



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Systems of Water Treatment

### Course

Field of study

Environmental Engineering

Area of study (specialization)

Water Supply, Water Soil Protection

Level of study

Second-cycle studies

Form of study

part-time

Year/Semester

1 / 2

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

### Number of hours

Lecture

20

Laboratory classes

12

Other (e.g. online)

Tutorials

Projects/seminars

20

### Number of credit points

6

### Lecturers

Responsible for the course/lecturer:

dr hab. inż. Joanna Jeż-Walkowiak

Responsible for the course/lecturer:

tel.

e-mail:

Faculty of Environmental Engineering and

Energy

ul. Berdychowo 4, 61-131 Poznań

### Prerequisites

1. Knowledge:

Student should have a basic knowledge about water technology, mathematics, chemistry, fluid mechanics and general knowledge from environmental engineering.

2. Skills:

Student should be able to search valuable information and read research articles and reports with understanding. Student should be able to perform mathematical calculations, physical, chemical, mechanics of the fluids and calculation of equipment and facilities of water treatment plants.



### 3. Social competencies:

Awareness to constantly update and supplement knowledge and skills.

#### Course objective

Knowledge of principles of design of processes and water treatment technological systems. Knowledge of possibilities and methods of intensification of treatment effectiveness. Skill of pilot research design and procedures at pre-design study of processes and objects of water treatment as well as ability of managing of design, investment and operation of water treatment plants.

#### Course-related learning outcomes

##### Knowledge

1. Student has structured and theoretically founded knowledge of methods of water treatment.
2. Student has an ordered knowledge of design methods of basic technological processes used in the raw water treatment technology

##### Skills

1. Student knows how to design raw water treatment plant.
2. Student knows how to do the conception of processes for raw water treatment plant.

##### Social competences

1. Student understands the need for teamwork in solving theoretical and practical problems
2. Student understands the different roles in teamwork and the need for information and knowledge exchange in a group work
3. Student understands the need for a systematic deepening and broadening his/her competences

#### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

##### Lecture

Lecture activity checkup

Written-oral final exam

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##### Laboratory

Short entrance test before each laboratory

Written report of each laboratory exercise, defence.

Written final test regarding all exercises

Activity evaluation during each laboratory



## Excercises

Written partial and final tests

Design exercises

Verification of project advancements and independent design work on each project

Written report, written final test and oral defence of the report.

## Programme content

Sources of anthropogenic contamination of natural water: surface water, groundwater. Classification of anthropogenic pollutants: toxicity, biodegradability. Water quality, mineralization, trophic. Experiment in water treatment designing, conception of treatment, pilot research, treatment train selection. Technological systems: effectiveness and reliability of treatment, multiple barrier treatment rule. Design of processes: sedimentation, coagulation with pH adjustment and adsorption, adsorptive resins, rapid and membrane filtration, chemical and catalytic oxidation, biological processes, disinfection, by-products, post disinfection reactivation of microorganism. Water quality in distribution systems: organoleptic quality, chemical stability of water, chemical and electrochemical corrosion, biological stability, biological corrosion, water conservation. Sludge management: mass and volume balance of backwash water and sludge, sedimentation, gravital thickening, mechanical dewatering, non-newtonian flow of sludge, drying, freezing, final sludge disposal and utilization.

## Teaching methods

- lecture with multimedia presentation
- performing experiments, individual and group work of students,
- measurement observation of experiences,
- presentation and operating instructions for research and measuring devices,
- presentation of interpretation possibilities of obtained test results.

### Outdoor activities

- demonstration of the technical object of the Water Treatment Plant
- demonstration of the filter rinsing process
- work of students in a smaller training group (discussion, questions about a specific topic, etc.)
- a multimedia presentation with a theoretical introduction regarding a given issue, based on a review of the literature from the last two years



- using different sources of knowledge (each student prepares two articles, one in Polish and the other in English).

- work in groups (workshops) - during the presentation students from other groups prepare questions for the presenting group.

### Bibliography

#### Basic

1. Apolinary L. Kowal, Maria Świdorska - Bróż, Oczyszczanie wody, PWN, Warszawa 2009
2. Zbigniew Heidich i inni, Urządzenia do uzdatniania wody, zasady projektowania i przykłady obliczeń, Arkady, Warszawa 1987
3. Hanna Majcherek, Podstawy hydromechaniki w inżynierii oczyszczania wody, wyd. Politechniki Poznańskiej, Poznań 2006
4. Marek M. Sozański, Peter M. Huck, Badania doświadczalne w rozwoju Technologii Uzdatniania Wody, Monografie Komitetu Inżynierii Środowiska PAN, vol. 42, Lublin 2007

#### Additional

1. Praca zbiorowa, Wodociągi i Kanalizacja w Polsce, tradycja i współczesność, Polska Fundacja Odnowy Zasobów Wodnych, Poznań ? Bydgoszcz 2002
2. AWWA, Technical Editor F. W. Pontius, Water Quality and Treatment, McGraw ? Hill, Inc, New York. 1990
3. MWH, Water Treatment Principles and Design (Secondo Editio, Revised by J. C. Crittenden, R. R. Trussell, D. W. Hanol, K. J. Howe and G. Tchobanoglous), John Wiley & Sons, Inc., Hoboken, NY, 2005.

### Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,0
Classes requiring direct contact with the teacher	52	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam, project preparation) <sup>1</sup>	98	4,0

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