



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Industrial Water and Wastewater

### Course

Field of study

Environmental Engineering

Area of study (specialization)

Water Supply, Water and Soil Protection

Level of study

Second-cycle studies

Form of study

part-time

Year/Semester

2 / 3

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

### Number of hours

Lecture

24

Tutorials

Laboratory classes

15

Projects/seminars

15

Other (e.g. online)

### Number of credit points

6

### Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

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## 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 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.
- familiarization 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 (lecture, laboratories) - [KIS2\_W04]
2. The student has knowledge of development trends and the most relevant new achievements in the field of industrial water and wastewater treatment (lecture) - [KIS2\_W05]
3. The student knows basic technological processes and equipment used in the industrial water and wastewater treatment technology (lecture, project) - [KIS2\_W07]
4. The student has detailed knowledge of life cycle of devices, objects and technical systems applied in industrial water and wastewater systems (lecture) - [KIS2\_W06]

Skills

1. The student is able to use advanced information and communication technologies (ICT), appropriate to perform typical engineering tasks (project) - [KIS2\_U02]



2. The student is able to plan and carry out experiments, including measurements, in the field of industrial water and wastewater treatment (laboratories) - [KIS2\_U03]
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.(laboratories) - [KIS2\_U04]
4. The student, when formulating and solving engineering tasks, is able to integrate knowledge, appropriate for environmental engineering as well as apply systemic approach, including non-technical aspects and the principles of sustainable development.(lecture) - [KIS2\_U05]
5. The student can formulate and test hypotheses related to engineering and simple research problems in the field of industrial water and wastewater treatment and is able to design a water softening station for boiler purposes(project, laboratories) - [KIS2\_U06, KIS2\_U07,KIS2\_U08]

#### Social competences

1. The student is aware of non-technical aspects and effects of engineering activity, including its environmental impact.(lecture) - [KIS2\_K01]
2. The student is aware of negative effects of activities exceeding the engineer's competence, and understand the need of expertise (lecture, project) - [KIS2\_K02]
3. The student is aware of responsibility for taking decision (laboratories). - [KIS2\_K03]

#### 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.

## PROJECT

- checking the progress of the project in each activity,
- putting the project (date of donation given on the thematic card),
- verbal defense of the project (verification of independent design work and acquired skills). Evaluation of the project (70% of the defense 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: neutralization, 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. Water softening. Chemical precipitation.
2. Wastewater neutralization
3. Ion-exchange processes in industry.
4. The use of adsorption to treat colored wastewater.

### Teaching methods

LECTURE: lecture with multimedia presentation, discussion with students

PROJECT: multimedia presentation, individual work, use of various sources of knowledge (photographs, catalog 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

### Bibliography

Basic

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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	54	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for exam, project preparation) <sup>1</sup>	96	4,0

<sup>1</sup> delete or add other activities as appropriate