, use of various sources of knowledge (photographs, catalogue cards, Internet), consultation with the teacher

LABORATORY: teaching materials developed by the teacher available via e-mail in a pdf form as a theoretical introduction to the exercise and description of the experiment carried out, introduction to the exercise and bench instruction, work in groups: performing experiments, observation, measurement, solving laboratory tasks, presenting the results of the experiment, multimedia presentation, discussion, case study, demonstration of technical objects

## Bibliography

Basic

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Additional

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4. Industrial Wastewater Management, Treatment, and Disposal. Water Environment Federation (WEF). Manual of Practice No.FD-3. Third Edition, 2008

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## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 150 | 6,0 |
| Classes requiring direct contact with the teacher | 90 | 3,5 |
| Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam/project defence, project preparation, reports preparation) [1] | 60 | 2,5 |

[1] delete or add other activities as appropriate