COURSE DESCRIPTION CARD - SYLLABUS

Course name
Technologies of Wastewater [S1IŚrod2>TŚ]

Course

Field of study
Environmental Engineering

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
30

Number of credit points

7,00

Coordinators

dr hab. inż. Zbysław Dymaczewski prof. PP
zbyslaw.dymaczewski@put.poznan.pl

Lecturers

Prerequisites

1.Knowledge: In mathematics, physics, chemistry, environmental biology, fluid mechanics and other areas, useful for formulating and solving simple excercises in the field of environmental engineering 2.Skills : Acquiring information from literature, databases and other properly selected sources, also in English or another foreign language recognized as a language of international communication in the field of environmental engineering. Solving excercises of fluid mechanics 3.Social competencies: Awareness of the need to constantly update and supplement knowledge and skills. Teamwork

Course objective

-The objective of the course is to broaden the knowledge and skills in the field of wastewater technology necessary for the selection and design facilities and processes for removal of organic and biogenic pollutants from municipal wastewater

Course-related learning outcomes

Knowledge:
1. Student knows the basic types of indicators of wastewater and sewage sludge pollution and the requirements for wastewater discharged into the sewage system and surface waters

2. Student knows and understands the methods of wastewater treatment in terms of removing from them the basic physical, chemical and biogenic pollutants and the treatment of sewage sludge generated in wastewater treatment plants.
3. Student knows and understands the principles of operation and calculation methods of basic wastewater treatment plant devices and facilities.

Skills:
1. Student is able to give a general concept of municipal wastewater treatment and management of sewage sludge generated in treatment plants.
2. Student is able to perform design calculations of devices and facilities for wastewater treatment and sewage sludge treatment.
3. Student is able to perform basic measurements in sewage and activated sludge (pH, redox potential, dissolved oxygen concentration, concentration of total suspended solids, sludge volume index, etc., and perform calculations determining the basic technological parameters of activated sludge.

Social competences:
1. Student sees the need for continuous and systematic extending of their competences.
2. Student is aware of the critical assessment of the solutions obtained resulting from the assumptions made and the large number of indicators of pollution in treated wastewater.
3. Student understands the need for teamwork in solving design and operational problems of wastewater treatment plants.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture
1. Attendance and lecture activity checkup
2. Written final exam - open and closed questions.
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 Sufficient (3,0)
below 50 - Insufficient (2,0)
Project
Project progress checks: wastewater quantity and quality balance, screens, grit chambers, primary settling tanks, biological reactors, secondary settling tanks, sludge section of the treatment plant (sludge quantity and quality, thickeners, separate digesters, sludge dewatering). A flowchart of the designed wastewater treatment plant. Each of these parts is assessed (calculations and graphical representation). Additionally, a test is held after the completion of each of the three project parts (Part 1 - mechanical treatment plant, Part 2 - biological treatment plant, Part 3 - sewage sludge processing). The final project grade is the arithmetic average of all grades obtained during the exercises, drawings, and the flowchart, as well as the three tests (each part and test must be passed), and the oral defense. For each question in the test, the maximum number of points is 2. Grading criteria (thresholds) depending on the percentage of points obtained:
≥90% very good (5.0)
≥80% good plus (4.5)
≥70% good (4.0)
≥60% satisfactory plus (3.5)
≥50% satisfactory (3.0)
<50% unsatisfactory (2.0)
Laboratories
1. Short entrance written test before each laboratory
2. Written report of each laboratory exercise
3. Written final test regarding all exercises
4. Activity evaluation during each laboratory (promoting activity)
Final test - No possibility to use smartphones, calculators etc.
Final test: umber of points - rating
11.01 - 12.00 very good (5.0)
9.76- 11.00 good plus (4.5)

8.51 - 9.75 good (4.0)
7.26 - 8.50 sufficient plus (3.5)
6.01 - 7.25 sufficient (3.0)
6.00 and less - insufficient (2.0)

Programme content

-Lecture
History of wastewater treatment. Type and characteristics of wastewater. Flow rates (quantity characteristic). Composition of wastewater. Wastewater characteristics (quality characteristic). Loading of contaminants. Unit loads. Population equivalent (p.e.). Regulation for wastewater effluent discharge. Efficiency of treatment process at wastewater treatment plants (WWTP). Types of WWTPs, process flowsheets, processes used, pollutants removed, devices and facilities used, effectiveness. Mechanical treatment (screening, grit chambers, grease tank, primary settling tanks). Chemical WWTP. Biological treatment (trickling filters, activated sludge). Integrated biological processes for organics and nutrients removal (nitrogen and phosphorus). Types of solid and sludge wastes at WWTP. Sewage sludge characteristics. Processes and devices used for treatment and disposal of sewage sludge: thickening, stabilization, dewatering. Sewage sludge disposal.
Laboratory subjects area:
Hydraulic flow through a settling tank
Aeration
Activated sludge process examination
Biological phosphorus removal
Biological nitrogen removal
Mechanical sludge dewatering
Project subjects:
1.Balance of rates (quantity characteristic) and composition of wastewater (quality characteristic). Loading of contaminants. Population equivalent (p.e.). Technological calculations of mechanical WWTP (screening, grit chambers, primary settling tanks)
2.Technological calculations of biological WWTP with nutrient removal (activated sludge, final settling tanks)
3.Technological calculations of devices used for treatment of sewage sludge (gravity and mechanical thickening, anaerobic digestion, devices for sludge dewatering).

Course topics

none

Teaching methods

Lecture - lecture with the use of multimedia presentation and the elements of seminar lecture and problem-focused lecture.
Laboratory exercises - exercise, problem method, case study, measurement, observation, experiment
Project - practical project carried out alone (independently)

Bibliography

Basic:
1. Poradnik eksploatatora oczyszczalni ścieków. (praca zbiorowa pod red. Zbysława Dymaczewskiego; aut: Z. Dymaczewski, T. Jaroszyński, J. Jeż-Walkowiak, M. Komorowska-Kaufman, M.Michałkiewicz, W.Niedzielski, M.M. Sozański i in.). Wyd. 3, rozszerz., zmienione i uaktualnione, Poznań 2011, PZITS
2. Heidrich Z., Witkowski A.: Urządzenia do oczyszczania ścieków - Projektowanie, przykłady obliczeń. Wyd. 2, Seidel-Przywecki. Sp. z o.o., Warszawa 2010
3. Bylka H., Dymaczewski Z., Harasymowicz E., Jaroszynski T., i inni : Wodociągi i kanalizacja w Polsce tradycja i współczesność. Poznań-Bydgoszcz 2002.
4. Catalogues (prospects, web pages of manufacturers)

Additional:
1. Wastewater Engineering. Treatment and Reuse. Metcalf & Eddy. Inc. Mc Graw Hill, Fourth edition, 2003

Breakdown of average student's workload

	Hours	ECTS
Total workload	175	7,00
Classes requiring direct contact with the teacher	90	3,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	85	3,50