

# POLITECHNIKA KRAKOWSKA IM. TADEUSZA KOŚCIUSZKI

## KARTA PRZEDMIOTU

obowiązuje studentów rozpoczynających studia w roku akademickim 2018/2019

Wydział Inżynierii Środowiska

Kierunek studiów: Inżynieria środowiska

Profil: Ogólnoakademicki

Forma studiów: stacjonarne

Kod kierunku: IŚ2

Stopień studiów: II

Specjalności: Environmental and land engineering sem. letni 2019

### 1 INFORMACJE O PRZEDMIOCIE

NAZWA PRZEDMIOTU	Water and wastewater treatment
NAZWA PRZEDMIOTU W JĘZYKU ANGIELSKIM	Water and wastewater treatment
KOD PRZEDMIOTU	WIŚ IŚ2 oIIS C7 18/19
KATEGORIA PRZEDMIOTU	Przedmioty kierunkowe
LICZBA PUNKTÓW ECTS	9.00
SEMESTRY	2

### 2 RODZAJ ZAJĘĆ, LICZBA GODZIN W PLANIE STUDIÓW

SEMESTR	WYKŁAD	ĆWICZENIA	LABORATORIUM	LABORATORIUM KOMPUTERO- WE	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 team during designing and analyzing the results of the work of the developed systems.

#### 6 TREŚCI PROGRAMOWE

LABORATORIUM		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
<b>L1</b>	Labs in water treatment topics	7
<b>L2</b>	Control and monitoring of wastewater treatment processes: chemical precipitation	3
<b>L3</b>	Control and monitoring of wastewater treatment processes: Activated sludge properties	2
<b>L4</b>	Control and monitoring of wastewater treatment processes: nitrification and denitrification in a model multistage activated sludge bioreactor	3

WYKŁAD		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
<b>W1</b>	Topics in water treatment	20

WYKŁAD		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
<b>W2</b>	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
<b>W3</b>	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
<b>W4</b>	Biological treatment: Fundamentals of biological treatment. Natural treatment methods. Small scale methods. Characteristics of the activated sludge method. Simplified treatment methods.	4
<b>W5</b>	Biological treatment: Unit processes used for advanced nitrogen and phosphorus removal. Integration of the processes. Configuration of bioreactors for nutrient removal from wastewater.	2
<b>W6</b>	Biological treatment: Fixed biomass. Trickling filters, rotating biological contactors, fluidized bed reactors. Anaerobic treatment of wastewater. Tertiary treatment processes: filtration, final aeration, disinfection.	4
<b>W7</b>	Sludge treatment and disposal: thickening, dewatering and stabilization. Sludge disposal methods: incineration, land reclamation, agriculture. Energy recovery from sewage sludge.	2
<b>W8</b>	Mass and energy flows. Optimization of wastewater treatment processes with computer simulation. Reduction of GHGs emission from wastewater treatment.	2

ĆWICZENIA		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
<b>C1</b>	Exercises in water treatment topics	8
<b>C2</b>	Technological calculations for process monitoring and control (effectiveness, wastewater influent fractions, mass and energy balance, biogas production, process rates, etc.)	4
<b>C3</b>	Simple mathematical modelling of biochemical processes	3

LABORATORIUM KOMPUTEROWE		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
<b>K1</b>	Development of the simulation model of the bioreactor designed during the design classes.	3

LABORATORIUM KOMPUTEROWE		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
<b>K2</b>	Verification and optimization of the reactor model in the context of technological performance and energy efficiency.	3

PROJEKT		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
<b>P1</b>	Designing of water treatment processes and systems	7
<b>P2</b>	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

## 7 NARZĘDZIA DYDAKTYCZNE

**N1** Lectures: 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
<b>Godziny kontaktowe z nauczycielem akademickim, w tym:</b>	
Godziny wynikające z planu studiów	90
Egzaminy i zaliczenia w sesji	2
<b>Godziny bez udziału nauczyciela akademickiego wynikające z nakładu pracy studenta</b>	30
<b>SUMARYCZNA LICZBA GODZIN DLA PRZEDMIOTU WYNIKAJĄCA Z CAŁEGO NAKŁADU PRACY STUDENTA</b>	<b>122</b>
SUMARYCZNA LICZBA PUNKTÓW ECTS DLA PRZEDMIOTU	9

## 9 SPOSOBY OCENY

### OCENA FORMUJĄCA

**F1** Lectures: Written examination 60%

**F2** Board classes: on-going evaluation of the students performance 10%

**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) 30%

### OCENA PODSUMOWUJĄCA

**P1** Compilation of the component grades

### WARUNKI ZALICZENIA PRZEDMIOTU

**W1** The requirements for taking the examination in semester II 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 II is a positive examination grade

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

### KRYTERIA OCENY

EFEKT KSZTALCENIA 1	
NA OCENĘ 2.0	Student does not have sufficient knowledge in the required scope.
NA OCENĘ 3.0	Student has sufficient knowledge in the required scope. Obtained between 60% and 68% of points for correct answers.
NA OCENĘ 3.5	Student has sufficient knowledge in the required scope. Obtained between 68% and 76% of points for correct answers.
NA OCENĘ 4.0	Student has sufficient knowledge in the required scope. Obtained between 77% and 84% of points for correct answers.
NA OCENĘ 4.5	Student has sufficient knowledge in the required scope. Obtained between 85% and 92% of points for correct answers.
NA OCENĘ 5.0	Student has sufficient knowledge in the required scope. Obtained between 93% and 100% of points for correct answers.
EFEKT KSZTALCENIA 2	
NA OCENĘ 2.0	Student is not able to carry out analyses of water, wastewater and sewage sludge samples independently or is not able to interpret the results correctly.
NA OCENĘ 3.0	Student is able to carry out typical analyses of water, wastewater and sewage sludge samples independently and to interpret the results correctly.

NA OCENĘ 3.5	Student is able to carry out typical analyses of water, wastewater and sewage sludge samples independently and to interpret the results correctly.
NA OCENĘ 4.0	Student is able to carry out typical analyses of water, wastewater and sewage sludge samples independently and to interpret the results correctly.
NA OCENĘ 4.5	Student is able to carry out typical analyses of water, wastewater and sewage sludge samples independently and to interpret the results correctly.
NA OCENĘ 5.0	Student is able to carry out typical analyses of water, wastewater and sewage sludge samples independently and to interpret the results correctly.
EFEKT KSZTAŁCENIA 3	
NA OCENĘ 2.0	Student is not able to design water and wastewater treatment systems independently and does not understand the processes to be applied.
NA OCENĘ 3.0	Student is able to design water and wastewater treatment systems independently but the designs have major errors.
NA OCENĘ 3.5	Student is able to design of water and wastewater treatment systems independently but the designs have some errors.
NA OCENĘ 4.0	Student is able to design water and wastewater treatment systems correctly but the designs have some minor errors.
NA OCENĘ 4.5	Student is able to design water and wastewater treatment systems correctly without any errors and has thorough understanding of the processes and technologies applied.
NA OCENĘ 5.0	Student is able to design water and wastewater treatment systems excellently and has deep understanding of the processes and technologies applied.
EFEKT KSZTAŁCENIA 4	
NA OCENĘ 2.0	Student is not able to perform even a basic analysis of the impact of a designed treatment system on the environment.
NA OCENĘ 3.0	Student is able to perform a basic analysis of the impact of a designed treatment system on the environment.
NA OCENĘ 3.5	Student is able to perform a basic analysis of the impact of a designed treatment system on the environment.
NA OCENĘ 4.0	Student is able to perform a basic analysis of the impact of a designed treatment system on the environment.
NA OCENĘ 4.5	Student is able to perform a basic analysis of the impact of a designed treatment system on the environment.
NA OCENĘ 5.0	Student is able to perform a basic analysis of the impact of a designed treatment system on the environment.
EFEKT KSZTAŁCENIA 5	

NA OCENĘ 2.0	Student is not able to carry out even a simple computer simulation of the designed wastewater treatment system.
NA OCENĘ 3.0	Student is able to carry out simple computer simulation of the designed wastewater treatment system but is not able to interpret the results.
NA OCENĘ 3.5	Student is able to carry out simple computer simulation of the designed wastewater treatment system and to interpret the results but is not able to optimize the model.
NA OCENĘ 4.0	Student is able to carry out simple computer simulation of the designed wastewater treatment system, interpret the results and perform simple optimization of the model.
NA OCENĘ 4.5	Student is able to carry out simple computer simulation of the designed wastewater treatment system, interpret the results and perform optimization of the model.
NA OCENĘ 5.0	Student is able to carry out computer simulation of the designed wastewater treatment system, interpret the results and perform complex optimization of the developed model.
EFEKT KSZTAŁCENIA 6	
NA OCENĘ 2.0	Student is not able to work independently nor in the team.
NA OCENĘ 3.0	Student is able to work independently but not in the team.
NA OCENĘ 3.5	Student is able to work independently and as a member of the team. Students role in the team is passive.
NA OCENĘ 4.0	Student is able to work independently and as a member of the team. Students role in the team is active.
NA OCENĘ 4.5	Student is able to work independently and as a member of the team. Students role in the team is inspiring.
NA OCENĘ 5.0	Student is able to work independently and as a member of the team. Students is a leader in the team or is inspiring and helping other team members.

## 10 MACIERZ REALIZACJI PRZEDMIOTU

EFEKT KSZTAŁCENIA	ODNIESIENIE DANEGO EFEKTU DO SZCZEGÓLOWYCH EFEKTÓW ZDEFINIOWANYCH DLA PROGRAMU	CELE PRZEDMIOTU	TREŚCI PROGRAMOWE	NARZĘDZIA DYDAKTYCZNE	SPOSOBY OCENY
EK1	K_W03 K_W05	Cel 1	L1 L2 L3 L4 W1 C1 K1 K2 P1 P2	N1 N2	F1 F2 P1

EFEKT KSZTAŁCENIA	ODNIESIENIE DANEGO EFEKTU DO SZCZEGÓŁOWYCH EFEKTÓW ZDEFINIOWANYCH DLA PROGRAMU	CELE PRZEDMIOTU	TREŚCI PROGRAMOWE	NARZĘDZIA DYDAKTYCZNE	SPOSOBY OCENY
EK2	K_W03 K_W05 K_W06 K_U16	Cel 1 Cel 2	L1 L2 L3 L4 W1 W2 W3 W4 W5 W6 W7 W8 C1 K2 P1 P2	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	L1 L2 L3 L4 W1 W2 W3 W4 W5 W6 W7 W8 C1 C2 C3 K1 P1 P2	N4	F4 P1
EK5	K_W03 K_W05 K_U05 K_U07 K_K01 K_K03 K_K07	Cel 4	L1 L2 L3 L4 W1 W2 W3 W4 W5 W6 W7 W8 C1 C2 C3 K1 K2 P1 P2	N4 N5	F4 P1
EK6	K_U14 K_U16	Cel 2 Cel 3	L1 L2 L3 L4 W1 W2 W3 W4 W5 W6 W7 W8 C1 C2 C3 K1 K2 P1 P2	N3 N5	F2 F4

## 11 WYKAZ LITERATURY

### LITERATURA PODSTAWOWA

- [1 ] Metcalf and Eddy — *Wastewater Engineering*, Miejscowość, 2003, McGraw-Hill
- [2 ] Spellman F. R. — *Handbook of Water and Wastewater Treatment Plant Operations*, Miejscowość, 2013, CRC Press

## 12 INFORMACJE O NAUCZYCIELACH AKADEMICKICH

### OSOBA ODPOWIEDZIALNA ZA KARTĘ

dr hab. inż. Jerzy Mikosz (kontakt: [jmikosz@pk.edu.pl](mailto:jmikosz@pk.edu.pl))

### OSOBY PROWADZĄCE PRZEDMIOT

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

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





## 13 ZATWIERDZENIE KARTY PRZEDMIOTU DO REALIZACJI

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(miejsowość, data)

(odpowiedzialny za przedmiot)

(dziekan)

**PRZYJMUJĘ DO REALIZACJI** (data i podpisy osób prowadzących przedmiot)

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