Politechnika Krakowska im. Tadeusza Kościuszki

Karta przedmiotu

obowiązuje studentów rozpoczynających studia w roku akademickim 2019/2020

Wydział Inżynierii Środowiska i Energetyki

Kierunek studiów: Inżynieria Środowiska — Profil: Ogólnoakademicki

Forma sudiów: stacjonarne — Kod kierunku: IŚ2

Stopień studiów: II

Specjalności: Environmental and land engineering

1 Informacje o przedmiocie

Nazwa przedmiotu	Water and wastewater treatment
Nazwa przedmiotu w języku angielskim	
Kod przedmiotu	WIŚIE IŚ2 oIIS C7 19/20
Kategoria przedmiotu	Przedmioty kierunkowe
Liczba punktów ECTS	9.00
Semestry	2

2 Rodzaj zajęć, liczba godzin w planie studiów

Semestr	Wykład	Cwiczenia	Laboratoria	Laboratoria komputerowe	Projekt	Seminarium
2	40	15	15	6	14	0

3 Cele przedmiotu

Cel 1 Acquisition of theoretical knowledge on water and wastewater treatment processes, technologies and installations.

Cel 2 Acquiring the ability to perform typical analyses of water and wastewater samples for process monitoring and control.

Cel 3 Acquiring knowledge and practical skills in designing of water and wastewater treatment processes and systems.

Cel 4 Gaining practical skills in application of computer simulation for wastewater treatment processes.

4 Wymagania wstępne w zakresie wiedzy, umiejętności i innych kompetencji

5 Efekty kształcenia

EK1 Wiedza Theoretical knowledge of water and wastewater treatment processes and technologies used for removal of different pollutants and the rules of their application.

EK2 Umiejętności Ability to carry out typical analyses of water, wastewater and sewage sludge samples independently and interpret the results.

EK3 Umiejętności Ability to effectively design of energy efficient water and wastewater treatment systems depending on the composition of incoming media.

EK4 Umiejętności Ability to perform basic analysis of the impact of a designed treatment system on the environment.

EK5 Umiejętności Ability to carry out simple computer simulation for verification and optimization of the designed wastewater treatment system.

EK6 Kompetencje społeczne Ability to work independently and in a team during designing and analyzing the results of operation of the developed systems.

6 Treści programowe

Cwiczenia		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
C1	Exercises in water treatment topics.	8
C2	Technological calculations for process monitoring and control (effectiveness, wastewater influent fractions, mass and energy balance, biogas production, process rates, etc.).	4
C3	Simple mathematical modelling of biochemical processes.	3

Wykład		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
W1	Topics in water treatment	20
W2	Introduction to sustainable wastewater management: Urban water cycle. Wastewater collection and transport. Wastewater quantity and quality. Effect of wastewater discharge to water environment. Legal regulations.	4

Wykład		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
W3	General characteristics of wastewater treatment processes. Overview of typical urban wastewater treatment system. Preliminary and primary treatment of wastewater: screening, grit removal, sedimentation, chemical precipitation.	2
W4	Biological treatment: Fundamentals of biological treatment. Natural treatment methods. Small scale methods. Characteristics of the activated sludge method. Simplified treatment methods.	4
W5	Biological treatment: Unit processes used for advanced nitrogen and phosphorus removal. Integration of the processes. Configuration of bioreactors for nutrient removal from wastewater.	2
W6	Biological treatment: Fixed biomass. Trickling filters, rotating biological contactors, fluidized bed reactors. Anaerobic treatment of wastewater. Tertiary treatment processes: filtration, final aeration, disinfection.	4
W7	Sludge treatment and disposal: thickening, dewatering and stabilization. Sludge disposal methods: incineration, land reclamation, agriculture. Energy recovery from sewage sludge.	2
W8	Mass and energy flows. Optimization of wastewater treatment processes with computer simulation. Reduction of GHGs emission from wastewater treatment.	2

Laboratoria		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
L1	Labs in water treatment topics.	7
L2	Control and monitoring of wastewater treatment processes: chemical precipitation.	3
L3	Control and monitoring of wastewater treatment processes: Activated sludge properties.	2
L4	Control and monitoring of wastewater treatment processes: nitrification and denitrification in a model multistage activated sludge bioreactor.	3

Projekt		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
P1	Designing of water treatment processes and systems.	7
P2	Design calculations of a multistage biological reactor for integrated nutrient removal with (alternatively): secondary sedimentation or membrane filtration. Flowscheme diagram of the designed reactor.	7

Laboratoria komputerowe		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
K1	Development of the simulation model of the bioreactor designed during the design classes.	3
K2	Verification and optimization of the reactor model in the context of technological performance and energy efficiency.	3

7 Narzędzia dydaktyczne

N1 Face-to-face lectures with slide presentations, movies and handouts (in pdf form). Technical trips to water and wastewater treatment facilities (if feasible).

N2 Board classes: Individual and group work in a classroom including board assignments.

N3 Laboratory: Individual assignment in a technological lab with final report.

N4 Design class: Individual design assignment under supervision of a lecturer.

N5 Computer lab: Individual work in a computer lab with specialized simulation software

N6 Consultations

8 Obciążenie pracą studenta

Forma aktywności	Średnia liczba godzin na zrealizowanie aktywności
Godziny kontaktowe z nauczycielem akademickim, w tym:	
Godziny wynikające z planu studiów	90
Konsultacje przedmiotowe	45
Egzaminy i zaliczenia w sesji	3
Godziny bez udziału nauczyciela akademickiego wynikające z nakładu pracy studenta, w tym:	
Przygotowanie się do zajęć, w tym studiowanie zalecanej literatury	60
Opracowanie wyników	15
Przygotowanie raportu, projektu, prezentacji, dyskusji	15
Sumaryczna liczba godzin dla przedmiotu wynikająca z całego nakładu pracy studenta	**228**
Sumaryczna liczba punktów ECTS dla przedmiotu	9.00

9 Sposoby oceny

Ocena formująca

F1 Lectures: Written examination with minimum 60% success (weight 0,6)

F2 Board classes: on-going evaluation of the students performance, partial tests (weight 0,1)

F3 Laboratory: quality of the reports (on accepted/not accepted basis)

F4 Design classes: quality of the design calculations for water and wastewater systems; for the wastewater part evaluated together with the results of computer simulation (weight 0,3)30%

Ocena podsumowująca

P1 Weighted average of the component grades

Warunki zaliczenia przedmiotu

W1 The requirements for taking examination in semester 2 are: 1. obtaining credit for laboratory; 2.obtaining credit for board classes; 3. obtaining credit for design classes

W2 The requirement for obtaining credit for the module in semester 2 is a positive examination grade (min 60%)

W3 The module grade in semester II = (board classes grade *0,1) + (design classes grade *0,3) + (examination grade * 0,6)

Kryteria oceny

Efekt kształcenia 1	
Na ocenę 2.0	The student does not even have basic knowledge of water and wastewater treatment processes and technologies and their applications or shows signicant gaps in knowledge.
Na ocenę 3.0	The student shows only basic knowledge of water and wastewater treatment processes and technologies and their application and has problems with understanding and interpretation of the presented concepts.
Na ocenę 3.5	The student demonstrates a basic level of knowledge in the subject area and shows understanding of most of the presented concepts.
Na ocenę 4.0	The student demonstrates a good level of knowledge in the subject area, understands most of the concepts discussed and is able to efectively use knowledge to solve a given problem.
Na ocenę 4.5	The student shows a very good level of knowledge in the subject area, understands most of the concepts discussed and is able to efectively use knowledge to solve a given problem.
Na ocenę 5.0	The student demonstrates a very good level of knowledge in the subject area, understands all the concepts discussed and is able to use the knowledge practically while demonstrating high independence of thinking and creativeness.
Efekt kształcenia 2	

Na ocenę 2.0	The student is not able to carry out any analysis of water, wastewater and sewage sludge samples independently or interpret the results
Na ocenę 3.0	Student is able to carry out only some of typical analyses of water, wastewater and sewage sludge samples with significant assistance of the Trainer or have major troubles with interpretation of the results.
Na ocenę 3.5	Student is able to carry out most of typical analyses of water, wastewater and sewage sludge samples with some assistance of the Trainer and have some troubles with interpretation of the results.
Na ocenę 4.0	Student is able to carry out majority of typical analyses of water, wastewater and sewage sludge samples independently and can interpret of the results with minor assistance of the Trainer.
Na ocenę 4.5	Student is able to carry out all typical analyses of water, wastewater and sewage sludge samples independently and can easily tinterpret of the results without any assistance of the Trainer.
Na ocenę 5.0	Student is able to carry out all typical analyses of water, wastewater and sewage sludge samples independently, can easily interpret of the results and demonstrates independence of thinking and creativity.
Efekt kształcenia 3	
Na ocenę 2.0	Student is not able to design even a simple water and wastewater treatment system.
Na ocenę 3.0	Student is able to design energy efficient water and wastewater treatment systems with significant assistance of the Trainer but has troubles with understanding of its operational principles.
Na ocenę 3.5	Student is able to design energy efficient water and wastewater treatment systems depending on the composition of incoming media with some assistance of the Trainer but have some troubles with understanding of its operational principles.
Na ocenę 4.0	Student is able to effectively design energy efficient water and wastewater treatment systems depending on the composition of incoming media with minor assistance of the Trainer and can understand and explain its operational principles.
Na ocenę 4.5	Student is able to effectively and independently design energy efficient water and wastewater treatment systems depending on the composition of incoming media and can fully understand and explain its operational principles.
Na ocenę 5.0	Student is able to effectively and independently design energy efficient water and wastewater treatment systems depending on the composition of incoming media, can fully understand and explain its operational principles and demonstrates independence of thinking and creativity.
Efekt kształcenia 4	
Na ocenę 2.0	Student is not able to perform even a basic analysis of the impact of a given treatment system on the environment.

Na ocenę 3.0	Student is able to perform only a generic analysis of the impact of a given treatment system on the environment with significant assistance of the Trainer.
Na ocenę 3.5	Student is able to perform only a simple analysis of the impact of a designed treatment system on the environment with some assistance of the Trainer.
Na ocenę 4.0	Student is able to perform independently a simple analysis of the impact of a designed treatment system on the environment.
Na ocenę 4.5	Student is able to perform independently even a more complex a simple analysis of the impact of a designed treatment system on the environment with minor assistance of the trainer.
Na ocenę 5.0	Student is able to perform independently even a complex analysis of the impact of a designed treatment system on the environment while demonstrating independence of thinking and creativity.
Efekt kształcenia 5	
Na ocenę 2.0	Student is not able to perform even a simple computer simulation of a given generic wastewater treatment system.
Na ocenę 3.0	Student is able to carry out computer simulation of a simple wastewater treatment system with some assistance of the Trainer but has difficulties with correct interpretation of the results.
Na ocenę 3.5	Student is able to perform computer simulation of a simple wastewater treatment system with with minor assistance of the Trainer and can interpret of the results.
Na ocenę 4.0	Student is able to perform independently computer simulation of even a complex wastewater treatment system with with some assistance of the Trainer and can interpret of the results.
Na ocenę 4.5	Student is able to perform independently computer simulation of even a complex wastewater treatment system and can interpret of the results correctly.
Na ocenę 5.0	Student is able to perform independently computer simulation of even a complex wastewater treatment system, can interpret of the results correctly while demonstrating independence of thinking and creativity.
Efekt kształcenia 6	
Na ocenę 2.0	Student does not even show a minimum level of independent work skills, nor willingness and commitment to teamwork.
Na ocenę 3.0	The student demonstrates the basic level of ability to work independently and is able to work in a team, but without commitment.
Na ocenę 3.5	The student demonstrates the skills of independent work, works efficiently in a team, but without commitment.
Na ocenę 4.0	The student works independently at a good level and works effectively in a team, showing commitment.
Na ocenę 4.5	The student works effectively both independently and in a team, showing commitment and initiative.

Na ocenę 5.0	The student works effectively both independently and in a team, showing great commitment, showing initiative and demonstrating clear leadership qualities.

10 Macierz realizacji przedmiotu

Efekt kształcenia	Odniesienie danego efektu do szczegółowych efektów zdefiniowanych dla programu	Cele przedmiotu	Treści programowe	Narzędzia dydaktyczne	Sposoby oceny
EK1	K_W03 K_W04 K_W05	Cel 1 Cel 2	C1 W1 L1 L2 L3 L4 P1 P2 K1 K2	N1 N2	F1 F2 P1
EK2	K_W03 K_W05 K_W06 K_U16	Cel 1 Cel 2	C1 W1 W2 W3 W4 W5 W6 W7 W8 L1 L2 L3 L4 P1 P2 K2	N3	F3 P1
EK3	K_W04 K_W05 K_U01 K_U08	Cel 3	L1 L2 L3 K1 K2	N4	F4 P1
EK4	K_W03 K_W06 K_U02 K_U16 K_U17 K_K01	Cel 3	C1 C2 C3 W1 W2 W3 W4 W5 W6 W7 W8 L1 L2 L3 L4 P1 P2 K1	N4	F4 P1
EK5	K_W03 K_W05 K_U05 K_U07 K_K01 K_K03 K_K07	Cel 4	C1 C2 C3 W1 W2 W3 W4 W5 W6 W7 W8 L1 L2 L3 L4 P1 P2 K1 K2	N4 N5	F4 P1
EK6	K_U14 K_U16	Cel 2 Cel 3	C1 C2 C3 W1 W2 W3 W4 W5 W6 W7 W8 L1 L2 L3 L4 P1 P2 K1 K2	N3 N5	F2 F4

11 Wykaz literatury

Literatura podstawowa

[1] Metcalf and Eddy — *Wastewater Engineering*, , 2003, McGraw-Hill

[2] Spellman F. R. — *Handbook of Water and Wastewater Treatment Plant Operations*, , 2013, CRC Press

12 Informacje o nauczycielach akademickich

Osoba odpowiedzialna za kartę

dr hab. inż. , prof. PK Jerzy Mikosz (kontakt: jmikosz@pk.edu.pl)

Osoby prowadzące przedmiot

1 dr hab. inż. Jerzy Mikosz (kontakt: jmikosz@pk.edu.pl)

2 dr hab. inż., prof. PK Stanislaw M. Rybicki (kontakt:)

13 Zatwierdzenie karty przedmiotu do realizacji

(miejscowość, data) (odpowiedzialny za przedmiot) (dziekan)

Przyjmuję do realizacji (data i podpisy osób prowadzących przedmiot)

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