



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Systems of Water Treatment

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

Other (e.g. online)

Number of credit points

6

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

Prerequisites



1. Knowledge: Student should have a basic knowledge about water technology (I degree of study), mathematics, chemistry, fluid mechanics and hydrology (I and II degree of study).

2. Skills:

Student should be able to perform mathematical calculations, physical, chemical, mechanics of the fluids and calculation of equipment and facilities of water treatment plants (I degree of study).

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. 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 knows the rules and methods of water treatment systems and processes design and of preparing a concept of water treatment sludge treatment and disposal. - [KIS2_W05; KIS2_W06; KIS2_W07;]
2. Student has structured knowledge of possibilities and methods of intensification of treatment effectiveness. - [KIS2_W05; KIS2_W06; KIS2_W07;]
3. Student knows the rules of research and literature study planning. - [KIS2_W05; KIS2_W06; KIS2_W07;]
4. Student knows the method of research on water treatment processes in pilot and laboratory scale. - [KIS2_W05; KIS2_W06; KIS2_W07;]
5. Student has the ability to describe the chemical and technological concept of water treatment as well as to select processes and parameters. - [KIS2_W05; KIS2_W06; KIS2_W07;]

Skills

1. Student can describe the water treatment system, including the processes selection and sequence. - [KIS2_U05; KIS2_U06; KIS2_U08; KIS2_U09; KIS2_U13;]
2. Student knows how to design the processes of water treatment based on pre-design research. - [KIS2_U05; KIS2_U06; KIS2_U08; KIS2_U09; KIS2_U13;]
3. Student knows how to do the conception of analytical control for treatment system, as well as prepare the operating instructions. - [KIS2_U05; KIS2_U06; KIS2_U08; KIS2_U09; KIS2_U13;]



4. Student can determine the technological system of sludge treatment and desposal. - [KIS2_U05; KIS2_U06; KIS2_U08; KIS2_U09; KIS2_U13;]

Social competences

1. Student understands the need for a systematic deepening and broadening his/her competences - [KIS2_K02; KIS2_K03;]

2. Student knows that there are often several solutions for technical problems with respect to technical conditions and economic aspects. - [KIS2_K02; KIS2_K03;]

3. Student understands the need for teamwork in solving theoretical and practical problems - [KIS2_K02; KIS2_K03;]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture activity checkup

Written final exam, with possible oral evaluation

Evaluation

4,6-5,0- very good
Lecture, main course (30h)

4,3-4,5 - plus good

4,0-4,2 - good

3,5-3,9 - plus satisfactoty

3,0-3,4 - satisfactoty

Less than 3,0 - not satisfactoty

Lecture, design procedure (15h)

Written exam, 5 questions, 20 points each

Evaluation

91 -100 - (5,0)

81 - 90 - (4,5)

71 - 80 - (4,0)

61 - 70 - (3,5)

50 - 60 - (3,0)



Less than 50 punktów - (2,0)

- Laboratory

Theory oral checkup before each laboratory

Written report of each laboratory exercise, defence.

Activity evaluation during each laboratory

Excercises (W2,W3, W5)

-report on field trip

-multimedial presentation

-two technical papers presentation

-written test

Evaluation

4,6-5,0- 5,5

4,3-4,5 4,5

4,0-4,2 4,0

3,5-3,9 3,5

3,0-3,4 3,0

Less than 3,0 2,0

- Design exercises:

Verification of project advancements and independent design work on each project

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

Final mark:70% defence evaluation+30%report evaluation

Programme content

Lecture (30h)

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.

Methods:

-multimedial presentation

Methods:

-multimedial presentation

Laboratory:

1. Iron removal and/or manganese in filtration proces trough oxidative and non-chemically active filtration materials. Granulometric and beckwash parametrs of rapid filters.

2. Coagulation of turbid surface water.

5. Colour removal in GAC filter and in silica sand bed, hydraulics and effects evaluation.

Excercise: Analisis and evaluation of WTP processes effectiveness.

1. Excercise scedule (1h). A,B,C groups formation, tasks for field trip and excercises

Topics:

A- Selection, solution preparation and dosing of coagulats and flocculants, preparation trains.

B-Organics removal from treated water.

C-GAC filters in Poland and abroad.

2. Field trip to water treatment plant (8h)

Topics:

-WTP technological train, process evaluation, water quality, objects, devices.

Methods:



- Field trip,
- WTP presentation
- backwash presentation
- small group workshop

3. Group tasks presentations (6h)

Topics

- Selection, solution preparation and dosing of coagulants and flocculants, preparation trains.
- Organics removal from treated water.
- GAC filters in Poland and abroad.

Design:

Design of surface water treatment plant:

1. Raw water evaluation.
2. Concept of water treatment.
3. Processes calculations.
4. Selection of devices.
5. Site map and objects pictures.
6. Objects drawings

Teaching methods

- multimedial presentation
- different sources of knowledge
- group work: questions and discussion.
- individual and group work
- measurements,
- presentation and operation of research and analytical equipment
- possible interpretation of results presentation



Bibliography

Basic

1. Heidrich Z. i inni: Urządzenia do uzdatniania wody. Arkady, Warszawa 1987
2. Praca zbiorowa, Wodociągi i Kanalizacja w Polsce, tradycja i współczesność, Polska Fundacja Odnowy Zasobów Wodnych, Poznań-Bydgoszcz, 2002 r.

Additional

1. AWWA, Technical Editor F. W. Pontius, Water Quality and Treatment, Mc Coraw-Hill, Inc, New York, 1990
2. MWA, Water Treatment, Principles and Design, John Wiley and Sons, Inc., Hoboken, New Jersey, 2005

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/tutorials, preparation for tests/exam, project preparation) ¹	60	2,5

¹ delete or add other activities as appropriate