Załącznik nr 2 do uchwały nr 410 Senatu Politechniki Opolskiej z dnia 29.05.2024 r.

Załącznik nr 11 do Księgi Jakości Kształcenia

KARTA PROGRAMU STUDIÓW

Nazwa programu studiów **Environmental Engineering**

Specjalności: Advanced Technologies in Environmental Engineering - ATEE

Nazwa wydziału **Wydział Mechaniczny**

poziom studiów (I stopnia / II stopnia / jednolite studia magisterskie)	Studia drugiego stopnia
profil studiów (ogólnoakademicki / praktyczny)	Ogólnoakademicki
forma studiów (stacjonarne / niestacjonarne)	Studia stacjonarne
program studiów obowiązuje od roku akademickiego	2024/2025
data i numer uchwały Senatu ustalającej program studiów	29.05.2024 Uchwała nr 410 Senatu Politechniki Opolskiej
data i numer uchwały Senatu ustalającej kierunkowe efekty uczenia się	29.05.2024 Uchwała nr 410 Senatu Politechniki Opolskiej
dyscyplina wiodąca (w ramach której będzie uzyskiwana ponad połowa efektów uczenia się) – podać udział procentowy	Inżynieria Środowiska, Górnictwo i Energetyka - 100%
pozostałe dyscypliny – podać udział procentowy	
czas trwania studiów (w semestrach)	3 sem.
łączna liczba punktów ECTS (w tym praktyki)	ATEE - 90 Razem - 90
łączna liczba godzin w planie studiów (w tym praktyki)	ATEE - 975 Razem - 975
wymiar (godzinowy) praktyk zawodowych, zasady i forma ich odbywania oraz liczba punktów ECTS, jaką student musi uzyskać w ramach tych praktyk (jeśli program studiów przewiduje praktyki)	Zasady i formę odbywania praktyk określono w karcie opisu przedmiotu oraz w Regulaminie praktyk studenckich w Politechnice Opolskiej.

tytuł zawodowy otrzymywany przez absolwenta	Magister inżynier
klasyfikacja ISCED	0712
związek z misją i strategią rozwoju Politechniki Opolskiej	Kształcenie na danym kierunku łączy najlepsze tradycje myśli technicznej z zadaniami dnia dzisiejszego i wyzwaniem wobec szybkich przemian technologicznych współczesnego świata. W działalności edukacyjnej i naukowo-badawczej wydziału łączy to potrzebę kształtowania nowoczesnej myśli wobec przemian ekonomicznych i perspektyw gospodarczych kraju z tworzeniem wartości etycznych świata nauki i techniki. Wokół tego posłannictwa skupiają się nauczyciele i studenci, badacze oraz pracownicy administracji, jak również przedstawiciele otoczenia gospodarczego i społecznego szkoły. Do podstawowych składników tak postrzeganej misji należą: kształcenie, badania naukowe oraz służba społeczna. Sprzyja to integracji i rozwojowi nauki, a także stymuluje kreatywność oraz wzmacnia więzi społeczne z regionem.
wymagania wstępne – oczekiwane kompetencje kandydata (szczególnie w przypadku studiów drugiego stopnia)	Ukończone studia I-go stopnia z tytułem inżyniera po danym lub pokrewnym kierunku. Preferowani są kandydaci o zainteresowaniach technicznych, umiejętnościach analitycznych oraz wiedzy z zakresu przedmiotów kierunkowych. Kandydat powinien również posiadać umiejętność rozwiązywania problemów i być zorientowany na pracę w grupie. Poziom 6 PRK.
zasady rekrutacji (w tym: przedmioty kwalifikacyjne oraz ustalone dla nich współczynniki wagowe)	Kandydat powinien posiadać tytuł zawodowy inżyniera lub równorzędny, uzyskany na tym samym lub pokrewnym kierunku studiów. Wykaz kierunków pokrewnych określa rada wydziału. Kryterium decydującym o przyjęciu na studia drugiego stopnia jest wartość wskaźnika rankingowego równa ocenie z dyplomu ukończenia poprzednich studiów, na tym samym lub pokrewnym kierunku. W przypadku braku dyplomu ukończenia studiów, kandydat może dostarczyć zaświadczenie o zdanym egzaminie dyplomowym. Oryginał lub odpis dyplomu (wydany przez uczelnię) wraz z suplementem musi być dostarczony w tym przypadku, w terminie określonym przez Komisję Rekrutacyjną.
sposoby weryfikacji zakładanych efektów uczenia się	Zgodnie ze sposobem weryfikacji przewidzianym przez prowadzącego w karcie przedmiotu.

sumaryczne wskaźniki charakteryzujące program studiów, a w tym:	łączna liczba punktów ECTS, którą student uzyskuje w ramach zajęć z bezpośrednim udziałem nauczycieli akademickich lub innych osób prowadzących zajęcia	Specj. / ECTS kont. ATEE / 51
	łączna liczba punktów ECTS, którą student uzyskuje w ramach zajęć z zakresu nauk podstawowych, do których odnoszą się efekty uczenia się dla określonego programu studiów, poziomu i profilu studiów	ATEE - 13
	dla profilu praktycznego łączna liczba punktów ECTS przypisanych do zajęć związanych z praktycznym przygotowaniem zawodowym, dla profilu ogólnoakademickiego łączna liczba punktów ECTS przypisanych do zajęć związanych z prowadzonymi w uczelni badaniami naukowymi w dyscyplinie lub dyscyplinach, do których przyporządkowany jest kierunek studiów	ATEE - 60
	liczba punktów ECTS, którą student musi uzyskać w ramach zajęć z dziedziny nauk humanistycznych lub nauk społecznych	ATEE - 6
	w przypadku studiów stacjonarnych I stopnia lub jednolitych magisterskich liczba godzin zajęć z wychowania fizycznego	nie dotyczy
	liczba punktów ECTS objętych programem studiów uzyskiwana w ramach zajęć do wyboru	ATEE - 36

Program studiów zaopiniowany przez organ samorządu studenckiego.

Sylwetka absolwenta

Environmental Engineering, Studia drugiego stopnia, Studia stacjonarne,
Advanced Technologies in Environmental Engineering

Wiedza:

Absolwent ma pogłębioną wiedzę z wybranych działów matematyki, fizyki, chemii, biologii i nauk o ziemi w zakresie potrzebnym do opisywania zjawisk i procesów związanych z technologiami inżynierii środowiska oraz posiada wiedzę na temat planowania przestrzennego. W zaawansowanym stopniu zna zasady identyfikowania zagrożeń, bezpieczeństwa i higieny pracy oraz ergonomii w czasie budowy i eksploatacji instalacji stosowanych w inżynierii środowiska. Posiada pogłębioną wiedzę z zakresu konwencjonalnych i alternatywnych źródeł energii oraz możliwości technicznych i technologicznych ich pozyskiwania, konwersji i zastosowania. Absolwent w zaawansowanym stopniu zna statystyczne metody analizy danych i opracowywania wyników pomiarów. Posiada pogłębioną wiedzę w zakresie modelowania procesów, zjawisk i urządzeń, zna metody numeryczne i informatyczne oraz narzędzia przydatne z punktu widzenia rozwiązywania zadań inżynierskich z zakresu inżynierii środowiska. Ma pogłębioną wiedzę o metodach, narzędziach i modelach zarządzania środowiskiem, w tym także gospodarki odpadami. Absolwent ma pogłębioną wiedzę z zakresu przygotowania i korzystania z dokumentacji inwestycyjnej oraz organizacji robót budowlanych i instalacyjnych; zna zasady projektowania procesów, obiektów i systemów inżynierii środowiska z uwzględnieniem ich wpływu na środowisko oraz niezawodności i bezpieczeństwa użytkowania. W zaawansowanym stopniu zna zasady projektowania aparatów i urządzeń stosowanych w inżynierii środowiska oraz trendy rozwojowe w budowie instalacji technicznych. W zaawansowanym stopniu zna zasady projektowania inżynierskiego oraz programowania komputerowego wspomagającego projektowanie infrastruktury środowiskowej. Absolwent posiada pogłębioną wiedzę z zakresu obserwacji zjawisk i procesów oraz zna metody wykonywania pomiarów charakterystycznych wielkości istotnych z punktu widzenia inżynierii środowiska; zna metody, techniki i aparaturę do badania zjawisk fizycznych, chemicznych i biologicznych oraz ma wiedzę o cyklu życia urządzeń, obiektów i systemów technicznych. Posiada specjalistyczną wiedzę do rozwiązywania problemów związanych z inżynierią środowiska. Ma uporządkowaną, podbudowaną teoretycznie wiedzę obejmującą kluczowe zagadnienia z zakresu inżynierii środowiska i innowacyjnych technologii. Ma pogłębioną wiedzę o roli środowiska naturalnego, ma świadomość zagrożeń oraz zna metody ich identyfikacji i ograniczania. Absolwent w zaawansowanym stopniu zna metody, techniki, narzędzia i materiały stosowane przy rozwiązywaniu złożonych zadań inżynierskich z zakresu inżynierii środowiska. Dzięki posiadanej wiedzy w zaawansowanym stopniu zna i rozumie fundamentalne dylematy współczesnej cywilizacji. Ma pogłębioną wiedzę o stosowaniu przepisów prawych, norm oraz wytycznych w projektowaniu i eksploatacji obiektów technicznych a także do rozumienia społecznych, ekonomicznych, prawnych i innych pozatechnicznych uwarunkowań działalności inżynierskiej.

Umiejętności:

Absolwent korzysta z osiągnięć intelektualnych innych autorów z poszanowaniem praw autorskich korzystając z literatury, baz danych oraz innych źródeł związanych z naukami technicznymi; potrafi integrować uzyskane informacje, dokonywać ich interpretacji, wyciągać wnioski oraz formułować opinie. Potrafi posługiwać się metodami statystycznymi w opracowaniu danych i w analizach środowiskowych oraz wykorzystuje programy komputerowe do rozwiązywania zadań inżynierskich. Potrafi przygotować w języku polskim oraz języku obcym uznawanym za podstawowy, zadany problem z zakresu inżynierii środowiska i zaprezentować go. Potrafi posługiwać się językiem obcym na poziomie B2+ Europejskiego Systemu Opisu Kształcenia Językowego oraz w wyższym stopniu w zakresie specjalistycznej terminologii. Absolwent potrafi samodzielnie planować, realizować oraz ukierunkowywać innych w procesie uczenia się przez całe życie. Potrafi posługiwać się technikami informacyjno-komunikacyjnymi, formułować graficznie i opisowo wytyczne do realizacji działań typowych do działalności inżynierskiej. Potrafi posługiwać się aparaturą pomiarową posiadając przy tym umiejętność szacowania błędów i planować i przeprowadzać eksperymenty, interpretować uzyskane wyniki i formułować wnioski. Potrafi przeprowadzić analizę zadania inżynierskiego i zastosować metody symulacyjne prowadzące do ich rozwiązywania, interpretować uzyskane wyniki i wyciągać wnioski, testować hipotezy. Absolwent potrafi dostrzegać aspekty systemowe i pozatechniczne przy formułowaniu i rozwiązywaniu zadań inżynierskich. Potrafi korzystać z dokumentacji inwestycyjnej, ocenić koszty inwestycji, stosować zasady organizacji robót instalacyjnych oraz dokonywać wstępnej analizy ekonomicznej podejmowanych działań inżynierskich. Potrafi rozwiązywać złożone zadania inżynierskie i zadania badawcze oraz dokonać krytycznej analizy sposobu ich funkcjonowania, a także ocenić istniejące rozwiązania techniczne z dziedziny inżynierii środowiska, w tym zawierające komponent badawczy oraz ocenić przydatność różnych metod i narzędzi służących do ich rozwiązania. Potrafi - zgodnie z zadaną specyfikacją - zaprojektować oraz zrealizować urządzenie, obiekt, system lub proces typowy dla inżynierii środowiska wykorzystując odpowiednie metody, techniki i narzędzia.

Kompetencje społeczne:

Absolwent rozumie potrzebę dokształcania się, podnoszenia kompetencji zawodowych, potrafi inspirować i organizować proces uczenia się innych osób. Rozumie wagę konieczności zapewniania bezpiecznych warunków pracy. Prawidłowo identyfikuje problemy inżynierskie oraz potrafi określać priorytety działań zawodowych. Potrafi współdziałać i pracować w grupie przejmując w niej różne role; rozumie ważność działań zespołowych a także potrafi samodzielnie planować, realizować oraz ukierunkowywać innych w procesie uczenia się przez całe życie. Rozumie społeczną rolę inżyniera oraz rozumie potrzebę przekazywania społeczeństwu wiarygodnych informacji dotyczących osiągnięć inżynierskich. Absolwent ma świadomość ważności i rozumie pozatechniczne aspekty i skutki działalności inżynierskiej, w tym jej wpływu na środowisko i związanej z tym odpowiedzialności za podejmowane decyzje. Ma świadomość ważności postępowania profesjonalnego, przestrzegania zasad etyki zawodowej oraz poszanowania różnorodności poglądów i opinii. Potrafi myśleć i działać w sposób kreatywny, innowacyjny i przedsiębiorczy oraz krytycznie oceniać odbierane treści.

Knowledge:

The graduate has in-depth knowledge of selected fields in mathematics, physics, chemistry,

biology and earth sciences to the extent necessary to describe phenomena and processes related to environmental engineering technologies and has knowledge of spatial planning. He/She has advanced knowledge of the principles of identification of hazards, occupational health and safety and ergonomics during the construction and operation of installations used in environmental engineering. He/She has in-depth knowledge of conventional and alternative energy sources as well as technical and technological possibilities for their acquisition, conversion and application. The graduate has advanced knowledge of statistical methods of data analysis and development of measurement results. He/She has in-depth knowledge of modelling of processes, phenomena and devices, knows numerical and computerised methods and tools useful for solving engineering tasks in the field of environmental engineering. He/She has in-depth knowledge of the environmental management methods, tools and models, including waste management. The graduate has in-depth knowledge of the preparation and use of project documentation and the organisation of construction and installation works; knows the principles of designing environmental engineering processes, facilities and systems with regard to their environmental impact and reliability and safety of use. He/She has advanced knowledge of the principles of design of apparatus and devices used in environmental engineering and development trends in the construction of technical installations. The graduate has advanced knowledge of the principles of engineering design and computer programming that support the design of environmental infrastructure. The graduate has in-depth knowledge in the observation of phenomena and processes and knows the methods of making measurements of characteristic quantities that are important from the point of view of environmental engineering; knows the methods, techniques and equipment for studying physical, chemical and biological phenomena and has knowledge of the life cycle of technical devices, facilities and systems. He/She has specialist knowledge for solving environmental engineering problems and has structured and theoretically underpinned knowledge covering the key issues in the field of environmental engineering and innovative technologies. He/She has in-depth knowledge of the role of the natural environment; is aware of the risks and knows how to identify and reduce them. The graduate has advanced knowledge of methods, techniques, tools and materials used to solve complex engineering tasks in the field of environmental engineering; knows and understands the fundamental dilemmas of modern civilisation thanks to their advanced knowledge. He/She has in-depth knowledge of the application of legal regulations, standards and guidelines in the design and operation of technical facilities as well as understanding of social, economic, legal and other non-technical aspects of engineering activity.

Skills:

The graduate uses other authors’ intellectual achievements, respecting copyrights and using literature, databases and other sources related to technical sciences; is able to integrate the obtained information, interpret it, draw conclusions and formulate opinions. He/She is able to use statistical methods in the development of data and environmental analyses and uses computer software to solve engineering tasks. The graduate is able to prepare and present an assigned environmental engineering problem in both Polish and a foreign language recognised as a basic language. He/She is able to use a foreign language at the B2+ level of the Common European Framework of Reference for Languages and at a higher level within the specialist terminology. The graduate is able to plan, execute and direct others in the

process of lifelong learning; use information and communication techniques, formulate graphically and descriptively the guidelines for carrying out tasks typical of engineering activity. He/She is able to use measuring apparatus and has the ability to estimate errors and plan and conduct experiments, interpret the obtained results and formulate conclusions. He/She is able to carry out an analysis of an engineering task and apply simulation methods to solve it, interpret the obtained results, draw conclusions and test hypotheses. The graduate is able to see systemic and non-technical aspects while formulating and solving engineering tasks; use project documentation, evaluate project costs, apply the principles of organisation of installation works and conduct a preliminary economic analysis of undertaken engineering activities. He/She is able to solve complex engineering and research tasks and critically analyse how they work, as well as evaluate the existing environmental engineering solutions, including those containing a research component and assess the suitability of different methods and tools for solving them. The graduate is able to design and construct a device, facility, system or process typical of environmental engineering, using appropriate methods, techniques and tools in accordance with the provided specification.

Social competences:

The graduate understands the need to learn, improve the professional skills and is able to inspire and organise the learning process of others. He/She understands the importance of the need to ensure safe working conditions; correctly identifies engineering problems and is able to prioritise professional activities. He/She is able to cooperate and work in a group, taking on different roles; understands the importance of teamwork and can independently plan, implement and direct others in the lifelong learning process; understands the social role of an engineer and understands the need to provide the public with reliable information on engineering achievements. The graduate is aware of the importance and understands the non-technical aspects and consequences of the engineering activity, including its environmental impact and the related responsibility for the decisions made. He/She is aware of the importance of professional conduct, adherence to professional ethics and respecting the diversity of views and opinions; think and act in a creative, innovative and entrepreneurial way and critically evaluate the received content.

Tabela kierunkowych efektów uczenia się

program studiów (kierunek studiów): **Environmental Engineering** poziom studiów: **Studia drugiego stopnia** profil studiów: **Ogólnoakademicki**	
symbol kierunkowych efektów uczenia się	efekty uczenia się (treść)
Wiedza: zna i rozumie	
IS_K2_W01	Has in-depth knowledge of selected areas of mathematics, physics, chemistry, biology and earth sciences to the extent needed to describe phenomena and processes related to environmental engineering technologies and has knowledge of spatial planning
IS_K2_W02	Student knows at an advanced level the principles of identifying hazards, occupational health and safety, and ergonomics during the construction and operation of installations used in environmental engineering.
IS_K2_W03	Has in-depth knowledge of conventional and alternative energy sources and the technical and technological possibilities of their acquisition, conversion and application
IS_K2_W04	Student knows advanced statistical methods of data analysis and preparation of measurement results
IS_K2_W05	Has in-depth knowledge of modeling processes, phenomena and devices, knows numerical and IT methods and tools useful for solving engineering tasks in the field of environmental engineering
IS_K2_W06	Has in-depth knowledge of modeling processes, phenomena and devices, knows numerical and IT methods and tools useful for solving engineering tasks in the field of environmental engineering
IS_K2_W07	Has in-depth knowledge of the preparation and use of investment documentation and the organization of construction and installation works; knows the principles of designing environmental engineering processes, facilities and systems, taking into account their impact on the environment and the reliability and safety of use
IS_K2_W08	Student has an advanced knowledge of the principles of designing apparatus and devices used in environmental engineering and development trends in the construction of technical installations
IS_K2_W09	He has an advanced knowledge of the principles of engineering design and computer programming supporting the design of environmental infrastructure
IS_K2_W10	Has in-depth knowledge of the observation of phenomena and processes and knows methods of performing measurements of characteristic quantities important from the point of view of environmental engineering; knows methods, techniques and equipment for examining physical, chemical and biological phenomena and has knowledge of the life cycle of devices, facilities and technical systems

IS_K2_W11	Has specialized knowledge to solve problems related to environmental engineering
IS_K2_W12	Has structured, theoretically based knowledge covering key issues in the field of environmental engineering and innovative technologies. Has in-depth knowledge of the role of the natural environment, is aware of threats and knows methods of identifying and reducing them
IS_K2_W13	He knows at an advanced level the methods, techniques, tools and materials used in solving complex engineering tasks in the field of environmental engineering
IS_K2_W14	Thanks to his advanced knowledge, he knows and understands the fundamental dilemmas of modern civilization
IS_K2_W15	Has in-depth knowledge of the application of legal regulations, standards and guidelines in the design and operation of technical facilities as well as understanding the social, economic, legal and other non-technical conditions of engineering activities
Umiejętności: potrafi	
IS_K2_U01	Student uses the intellectual achievements of other authors, respecting copyrights, using literature, databases and other sources related to technical sciences; can integrate the information obtained, interpret it, draw conclusions and formulate opinions
IS_K2_U02	Is able to use statistical methods in data processing and environmental analyses, and uses computer programs to solve engineering tasks
IS_K2_U03	Is able to prepare in Polish and a foreign language considered to be a basic environmental engineering problem and present it
IS_K2_U04	Can use a foreign language at the B2+ level of the Common European Framework of Reference for Languages and to a higher degree in the field of specialized terminology
IS_K2_U05	Is able to independently plan, implement and guide others in the lifelong learning process
IS_K2_U06	Is able to use information and communication techniques, formulate graphically and descriptively guidelines for the implementation of activities typical of engineering activities
IS_K2_U07	Is able to use measuring equipment with the ability to estimate errors, plan and conduct experiments, interpret the obtained results and formulate conclusions
IS_K2_U08	Is able to analyze an engineering task and apply simulation methods to solve them, interpret the obtained results and draw conclusions, test hypotheses
IS_K2_U09	Is able to notice systemic and non-technical aspects when formulating and solving engineering tasks
IS_K2_U10	Is able to use investment documentation, assess investment costs, apply the principles of organizing installation works and make a preliminary economic analysis of undertaken engineering activities

IS_K2_U11	Is able to solve complex engineering tasks and simple research tasks and critically analyze how they function, as well as evaluate existing technical solutions in the field of environmental engineering, including those containing a research component, and assess the usefulness of various methods and tools for solving them
IS_K2_U12	Is able - in accordance with given specifications - to design and implement a simple device, facility, system or process typical of environmental engineering using appropriate methods, techniques and tools
Kompetencje społeczne: jest gotów do	
IS_K2_K01	Student understands the need for further education and improvement of professional competences; can inspire and organize the learning process of other people
IS_K2_K02	Student understands the importance of ensuring safe working conditions
IS_K2_K03	Correctly identifies engineering problems and is able to define priorities for professional activities
IS_K2_K04	Is able to cooperate and work in a group, taking on various roles in it; understands the importance of team activities and is able to independently plan, implement and guide others in the lifelong learning process. Understands the social role of an engineer and the need to provide the public with reliable information regarding engineering achievements
IS_K2_K05	Is aware of the importance and understands non-technical aspects and consequences of engineering activities, including its impact on the environment and the related responsibility for decisions made
IS_K2_K06	Is aware of the importance of professional conduct, compliance with the principles of professional ethics and respect for diversity of views and opinions
IS_K2_K07	Can think and act in a creative, innovative and enterprising way and critically evaluate the received content

Objaśnienia

Symbol efektu tworzą:
- litera K – wyróżnik efektów kierunkowych,
- liczba 1 – studia pierwszego stopnia,
- znak _ (podkreślnik),
- litery W, U lub K – oznaczenie kategorii efektów (W – wiedza, U – umiejętności, K – kompetencje społeczne),
- 01, ... - numer efektu w obrębie danej kategorii, zapisany w postaci dwóch cyfr (numery 1-9 należy poprzedzić cyfrą 0).

Tabela odniesień efektów kierunkowych do charakterystyk drugiego stopnia Polskiej Ramy Kwalifikacji

program studiów (kierunek studiów): **Environmental Engineering** poziom studiów: **Studia drugiego stopnia** profil studiów: **Ogólnoakademicki**		
symbol kierunkowych efektów uczenia się	efekty uczenia się (treść)	kod składnika opisu
Wiedza: zna i rozumie		
IS_K2_W01	Has in-depth knowledge of selected areas of mathematics, physics, chemistry, biology and earth sciences to the extent needed to describe phenomena and processes related to environmental engineering technologies and has knowledge of spatial planning	P7S_WG1
IS_K2_W02	Student knows at an advanced level the principles of identifying hazards, occupational health and safety, and ergonomics during the construction and operation of installations used in environmental engineering.	P7S_WG1
IS_K2_W03	Has in-depth knowledge of conventional and alternative energy sources and the technical and technological possibilities of their acquisition, conversion and application	P7S_WG1 P7S_WG2
IS_K2_W04	Student knows advanced statistical methods of data analysis and preparation of measurement results	P7S_WG1
IS_K2_W05	Has in-depth knowledge of modeling processes, phenomena and devices, knows numerical and IT methods and tools useful for solving engineering tasks in the field of environmental engineering	P7S_WG1 P7S_WG2
IS_K2_W06	Has in-depth knowledge of modeling processes, phenomena and devices, knows numerical and IT methods and tools useful for solving engineering tasks in the field of environmental engineering	P7S_WG1 P7S_WG2
IS_K2_W07	Has in-depth knowledge of the preparation and use of investment documentation and the organization of construction and installation works; knows the principles of designing environmental engineering processes, facilities and systems, taking into account their impact on the environment and the reliability and safety of use	P7S_WG1
IS_K2_W08	Student has an advanced knowledge of the principles of designing apparatus and devices used in environmental engineering and development trends in the construction of technical installations	P7S_WG1 P7S_WG2
IS_K2_W09	He has an advanced knowledge of the principles of engineering design and computer programming supporting the design of environmental infrastructure	P7S_WG1

IS_K2_W10	Has in-depth knowledge of the observation of phenomena and processes and knows methods of performing measurements of characteristic quantities important from the point of view of environmental engineering; knows methods, techniques and equipment for examining physical, chemical and biological phenomena and has knowledge of the life cycle of devices, facilities and technical systems	P7S_WG1 P7S_WG2
IS_K2_W11	Has specialized knowledge to solve problems related to environmental engineering	P7S_WG2
IS_K2_W12	Has structured, theoretically based knowledge covering key issues in the field of environmental engineering and innovative technologies. Has in-depth knowledge of the role of the natural environment, is aware of threats and knows methods of identifying and reducing them	P7S_WG1
IS_K2_W13	He knows at an advanced level the methods, techniques, tools and materials used in solving complex engineering tasks in the field of environmental engineering	P7S_WG2
IS_K2_W14	Thanks to his advanced knowledge, he knows and understands the fundamental dilemmas of modern civilization	P7S_WK1
IS_K2_W15	Has in-depth knowledge of the application of legal regulations, standards and guidelines in the design and operation of technical facilities as well as understanding the social, economic, legal and other non-technical conditions of engineering activities	P7S_WK2 P7S_WK3
Umiejętności: potrafi		
IS_K2_U01	Student uses the intellectual achievements of other authors, respecting copyrights, using literature, databases and other sources related to technical sciences; can integrate the information obtained, interpret it, draw conclusions and formulate opinions	P7S_UK2 P7S_UO1 P7S_UO2 P7S_UW1
IS_K2_U02	Is able to use statistical methods in data processing and environmental analyses, and uses computer programs to solve engineering tasks	P7S_UW1 P7S_UW2
IS_K2_U03	Is able to prepare in Polish and a foreign language considered to be a basic environmental engineering problem and present it	P7S_UK1 P7S_UK2 P7S_UK3
IS_K2_U04	Can use a foreign language at the B2+ level of the Common European Framework of Reference for Languages and to a higher degree in the field of specialized terminology	P7S_UK3
IS_K2_U05	Is able to independently plan, implement and guide others in the lifelong learning process	P7S_UU
IS_K2_U06	Is able to use information and communication techniques, formulate graphically and descriptively guidelines for the implementation of activities typical of engineering activities	P7S_UW1
IS_K2_U07	Is able to use measuring equipment with the ability to estimate errors, plan and conduct experiments, interpret the obtained results and formulate conclusions	P7S_UW1
IS_K2_U08	Is able to analyze an engineering task and apply simulation methods to solve them, interpret the obtained results and draw conclusions, test hypotheses	P7S_UW1 P7S_UW2
IS_K2_U09	Is able to notice systemic and non-technical aspects when formulating and solving engineering tasks	P7S_UW1

IS_K2_U10	Is able to use investment documentation, assess investment costs, apply the principles of organizing installation works and make a preliminary economic analysis of undertaken engineering activities	P7S_UW1
IS_K2_U11	Is able to solve complex engineering tasks and simple research tasks and critically analyze how they function, as well as evaluate existing technical solutions in the field of environmental engineering, including those containing a research component, and assess the usefulness of various methods and tools for solving them	P7S_UW1 P7S_UW2
IS_K2_U12	Is able - in accordance with given specifications - to design and implement a simple device, facility, system or process typical of environmental engineering using appropriate methods, techniques and tools	P7S_UW2
Kompetencje społeczne: jest gotów do		
IS_K2_K01	Student understands the need for further education and improvement of professional competences; can inspire and organize the learning process of other people	P7S_KK2 P7S_KO1
IS_K2_K02	Student understands the importance of ensuring safe working conditions	P7S_KO1 P7S_KR
IS_K2_K03	Correctly identifies engineering problems and is able to define priorities for professional activities	P7S_KK1
IS_K2_K04	Is able to cooperate and work in a group, taking on various roles in it; understands the importance of team activities and is able to independently plan, implement and guide others in the lifelong learning process. Understands the social role of an engineer and the need to provide the public with reliable information regarding engineering achievements	P7S_KO1
IS_K2_K05	Is aware of the importance and understands non-technical aspects and consequences of engineering activities, including its impact on the environment and the related responsibility for decisions made	P7S_KK2 P7S_KO1 P7S_KO2
IS_K2_K06	Is aware of the importance of professional conduct, compliance with the principles of professional ethics and respect for diversity of views and opinions	P7S_KO1 P7S_KR
IS_K2_K07	Can think and act in a creative, innovative and enterprising way and critically evaluate the received content	P7S_KO2 P7S_KO3

Uniwersalne charakterystyki poziomu 7 Polskiej Ramy Kwalifikacji zostały uwzględnione

Tabela pokrycia charakterystyk drugiego stopnia Polskiej Ramy Kwalifikacji przez kierunkowe efekty uczenia się

program studiów (kierunek studiów): **Environmental Engineering**
poziom studiów: **Studia drugiego stopnia**
profil studiów: **Ogólnoakademicki**

kod składnika opisu	charakterystyki drugiego stopnia Polskiej Ramy Kwalifikacji	symbol kierunkowych efektów uczenia się
Wiedza: zna i rozumie		
P7S_WG1	Zna i rozumie w pogłębionym stopniu – wybrane fakty, obiekty i zjawiska oraz dotyczące ich metody i teorie wyjaśniające złożone zależności między nimi, stanowiące zaawansowaną wiedzę ogólną z zakresu dyscyplin naukowych lub artystycznych tworzących podstawy teoretyczne, uporządkowaną i podbudowaną teoretycznie wiedzę obejmującą kluczowe zagadnienia oraz wybrane zagadnienia z zakresu zaawansowanej wiedzy szczegółowej – właściwe dla programu studiów.	IS_K2_W01 IS_K2_W02 IS_K2_W03 IS_K2_W04 IS_K2_W05 IS_K2_W06 IS_K2_W07 IS_K2_W08 IS_K2_W09 IS_K2_W10 IS_K2_W12
P7S_WG2	Zna i rozumie główne tendencje rozwojowe dyscyplin naukowych lub artystycznych, do których jest przyporządkowany kierunek studiów.	IS_K2_W03 IS_K2_W05 IS_K2_W06 IS_K2_W08 IS_K2_W10 IS_K2_W11 IS_K2_W13
P7S_WK1	Zna i rozumie fundamentalne dylematy współczesnej cywilizacji.	IS_K2_W14
P7S_WK2	Zna i rozumie ekonomiczne, prawne, etyczne i inne uwarunkowania różnych rodzajów działalności zawodowej związanej z kierunkiem studiów, w tym zasady ochrony własności przemysłowej i prawa autorskiego.	IS_K2_W15
P7S_WK3	Zna i rozumie podstawowe zasady tworzenia i rozwoju różnych form przedsiębiorczości.	IS_K2_W15
Umiejętności: potrafi		
P7S_UK1	Potrafi komunikować się na tematy specjalistyczne ze zróżnicowanymi kręgami odbiorców.	IS_K2_U03
P7S_UK2	Potrafi prowadzić debatę.	IS_K2_U01 IS_K2_U03
P7S_UK3	Potrafi posługiwać się językiem obcym na poziomie B2+ Europejskiego Systemu Opisu Kształcenia Językowego oraz specjalistyczną terminologią.	IS_K2_U03 IS_K2_U04
P7S_UO1	Potrafi kierować pracą zespołu.	IS_K2_U01
P7S_UO2	Potrafi współdziałać z innymi osobami w ramach prac zespołowych i podejmować wiodącą rolę w zespołach.	IS_K2_U01

P7S_UU	Potrafi samodzielnie planować i realizować własne uczenie się przez całe życie i ukierunkowywać innych w tym zakresie.	IS_K2_U05
P7S_UW1	Potrafi wykorzystywać posiadaną wiedzę – formułować i rozwiązywać złożone i nietypowe problemy oraz innowacyjnie wykonywać zadania w nieprzewidywalnych warunkach przez: - właściwy dobór źródeł i informacji z nich pochodzących, dokonywanie oceny, krytycznej analizy, syntezy, twórczej interpretacji i prezentacji tych informacji, - dobór oraz stosowanie właściwych metod i narzędzi, w tym zaawansowanych technik informacyjno-komunikacyjnych, - przystosowanie istniejących lub opracowanie nowych metod i narzędzi.	IS_K2_U01 IS_K2_U02 IS_K2_U06 IS_K2_U07 IS_K2_U08 IS_K2_U09 IS_K2_U10 IS_K2_U11
P7S_UW2	Potrafi formułować i testować hipotezy związane z prostymi problemami badawczymi.	IS_K2_U02 IS_K2_U08 IS_K2_U11 IS_K2_U12
Kompetencje społeczne: jest gotów do		
P7S_KK1	Jest gotów do krytycznej oceny posiadanej wiedzy i odbieranych treści.	IS_K2_K03
P7S_KK2	Jest gotów do uznawania znaczenia wiedzy w rozwiązywaniu problemów poznawczych i praktycznych oraz zasięgania opinii ekspertów w przypadku trudności z samodzielnym rozwiązaniem problemu.	IS_K2_K01 IS_K2_K05
P7S_KO1	Jest gotów do wypełniania zobowiązań społecznych, współorganizowania działalności na rzecz środowiska społecznego.	IS_K2_K01 IS_K2_K02 IS_K2_K04 IS_K2_K05 IS_K2_K06
P7S_KO2	Jest gotów do inicjowania działań na rzecz interesu publicznego.	IS_K2_K05 IS_K2_K07
P7S_KO3	Jest gotów do myślenia i działania w sposób przedsiębiorczy.	IS_K2_K07
P7S_KR	Jest gotów do odpowiedzialnego pełnienia ról zawodowych, z uwzględnieniem zmieniających się potrzeb społecznych, w tym: - rozwijania dorobku zawodu, - podtrzymywania etosu zawodu, - przestrzegania i rozwijania zasad etyki zawodowej oraz działania na rzecz przestrzegania tych zasad.	IS_K2_K02 IS_K2_K06

Tabela odniesień kierunkowych efektów uczenia się do uzyskania kompetencji inżynierskich Polskiej Ramy Kwalifikacji

program studiów (kierunek studiów): **Environmental Engineering** poziom studiów: **Studia drugiego stopnia** profil studiów: **Ogólnoakademicki**		
symbol kierunkowych efektów uczenia się	efekty uczenia się (treść)	kod składnika opisu
Wiedza: zna i rozumie		
IS_K2_W01	Has in-depth knowledge of selected areas of mathematics, physics, chemistry, biology and earth sciences to the extent needed to describe phenomena and processes related to environmental engineering technologies and has knowledge of spatial planning	
IS_K2_W02	Student knows at an advanced level the principles of identifying hazards, occupational health and safety, and ergonomics during the construction and operation of installations used in environmental engineering.	
IS_K2_W03	Has in-depth knowledge of conventional and alternative energy sources and the technical and technological possibilities of their acquisition, conversion and application	
IS_K2_W04	Student knows advanced statistical methods of data analysis and preparation of measurement results	
IS_K2_W05	Has in-depth knowledge of modeling processes, phenomena and devices, knows numerical and IT methods and tools useful for solving engineering tasks in the field of environmental engineering	
IS_K2_W06	Has in-depth knowledge of modeling processes, phenomena and devices, knows numerical and IT methods and tools useful for solving engineering tasks in the field of environmental engineering	
IS_K2_W07	Has in-depth knowledge of the preparation and use of investment documentation and the organization of construction and installation works; knows the principles of designing environmental engineering processes, facilities and systems, taking into account their impact on the environment and the reliability and safety of use	
IS_K2_W08	Student has an advanced knowledge of the principles of designing apparatus and devices used in environmental engineering and development trends in the construction of technical installations	
IS_K2_W09	He has an advanced knowledge of the principles of engineering design and computer programming supporting the design of environmental infrastructure	

IS_K2_W10	Has in-depth knowledge of the observation of phenomena and processes and knows methods of performing measurements of characteristic quantities important from the point of view of environmental engineering; knows methods, techniques and equipment for examining physical, chemical and biological phenomena and has knowledge of the life cycle of devices, facilities and technical systems	
IS_K2_W11	Has specialized knowledge to solve problems related to environmental engineering	P7S_WG
IS_K2_W12	Has structured, theoretically based knowledge covering key issues in the field of environmental engineering and innovative technologies. Has in-depth knowledge of the role of the natural environment, is aware of threats and knows methods of identifying and reducing them	
IS_K2_W13	He knows at an advanced level the methods, techniques, tools and materials used in solving complex engineering tasks in the field of environmental engineering	P7S_WG
IS_K2_W14	Thanks to his advanced knowledge, he knows and understands the fundamental dilemmas of modern civilization	P7S_WK
IS_K2_W15	Has in-depth knowledge of the application of legal regulations, standards and guidelines in the design and operation of technical facilities as well as understanding the social, economic, legal and other non-technical conditions of engineering activities	P7S_WK
Umiejętności: potrafi		
IS_K2_U01	Student uses the intellectual achievements of other authors, respecting copyrights, using literature, databases and other sources related to technical sciences; can integrate the information obtained, interpret it, draw conclusions and formulate opinions	
IS_K2_U02	Is able to use statistical methods in data processing and environmental analyses, and uses computer programs to solve engineering tasks	
IS_K2_U03	Is able to prepare in Polish and a foreign language considered to be a basic environmental engineering problem and present it	
IS_K2_U04	Can use a foreign language at the B2+ level of the Common European Framework of Reference for Languages and to a higher degree in the field of specialized terminology	
IS_K2_U05	Is able to independently plan, implement and guide others in the lifelong learning process	
IS_K2_U06	Is able to use information and communication techniques, formulate graphically and descriptively guidelines for the implementation of activities typical of engineering activities	
IS_K2_U07	Is able to use measuring equipment with the ability to estimate errors, plan and conduct experiments, interpret the obtained results and formulate conclusions	P7S_UW1
IS_K2_U08	Is able to analyze an engineering task and apply simulation methods to solve them, interpret the obtained results and draw conclusions, test hypotheses	P7S_UW2
IS_K2_U09	Is able to notice systemic and non-technical aspects when formulating and solving engineering tasks	P7S_UW4

IS_K2_U10	Is able to use investment documentation, assess investment costs, apply the principles of organizing installation works and make a preliminary economic analysis of undertaken engineering activities	P7S_UW2
IS_K2_U11	Is able to solve complex engineering tasks and simple research tasks and critically analyze how they function, as well as evaluate existing technical solutions in the field of environmental engineering, including those containing a research component, and assess the usefulness of various methods and tools for solving them	P7S_UW3
IS_K2_U12	Is able - in accordance with given specifications - to design and implement a simple device, facility, system or process typical of environmental engineering using appropriate methods, techniques and tools	P7S_UW4
Kompetencje społeczne: jest gotów do		
IS_K2_K01	Student understands the need for further education and improvement of professional competences; can inspire and organize the learning process of other people	
IS_K2_K02	Student understands the importance of ensuring safe working conditions	
IS_K2_K03	Correctly identifies engineering problems and is able to define priorities for professional activities	
IS_K2_K04	Is able to cooperate and work in a group, taking on various roles in it; understands the importance of team activities and is able to independently plan, implement and guide others in the lifelong learning process. Understands the social role of an engineer and the need to provide the public with reliable information regarding engineering achievements	
IS_K2_K05	Is aware of the importance and understands non-technical aspects and consequences of engineering activities, including its impact on the environment and the related responsibility for decisions made	
IS_K2_K06	Is aware of the importance of professional conduct, compliance with the principles of professional ethics and respect for diversity of views and opinions	
IS_K2_K07	Can think and act in a creative, innovative and enterprising way and critically evaluate the received content	

Tabela pokrycia kompetencji inżynierskich Polskiej Ramy Kwalifikacji przez kierunkowe efekty uczenia się

program studiów (kierunek studiów): **Environmental Engineering** poziom studiów: **Studia drugiego stopnia** profil studiów: **Ogólnoakademicki**		
kod składnika opisu	charakterystyki drugiego stopnia Polskiej Ramy Kwalifikacji	symbol kierunkowych efektów uczenia się
Wiedza: zna i rozumie		
P7S_WG	Zna i rozumie podstawowe procesy zachodzące w cyklu życia urządzeń, obiektów i systemów technicznych.	IS_K2_W11 IS_K2_W13
P7S_WK	Zna i rozumie podstawowe zasady tworzenia i rozwoju różnych form indywidualnej przedsiębiorczości.	IS_K2_W14 IS_K2_W15
Umiejętności: potrafi		
P7S_UW1	Potrafi planować i przeprowadzać eksperymenty, w tym pomiary i symulacje komputerowe, interpretować uzyskane wyniki i wyciągać wnioski.	IS_K2_U07
P7S_UW2	Potrafi przy identyfikacji i formułowaniu specyfikacji zadań inżynierskich oraz ich rozwiązywaniu: - wykorzystywać metody analityczne, symulacyjne i eksperymentalne, - dostrzegać ich aspekty systemowe i pozatechniczne, wtym aspekty etyczne, - dokonywać wstępnej oceny ekonomicznej proponowanych rozwiązań podejmowanych działań inżynierskich.	IS_K2_U08 IS_K2_U10
P7S_UW3	Potrafi dokonywać krytycznej analizy sposobu funkcjonowania istniejących rozwiązań technicznych i oceniać ich rozwiązania.	IS_K2_U11
P7S_UW4	Potrafi projektować - zgodnie z zadaną specyfikacją - oraz wykonywać typowe dla kierunku studiów proste urządzenia, obiekty, systemy lub realizować procesy, używając odpowiednio dobranych metod, technik, narzędzi i materiałów.	IS_K2_U09 IS_K2_U12

Wydział Mechaniczny

POLITECHNIKA OPOLSKA

Plan studiów
Study plan

Kierunek studiów – Field of study

- ENVIRONMENTAL ENGINEERING

- INŻYNIERIA ŚRODOWISKA

Studia stacjonarne
drugiego stopnia
- wg specjalności

Second Cycle Programme – Full-Time Studies

CHARAKTERYSTYKA OGÓLNA

kierunek studiów: Environmental Engineering

specjalność: Advanced Technologies in Environmental Engineering

profil: Ogólnoakademicki

nazwa wydziału: Wydział Mechaniczny

plan studiów	uchwała Senatu PO z dnia	nr 410 Senatu PO z dn.29.05.2024r.
	obowiązuje od roku akademickiego	**2024/2025**
forma studiów (stacjonarne / niestacjonarne)		**stacjonarne**
poziom studiów (I stopnia / II stopnia)		**II-go stopnia**
czas trwania (w sem.)		**3**
tytuł zawodowy otrzymywany przez absolwenta		**Magister inżynier**
liczba punktów ECTS		**90**

PLAN STUDIÓW – STUDY PLAN

POLITECHNIKA OPOLSKA **WYDZIAŁ MECHANICZNY**	**OPOLE UNIVERSITY OF TECHNOLOGY** **FACULTY OF MECHANICAL ENGINEERING**
Kierunek studiów:	**Field of study:**
ENVIRONMENTAL ENGINEERING	**INŻYNIERIA ŚRODOWISKA**
STUDIA STACJONARNE DRUGIEGO STOPNIA – MAGISTERSKIE	
SECOND CYCLE PROGRAMME - FULL-TIME STUDIES *(Master of Science degree)*	

Specjalność – Specialization:

ADVANCED TECHNOLOGIES IN ENVIRONMENTAL ENGINEERING
- ADVANCED TECHNOLOGIES IN ENVIRONMENTAL ENGINEERING

SEMESTR: 1 (1st Semester)		Liczba godzin zajęć w semestrze; E – egzamin Working time (hours) a semester; E – Exam					ECTS	TYP
Nr	Przedmiot Subject unit – semester curricular	W (Lecture)	C (Practical classes)	L (Laboratory classes)	P (Project)	S (Seminar)		
1.1	Environmental Statistics Statystyka w Inżynierii Środowiska	15	-	15	-	-	2	P
1.2	Advanced Environmental Chemistry Chemia środowiska	15E	-	15	-	-	2	K
1.3	Modern Materials in Engineering Applications Nowoczesne materiały w zastosowaniach inżynierskich	15	-	-	-	-	1	P
1.4	Safety and Reliability of Engineering Systems Niezawodność i bezpieczństwo systemów inżynierskich	15	-	-	-	-	1	P
1.5	Computer Aided Design Komputerowe Wspomaganie Projektowania	15	-	-	30	-	3	P
1.6	Data Bases and Advanced GIS Bazy danych i zaawansowany GIS	15	-	30	-	-	3	P
1.7	Heat and Mass Transfer Processes Design Projektowanie procesów wymiany ciepła i masy	30E	15	-	15	-	5	K
1.8	Environmental Analytics Analityka środowiskowa	15	-	15	-	-	2	K
1.9	Water Treatment Technologies Technologie uzdatniania wody	15E	-	30	15	-	4	K
1.10	Clean Fossil and Alternative Fuels Czyste paliwa konwencjonalne i paliwa alternatywne	15	-	15	-	-	2	K
Przedmioty wybieralne – wymagana liczba p. ECTS w semestrze (Optional units – compulsory ECTS in a semester)							2	
1.11	Technical Foreign Language Język obcy techniczny	-	-	30	-	-	(2)	W
	Technical Foreign Language Język obcy techniczny	-	-	30	-	-	(2)	W
Przedmioty humanistyczne lub społeczne wybieralne – wymagana liczba p. ECTS w semestrze (Optional units – compulsory ECTS in a semester)							3	
1.12	Module I: Communication and Negotiations in Business Komunikacja i negocjacje w biznesie	30	-	-	-	-	(3)	W-HS
	Module I: Ethics in Business Etyka biznesu	30	-	-	-	-	(3)	W-HS
Liczba godzin w semestrze (Number of hours in a semester)		195	225				30	
Razem godzin/ECTS w semestrze (Total hours/ECTS in a semester)		420						

SEMESTR: 2 (2nd Semester)		Liczba godzin zajęć w semestrze; E – egzamin Working time (hours) a semester; E – Exam					ECTS	TYP
Nr	Przedmiot Subject unit – semester curricular	W (Lecture)	C (Practical classes)	L (Laboratory classes)	P (Project)	S (Seminar)		
2.1	Renewable Energy Technologies Technologie Odnawialnych Źródeł Energii	30E	-	15	-	-	4	K
2.2	Bioprocess Technologies in Engineering Technologie Bioprocesowe	30	15	-	-	-	3	P
2.3	Biological Wastewater Treatment Biologiczne oczyszczanie ścieków	15	-	15	15	-	3	K
2.4	Techniques of Air Pollution Control Techniki pomiaru zanieczyszczeń powietrza	15E	-	30	-	-	4	K
2.5	Technologies of Material Reuse Technologie odzysku materiałowego	15E	-	-	-	15	2	K
Przedmioty humanistyczne lub społeczne wybieralne – wymagana liczba p. ECTS w semestrze (Optional units – compulsory ECTS in a semester)							3	
2.6	Module III: Enviromental Law and Policy Prawo i normy ochrony środowiska	15	-	-	-	-	(1)	W-HS
	Module III: Sustainable Development for Engineers Zrównoważony rozwój dla inżynierów	15	-	-	-	-	(1)	W-HS
2.7	Module II: Creativity Training Trening kreatywności	-	-	30	-	-	(2)	W-HS
	Module II: Design Thinking Myślenie projektowe	-	-	30	-	-	(2)	W-HS
Przedmioty wybieralne kierunkowe – wymagana liczba p. ECTS w semestrze (Optional units – compulsory ECTS in a semester)							11	
2.8	Elective subject: Energy Consumption of Industrial Processes Przedmiot wybieralny: Energochłonność procesów przemysłowych	15	15	-	-	-	(2)	W-K
	Elective subject: Engineering of Chemical Reactors Przedmiot wybieralny: Inżynieria Reaktorów Chemicznych	15	15	-	-	-	(2)	W-K
2.9	Elective subject: Mass Exchanger Design Przedmiot wybieralny: Projekt wymiennika masy	15	-	-	15	-	(2)	W-K
	Elective subject: Multiphase Flow in Environmental Technology Przedmiot wybieralny: Przepływy wielofazowe w technologii inżynierii środowiska	15	-	-	15	-	(2)	W-K
2.10	Elective subject: Spatial Planning Przedmiot wybieralny: Planowanie przestrzenne	15	-	-	15	-	(2)	W-K
	Elective subject: Urban design Przedmiot wybieralny: Projektowanie urbanistyczne	15	-	-	15	-	(2)	W-K
2.11	Master`s Thesis Praca magisterska	E -godziny niekontaktowe (un-contact hours)					(5)	W-K

Liczba godzin w semestrze (Number of hours in a semester)	165	180	30	
Razem godzin/ECTS w semestrze (Total hours/ECTS in a semester)	345			

SEMESTR: 3 (3rd Semester)		Liczba godzin zajęć w semestrze; E – egzamin Working time (hours) a semester; E – Exam					ECTS	TYP
Nr	Przedmiot / Subject unit – semester curricular	W (Lecture)	C (Practical classes)	L (Laboratory classes)	P (Project)	S (Seminar)		
3.1	Modelling of Water Distribution Systems / Modelowanie systemów zaopatrzenia w wodę	15	-	15	-	-	2	K
3.2	Environmental Fluid Transport / Transport płynów w Inżynierii Środowiska	15	-	15	15	-	3	K
3.3	Modelling of Pollutant Propagation in Atmosphere / Modelowanie rozprzestrzeniania zanieczyszczeń w atmosferze	15	-	15	-	-	2	K
3.4	Waste to Energy - Application Technologies / Energetyczne wykorzystanie odpadów	15	-	-	-	15	2	K
3.5	Energy Analysis and Feasibility Studies / Analizy energetyczne i studia wykonalności	15	-	-	15	-	2	K
3.6	Modelling of Energy Systems / Modelowanie systemów energetycznych	15E	-	-	15	-	2	K
Przedmioty wybieralne kierunkowe – wymagana liczba p. ECTS w semestrze (Optional units – compulsory ECTS in a semester)							17	
3.7	Diploma Seminar / Seminarium dyplomowe	-	-	-	-	15	(2)	W-K
3.8	Master`s Thesis / Praca magisterska	E -godziny niekontaktowe (un-contact hours)					(15)	W-K
Liczba godzin w semestrze (Number of hours in a semester)		90	120				30	
Razem godzin/ECTS w semestrze (Total hours/ECTS in a semester)		210						

PLAN STUDIÓW RAZEM (TOTAL STUDY PLAN)		ECTS
Łącznie godzin kontaktowych/ECTS w planie studiów / Total contact hours/ECTS in study plan	975	90

STATYSTYKA PROGRAMU STUDIÓW			
Typ	Przedmioty - p. ECTS razem	wg planu	udział
K	Kierunkowe	41	45.56 %
P	Podstawowe	13	14.44 %
W	Wybieralne	2	2.22 %
W-HS	Humanistyczne lub społeczne, wybieralne	6	6.67 %

W-K	Wybieralne kierunkowe	28	31.11 %
	Łącznie:	90	100.00 %

Program studiów dostosowany do kierunkowych efektów uczenia się dla kierunku studiów ENVIRONMENTAL ENGINEERING (studia drugiego stopnia)
Plan i program studiów:
– uchwalony przez Senat PO
– zaopiniowany przez samorząd studencki.

Politechnika Opolska
Wydział Mechaniczny
Opole 2024 r.

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	First

Course Title	Advanced Environmental Chemistry
Nazwa przedmiotu	Chemia środowiska

ECTS points	2	Subject type	K
Language of lecture	angielski	Mode of completing the course	Examination

Course code	A.2.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	S/he has extended and deepened knowledge of mathematics, physics, chemistry and other areas appropriate for the field of study useful for formulating and solving complex tasks related to the field of study.
		2	
	Skills	1	S/he is able to obtain information from the literature, databases and other properly selected sources in English.
		2	S/he is able to plan and carry out experiments, inrpret the results and draw conclusions.
	Social Competence	1	S/he understands the need for the lifelong learning.
		2	

Course Goals The aim of the course is to familiarize students with the basic issues of environmental chemistry.

Programme content The subject provides knowledge on issues related to environmental chemistry. During the module, the student acquires knowledge and skills in the field of chemical processes in the water, soil and atmosphere environments and the circulation of elements in nature. The acquired knowledge allows the use of a systemic approach to assess the state of the natural environment and the degree of its pollution.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broadened and deepened knowledge of chemistry and earth science in terms necessary to describe phenomena and processes related to environmental engineering technology.	IS_K2_W01	W L	A F H
	2	Student knows methods, techniques and equipment for analyzing chemical phenomena from the perspective of engineering and environmental protection	IS_K2_W10	L	F H R
Skills	1	Student obtains information from literature, databases and other sources related to environmental chemistry	IS_K2_U01	L	F H
	2	Student can use statistical methods in data development and environmental analysis	IS_K2_U02	L	F H R
Social Competence	1	Student can understand the necessity of further training, of improving professional skills	IS_K2_K01	W L	A F H
	2	Student can understand the importance of necessity to provide safe working environment	IS_K2_K02	L	F H R

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr hab. inż. Guziałowska-Tic Joanna
Calculation class (C)	0	
Laboratory class (L)	15	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	15
Project (P)	0

Seminar (S)	0
Preparation for classes	7
Preparation of a report/paper/ project/presentation	6
Independent study of the course topics	6
Examination or final colloquium	1
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second
Course Title	Biological Wastewater Treatment
Nazwa przedmiotu	Biologiczne oczyszczanie ścieków

ECTS points	3	Subject type	K
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	C.1.2.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	basic concepts in biology and chemistry
		2	
	Skills	1	self-learning
		2	
	Social Competence	1	A student is able to interact and work in a group, understand the importance of team activities
		2	A student can think and act in a creative and innovative way

Course Goals Introduce students to the unit operations and processes used in the biological treatment of wastewater. Develop understanding of biological treatment models.

Programme content Overview of wastewater treatment processes. Importance of biological treatment methods.Aerobic treatment processes (Activated Sludge, Sequencing Batch Reactors). Anaerobic treatment processes (Anaerobic Digestion, Upflow Anaerobic Sludge Blanket). Comparison of different biological treatment methods.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	S/he has broadened knowledge of methods, techniques, tools and materials used in solving complex engineering tasks in the field of the studies	IS_K2_W07	W L P	C F L
	2	S/hehas knowledge which is necessary to understand the social, economic, legal and other non-technical conditions of engineering activities and their role in engineering practice	IS_K2_W08	W L P	C F L
Skills	1	S/he can communicate using a variety of techniques in the workplace and in other environments, also in English or another foreign language recognized as a international communication language in the field of study	IS_K2_U02	L P	C F L
	2	S/he can use information and communication technologies relevant to the implementation of tasks typical engineering activities	IS_K2_U07	L P	C F L
Social Competence	1	S/he understands the need for lifelong learning, it can inspire and organize the process of other people learning	IS_K2_K01	W L P	C F L
	2	S/he is able to interact and work in a group, taking in her various roles	IS_K2_K03	W L P	C F L

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan

The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr inż. Boguniewicz-Zabłocka Joanna
Calculation class (C)	0	
Laboratory class (L)	15	
Project (P)	15	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	15
Project (P)	15
Seminar (S)	0
Preparation for classes	10
Preparation of a report/paper/ project/presentation	10
Independent study of the course topics	6
Examination or final colloquium	4
Additional contact hours	0
Total student workload	75
Number of contact hours (from the study plan)	45

* hour (class) means 45 minutes

dr hab. inż. Kłosok-Bazan Iwona
Head of the organizational unit
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dr inż. Wydrych Jacek
Dean of Faculty
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Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second
Course Title	Bioprocess Technologies in Engineering

Nazwa przedmiotu	Technologie Bioprocesowe		
ECTS points	3	Subject type	P
Language of lecture	angielski	Mode of completing the course	Course credit
Course code	B.3.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	Basic knowledge of biology, chemistry and chemical calculations.
		2	Basic knowledge in the field of mathematical- natural sciences and technical sciences.
	Skills	1	Student is able to obtain information from literature, databases and other sources related to technical sciences.
		2	Student is able to perform simple chemical calculations.
	Social Competence	1	Student understands the need for further education and improvement of qualifications.
		2	The student demonstrates communication and team cooperation skills.

Course Goals The aim of the course is to present basic issues related to the industrial realization of processes involving microorganisms, plant or animal cells. Description of construction solutions of bioreactors, conditions of their work, description of preparation methods of biotechnological raw materials and methods of separation and purification of bioproducts.

Programme content The subject of Bioprocess Engineering provides students with comprehensive knowledge of the principles and practices involved in the realization of biotechnological processes in industries. Students gain an understanding of fundamental concepts such as microbial growth kinetics, enzyme kinetics, fermentation processes, and downstream processing techniques. Through theoretical learning and practical applications, students develop the skills necessary to design, optimize, and scale up bioprocesses for the production of valuable products. Students learn about the integration of bioprocess engineering with other disciplines.such as chemical engineering, biochemistry, and microbiology. By the end of the course, students are equipped with the knowledge and skills required to address challenges in bioprocess engineering.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student knows the broadened design rules of devices and equipment used in environmental engineering and is familiar with development trends in construction of environmental protection installations.	IS_K2_W12	W C	C
	2	Student has deepened knowledge in the field of innovative technologies used in environmental engineering and related science disciplines, knows the principle of sustainable development.	IS_K2_W11	W C	C
	3	Student knows methods, techniques, tools and materials used in solving complex engineering tasks in the field of environmental engineering.	IS_K2_W13	W C	C
Skills	1	Student obtains information from literature, databases and other sources related to technical sciences; Student can integrate obtained information, interpret, draw conclusions and formulate opinions.	IS_K2_U01	C	C
	2	Student uses computer programs to solve engineering tasks.	IS_K2_U02	C	C
	3	Student has autonomous learning skills, works individually and in a team.	IS_K2_U05	C	C
Social Competence	1	Student is able to interact and work in a group performing different roles; Student can understand the importance of collective action.	IS_K2_K04	C	C
	2	Student can understand the important role of an engineer.	IS_K2_K05	W C	C
	3	Student can understand the necessity of further training, improving professional skills, is able to inspire and organize learning process of others.	IS_K2_K01	W C	C

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname

Lecture (W)	30	dr inż. Płaczek Małgorzata
Calculation class (C)	15	
Laboratory class (L)	0	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	30
Calculation class (C)	15
Laboratory class (L)	0
Project (P)	0
Seminar (S)	0
Preparation for classes	15
Preparation of a report/paper/ project/presentation	13
Independent study of the course topics	0
Examination or final colloquium	2
Additional contact hours	0
Total student workload	75
Number of contact hours (from the study plan)	45

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
Head of the organizational unit
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dr inż. Wydrych Jacek
Dean of Faculty
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Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering		
Profile of Education	General Academic		
Level of study	Second Cycle Studies		
Specialization	Advanced Technologies in Environmental Engineering		
Form of Study	Full-Time Studies		
Semester	First		
Course Title	Clean Fossil and Alternative Fuels		
Nazwa przedmiotu	Czyste paliwa konwencjonalne i paliwa alternatywne		
ECTS points	2	Subject type	K

Language of lecture	angielski	Mode of completing the course	Course credit
Course code	C.4.2.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	The student has basic knowledge in the field of chemistry and thermodynamics
		2	
	Skills	1	The student gathers information from literature, databases, and other sources, and is able to analyze them
		2	
	Social Competence	1	Student posseses a self-learning skills
		2	Student is able to work in a team

Course Goals The aim of the course is to familiarize students with the technologies of clean fossil and alternative fuels.

Programme content The scope of the classes includes issues related, among others, to coal conversion, biofuels, and synthetic fuels.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has specialized knowledge for solving problems related to environmental engineering	IS_K2_W13	W L	C H P R
	2	Student has broadened knowledge about role of environment, is aware of risks and knows methods of their identification and limitation.	IS_K2_W12	W L	C H P R
Skills	1	Student is able to communicate in the range relating to environmental engineering using different techniques in various environments, also in English language.	IS_K2_U04	L	H P R
	2	Student can make a critical analysis of the functioning and evaluate the existing technical solutions used in environmental engineering.	IS_K2_U11	L	H P R
Social Competence	1	Student understand needs of self-learning	IS_K2_K01	W L	C H P R
	2	Student can correctly identify engineering problems and is able to set priotities for professional activities.	IS_K2_K03	W L	C H P R

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr hab. inż. Wzorek Małgorzata
Calculation class (C)	0	
Laboratory class (L)	15	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	15
Project (P)	0
Seminar (S)	0
Preparation for classes	5
Preparation of a report/paper/ project/presentation	5
Independent study of the course topics	10
Examination or final colloquium	0
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
Head of the organizational unit
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Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic

Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	First

Course Title	Computer Aided Design
Nazwa przedmiotu	Komputerowe Wspomaganie Projektowania

ECTS points	3	Subject type	P
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	A.5.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	Understanding of Technical Drawing Principles: Familiarity with technical drawing principles, including geometric shapes, projections, dimensioning, and tolerancing, is beneficial.
		2	Mathematics and Geometry Knowledge: A solid understanding of mathematics, particularly geometry, is important for CAD work. Concepts such as angles, measurements, and geometric transformations are frequently used.
	Skills	1	Spatial Visualization Skills: Strong spatial visualization skills are advantageous for understanding three-dimensional objects and their representations.
		2	Proficiency in CAD Software (Optional): While not mandatory for beginners, familiarity with CAD software such as AutoCAD, SolidWorks, or CATIA can be helpful. However, introductory courses often assume no prior experience with specific CAD tools.
		3	Problem-Solving Skills: The ability to solve complex problems and think critically is important for troubleshooting issues that may arise during the CAD design process.
	Social Competence	1	A student understands the need to learn and gather knowledge
		2	S/he is adapted to work both individually and in a team

Course Goals The aim of the course is to practice the basics and extend the skills of correct solid modeling in the 3D CAD system. Students learn how to design individual parts, perform presentations, technical documentation, and teams.

Programme content Introduction to CAD Principles: Understanding the fundamental concepts and principles of Computer Aided Design, including software interface navigation, basic drawing commands, and file management. 2D Drafting and Design: Learning to create and modify 2D drawings using CAD software, including techniques for drawing lines, circles, arcs, and text, as well as dimensioning and annotation tools.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	A student has an advanced knowledge of methods, techniques, tools used to solve simple engineering tasks in the field of three-dimensional modeling, preparation of technical documentation	IS_K2_W02	W	C D
	2				
Skills	1	A student has the ability to self-education, can obtain data from the literature.	IS_K2_U02	P	K P R
	2	A student can - in accordance with the given specification - design and implement a simple device, object, system typical for the studied field of study, using the right methods, techniques and tools	IS_K2_U12	P	K P R
Social Competence	1	A student understands the need to learn throughout life; can inspire and organize the learning process of other people	IS_K2_K05	W	C D
	2				

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr inż. Pochwała Sławomir
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	30	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	30
Seminar (S)	0
Preparation for classes	10

Preparation of a report/paper/ project/presentation	19
Independent study of the course topics	0
Examination or final colloquium	1
Additional contact hours	0
Total student workload	75
Number of contact hours (from the study plan)	45

* hour (class) means 45 minutes

dr hab. inż. Kłosok-Bazan Iwona
Head of the organizational unit
(stamp/signature)

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Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	First
Course Title	Data Bases and Advanced GIS
Nazwa przedmiotu	Bazy danych i zaawansowany GIS

ECTS points	3	Subject type	P
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	A.6.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	Bases of GIS
		2	
	Skills	1	Proficient computer skills
		2	A student creates and edits vector layers in the GIS program. Ability to perform basic attribute and spatial queries
	Social Competence	1	A student notes the complexity of metadata documentation and databases
		2	S/he is persistent in the study of GIS and pogramming

Course Goals This course provides students with advanced knowledge in computer and information science for geographic information systems.

Programme content The course offers students the opportunity to study and critically examine the outcome of state-of-the-art research projects in the area of spatial and spatiotemporal data management.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has a deepened knowledge of database normalization and denormalization and query optimization.	IS_K2_W04	W L	C H I J
	2	Student has knowledge of the problems associated with the efficient management of large amounts of data, including distributed and non-relational databases.	IS_K2_W05	W L	C H I J
	3	Student understands the issues related to the database systems security.	IS_K2_W09	W L	C H I J
Skills	1	Student is able to design a database system that meets the performance requirements.	IS_K2_U02	L	H I J
	2				
Social Competence	1	Student is aware the risk of a database systems.	IS_K2_K05	L	H I J
	2				

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr inż. Wydrych Jacek
Calculation class (C)	0	
Laboratory class (L)	30	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15

Calculation class (C)	0
Laboratory class (L)	30
Project (P)	0
Seminar (S)	0
Preparation for classes	5
Preparation of a report/paper/ project/presentation	21
Independent study of the course topics	4
Examination or final colloquium	0
Additional contact hours	0
Total student workload	75
Number of contact hours (from the study plan)	45

* hour (class) means 45 minutes

dr hab. inż. Kłosok-Bazan Iwona
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Dean of Faculty
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Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Third
Course Title	Diploma Seminar
Nazwa przedmiotu	Seminarium dyplomowe

ECTS points	2	Subject type	W-K
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	C.5.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	All the knowledge gained during the courses of study
		2	
	Skills	1	Ability to think independently and organize work
		2	
	Social Competence	1	Student understands the need for lifelong learning, it can inspire and organize the process of other people learning
		2	Student is aware of and understands the validity of the non-technical aspects and effects of engineering activities, including its impact on theenvironment, and the associated responsibility for decisions

Course Goals The purpose of the course is to prepare students to defend Master thesis.

Programme content Students' own presentations related to the development of issues related to the diploma exam and realisation of the diploma thesis.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broadened and deepened knowledge of selected fields of mathematics, physics, chemistry, biology and earth science in terms necessary to describe phenomena and processes related to environmental engineering technology.	IS_K2_W 01	S	N O P R
	2	Student has knowledge of process, phenomena and device modeling in environmental engineering.	IS_K2_W 05	S	N O P R
	3	Student knows the designing rules of devices and equipment used in environmental engineering and is familiar with development	IS_K2_W 10	S	N O P R
Skills	1	Student obtains information from literature, databases and other sources related to technical sciences; Student can integrate obtained information, interpret, draw conclusions and formulate opinions.	IS_K2_U 01	S	N O P R
	2	Student can prepare in English considered as basic, a set problem of environmental engineering.	IS_K2_U 04	S	N O P R
	3	Student is able to prepare and present considered as basic, an oral presentation of detailed engineering issues.	IS_K2_U 03	S	N O P R
Social Competence	1	Student can understand the necessity of further training, of improving professional skills, is able to inspire and organize learning process of	IS_K2_K 01	S	N O P R
	2	Student can think and act in a creative, innovative and entrepreneurial way.	IS_K2_K 07	S	N O P R

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	0	dr hab. inż. Kłosok-Bazan Iwona
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	0	
Seminar (S)	15	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	0
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	0
Seminar (S)	15
Preparation for classes	15
Preparation of a report/paper/ project/presentation	20
Independent study of the course topics	0
Examination or final colloquium	0
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	15

* hour (class) means 45 minutes

dr hab. inż. Kłosok-Bazan Iwona
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic

Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second

Course Title	Elective subject: Energy Consumption of Industrial Processes
Nazwa przedmiotu	Przedmiot wybieralny: Energochłonność procesów przemysłowych

ECTS points	2	Subject type	W-K
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	E.4.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	Basic concepts related to energy, work, power, and thermodynamics.
		2	Basic knowledge of industrial processes, their operation, and applications.
		3	Basic knowledge of statistical concepts and the ability to analyze data.
	Skills	1	Skills in algebra and calculus important for modeling energy flows and efficiencies.
		2	Ability to analyze data related to energy consumption.
	Social Competence	1	Student is competent in creative thinking
		2	Student is competent and has ability to cooperate

Course Goals Getting familliar with issues of energy consumption of industrial processes.

Programme content Basic concepts related to energy in an industrial context, such as energy consumption, energy efficiency, and energy balance. Analysis of various industrial sectors regarding their specific energy consumption. Strategies and technologies for improving energy efficiency in industry, such as heat recovery, process optimization, equipment modernization, and implementation of energy management systems.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broad and deep knowledge in the range needed to describe processes applied in industry installations.	IS_K2_W01	W C	C G
	2	Student knows numerical methods and computer tools useful in solving engineering tasks in the field of energy consumption in industry.	IS_K2_W05	W C	C G
	3	Student has broadened knowledge essential for solving problems of energy supplying and consumption in industry plants.	IS_K2_W11	W C	C G
	4	Student knows methods, techniques and tools applied for solving complex energy consumption issues in industry installations and processes.	IS_K2_W13	W C	C G
Skills	1	Student uses analytic methods for energy consumption data processing	IS_K2_U02	C	C G
	2	Student is able to carry analysis of industrial energy consuming process as well as apply different simulation methods for solving energy management problems in industry	IS_K2_U08	C	C G
	3	Student has ability to solve complex engineering issues and recognize efficiency of industry processes regarding energy consumption.	IS_K2_U11	C	C G
Social Competence	1	Student understands the necessity of further training and improving professional skills as a basis for better understanding energy consumption processes in industry.	IS_K2_K01	W C	C G
	2	Student correctly identifies engineering problems and is able to set priorities for professional activities in industry energy sector	IS_K2_K03	W C	C G
	3	Student recognizes importance of being professional in all kinds of actions leading to optimal energy consumption in industry.	IS_K2_K06	W C	C G

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname

Lecture (W)	15	dr inż. Tańczuk Mariusz
Calculation class (C)	15	
Laboratory class (L)	0	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	15
Laboratory class (L)	0
Project (P)	0
Seminar (S)	0
Preparation for classes	10
Preparation of a report/paper/ project/presentation	0
Independent study of the course topics	8
Examination or final colloquium	2
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
Head of the organizational unit
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dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second
Course Title	Elective subject: Engineering of Chemical Reactors
Nazwa przedmiotu	Przedmiot wybieralny: Inżynieria Reaktorów Chemicznych

ECTS points	2	Subject type	W-K

Language of lecture	angielski	Mode of completing the course	Course credit
Course code	E.4.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	Student is able to do simple chemical and process calculations.
		2	Student has knowledge of thermodynamic calculations.
		3	Student recognizes systems and equipment.
	Skills	1	Student is able to obtain information from the literature.
		2	Student understands the methods of processes balancing and can interpret the results of calculations.
	Social Competence	1	Student understands the need for further training and improve their skills.
		2	

Course Goals The aim of the course is to provide students with knowledge about the basics of chemical reactor engineering, as a branch of chemical engineering that deals with the design, construction, operation, and optimization of reactors used in industrial chemical processes.

Programme content The subject provides knowledge on issues related to the current state of knowledge and the latest achievements in the field of chemical engineering of reactors. The student acquires knowledge related to the design, construction, operation, and optimization of chemical reactors used in various industrial processes. Emphasis is placed on understanding the principles of homogeneous and heterogeneous systems, reactor types, catalysts, and operating conditions. The student develops competences in analyzing and interpreting reactor performance data, conducting reactor design calculations, and optimizing reactor processes for desired outcomes. Throughout the module, the student gains practical skills in conducting chemical engineering calculations relevant to reactor design and operation.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student knows the designing rules of devices and equipment used in environmental engineering and is familiar with development trends in construction of environmental protection installations.	IS_K2_W08	W C	C
	2	Student has current knowledge in the field of chemical engineering of reactors and its role in sustainable development.	IS_K2_W12	W C	C
	3	Student knows methods, techniques, tools and materials used in solving complex engineering tasks in the field of chemical engineering.	IS_K2_W13	W C	C
Skills	1	Student obtains information from literature, databases, and other sources within the field of science and chemical reactors engineering; Student can integrate obtained information, interpret, draw conclusions, and formulate opinions relating field of chemical reactor engineering.	IS_K2_U01	C	C
	2	Student uses computer programs to solve engineering tasks.	IS_K2_U02	C	C
	3	Student has autonomous learning skills, works individually and in a team, and is proficient in reactor engineering calculations.	IS_K2_U05	C	C
Social Competence	1	Student is able to interact and work in a group performing different roles; Student can uderstand the importance of collective action.	IS_K2_K04	W C	C
	2	Student can understand the necessity of further training, an improving professional skills, is able to inspire and organize learning process of others.	IS_K2_K01	W C	C

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname

Lecture (W)	15	dr inż. Płaczek Małgorzata
Calculation class (C)	15	
Laboratory class (L)	0	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	15
Laboratory class (L)	0
Project (P)	0
Seminar (S)	0
Preparation for classes	10
Preparation of a report/paper/ project/presentation	0
Independent study of the course topics	10
Examination or final colloquium	0
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
Head of the organizational unit
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dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering		
Profile of Education	General Academic		
Level of study	Second Cycle Studies		
Specialization	Advanced Technologies in Environmental Engineering		
Form of Study	Full-Time Studies		
Semester	Second		
Course Title	Elective subject: Mass Exchanger Design		
Nazwa przedmiotu	Przedmiot wybieralny: Projekt wymiennika masy		
ECTS points	2	Subject type	W-K

Language of lecture	angielski	Mode of completing the course	Course credit

Course code	E.5.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	The student has a fundamental understanding of thermodynamics and fluid dynamics.
		2	
	Skills	1	The student is capable of analyzing information gathered from various sources and conducting process calculations.
		2	
	Social Competence	1	The student recognizes the need for continuous learning and personal development.
		2	The student is competent in their ability to cooperate within a team.

Course Goals The aim of the subject is to provide comprehensive knowledge regarding the design of devices for mass transfer processes.

Programme content The subject provides knowledge related to the mechanisms of mass transfer processes and devices used for their implementation in various industries. Students gain essential skills for designing such devices, selecting internal equipment for apparatuses, understanding their construction, and determining operational parameters.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	The student has expanded knowledge of mass exchanger design.	IS_K2_W10	W P	C L
	2	At an advanced level, S/he is familiar with the methods, techniques, tools, and materials used in solving complex engineering tasks in the field of mass transfer device design.	IS_K2_W13	P	L
Skills	1	The student uses the intellectual achievements of other authors with respect for copyright laws, drawing from literature, databases, and other sources related to technical sciences. The student can integrate acquired information, interpret it, and formulate opinions in the realm of devices and phenomena associated with mass transfer.	IS_K2_U01	P	L
	2	Student possesses the ability to design a mass exchanger, including selecting appropriate materials, determining optimal dimensions, analyzing performance requirements, and ensuring compatibility with industry standards and regulations.	IS_K2_U12	P	L
Social Competence	1	Student properly interprets issues related to the design of mass exchangers.	IS_K2_K03	W P	C L
	2	Student can cooperate and work in a group.	IS_K2_K04	P	L

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr inż. Płaczek Małgorzata
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	15	
Seminar (S)	0	

Student workload

Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	15
Seminar (S)	0
Preparation for classes	8
Preparation of a report/paper/ project/presentation	10
Independent study of the course topics	0
Examination or final colloquium	2
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
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Dean of Faculty
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Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second

Course Title	Elective subject: Multiphase Flow in Environmental Technology
Nazwa przedmiotu	Przedmiot wybieralny: Przepływy wielofazowe w technologii inżynierii środowiska

ECTS points	2	Subject type	W-K
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	E.5.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	Basic knowledge in the field of mathematical, fluid mechanics, technical sciences.
		2	
	Skills	1	Student is able to perform simple mathematical calculations.
		2	Student is able to obtain information from literature, databases and other sources related to technical sciences.
	Social Competence	1	Student understands the need for further education and improvement of qualifications.
		2	The student demonstrates communication and team cooperation skills.

Course Goals The aim of the course is to introduce students to fundamental concepts surrounding multiphase flows and their occurrence in various industrial processes and apparatuses.

Programme content The subject provides knowledge on issues related to multiphase flows phenomena in environmental technology. Within the module, students acquire knowledge and skills necessary for understanding, analyzing, and calculating systems with multiphase flows in environmental engineering applications. This includes the study of various multiphase flow regimes, such as gas-liquid, liquid-liquid, and gas-solid systems. Students learn to design equipment and installations where multiphase flows are used. Through theoretical learning and practical applications, students develop the ability to address challenges and optimize processes involving multiphase flows in environmental technology.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broadened knowledge of phenomena and processes observation and knows the methods of measurement of characteristic quantities relevant to the environmental engineering.	IS_K2_W10	W P	C L
	2	Student demonstrates structured and theoretically underpinned basic knowledge which includes main issues of environmental engineering. Student has knowledge about role of environment, is aware of risks and knows methods of their identification and limitation.	IS_K2_W12	W P	C L
Skills	1	S/he utilizes the intellectual achievements of other authors , accessing literature, databases, and other sources related to technical sciences, including multiphase flows; capable of integrating obtained information, interpreting it, drawing conclusions, and formulating opinions.	IS_K2_U01	P	L
	2	The student is able to conduct analysis of engineering tasks involving multiphase flows, apply simulation methods to reach solutions, interpret the results, and draw conclusions based on them.	IS_K2_U08	P	L
	3	S/he can solve complex engineering tasks, as well as conduct critical analysis of their functioning, evaluate existing technical solutions in the field of environmental engineering, especially those covering issues of multiphase fows, and assess the utility of various methods and tools used for their resolution.	IS_K2_U11	P	C L
Social Competence	1	Student can correctly identify engineering problems and is able to set priotities for professional activities.	IS_K2_K03	W P	C L
	2	Student is capable of thinking and acting in a creative, innovative, and entrepreneurial manner, as well as critically evaluating received content in area of multiphase flows.	IS_K2_K07	W P	C L

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan

The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr inż. Płaczek Małgorzata
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	15	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	15
Seminar (S)	0
Preparation for classes	5
Preparation of a report/paper/ project/presentation	10
Independent study of the course topics	5
Examination or final colloquium	0
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second
Course Title	Elective subject: Spatial Planning

Nazwa przedmiotu	Przedmiot wybieralny: Planowanie przestrzenne		
ECTS points	2	Subject type	W-K
Language of lecture	angielski	Mode of completing the course	Course credit
Course code	E.6.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	Bases of GIS
		2	Bases of CAD
	Skills	1	Proficient computer skills
		2	A student creates, edits, and uses the basic attributes of vector layers in GIS program
		3	A student creates 3D objects in any CAD program
	Social Competence	1	A student notes the complexity of spatial problems.
		2	A student is persistent in the study of spatial problems.

Course Goals The primary purpose of the course is to prepare students to become creative, problem-solving professionals. You'll develop the necessary skills and knowledge to address the complex urban challenges of our age and understand, plan and deliver future urban design in an integrative way.

Programme content Familiarizing the student with spatial planning instruments: direct - organizational, legal, investment, social; indirect - economic, marketing and promotion, monitoring. Familiarization with the means of implementing rational shaping of space by the adopted directions of spatial planning.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	The student has broadened knowledge about the system of planning documents in Poland and selected countries, their relevance and legal force.	IS_K2_W15	W	C
	2	Student knows the legal and methodological basis of spatial planning including landscaping.	IS_K2_W01	W	C
Skills	1	Student is able to analyze planning documents in terms of investment execution and landscape design.	IS_K2_U10	W P	C K L M
	2	The student is able to perform the graphical part of the planning documentation.	IS_K2_U06	P	K L M
Social Competence	1	Student has competence in active participation in the spatial planning process, including landscaping.	IS_K2_K04	P	K L M
	2				

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr inż. Wydrych Jacek
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	15	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	15
Seminar (S)	0
Preparation for classes	0
Preparation of a report/paper/ project/presentation	11
Independent study of the course topics	8
Examination or final colloquium	1
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Kłosok-Bazan Iwona
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic

Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second

Course Title	Elective subject: Urban design
Nazwa przedmiotu	Przedmiot wybieralny: Projektowanie urbanistyczne

ECTS points	2	Subject type	W-K
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	E.6.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	Bases of GIS
		2	Bases of CAD
	Skills	1	Proficient computer skills
		2	A student creates, edits, and uses the basic attributes of vector layers in GIS program
		3	A student creates 3D objects in any CAD program
	Social Competence	1	A student notes the complexity of spatial problems.
		2	A student is persistent in the study of spatial problems.

Course Goals The primary purpose of the course is to prepare students to become creative, problem-solving professionals. You'll develop the necessary skills and knowledge to address the complex urban challenges of our age and understand, plan and deliver future urban design in an integrative way.

Programme content Basics and theory of urban design. Urban planning elements. City landscape. Shaping urban space. Principles of shaping urban functions of high complexity. Functional and spatial structure of the city. Rules for areas classified as residential, utility, and natural areas in the city. Shaping development. Principles of individual location of buildings and functions in the city

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	The student acquires knowledge about the aesthetic, technical, and legal requirements for shaping urban development and infrastructure and about the spatial planning system in Poland.	IS_K2_W10	W	C
	2	The student knows the legal and methodological basis of urban design including landscaping.	IS_K2_W15	W	C
Skills	1	Student is able to analyze planning documents in terms of investment execution and landscape design.	IS_K2_U07	W P	C K L M
	2	The student is able to perform the graphical part of the planning documentation.	IS_K2_U10	P	K L M
Social Competence	1	Student has competence in active participation in the spatial planning process, including landscaping.	IS_K2_K04	P	K L M
	2				

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr inż. Wydrych Jacek
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	15	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	15
Seminar (S)	0
Preparation for classes	0

Preparation of a report/paper/ project/presentation	11
Independent study of the course topics	8
Examination or final colloquium	1
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

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dr inż. Wydrych Jacek
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Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Third
Course Title	Energy Analysis and Feasibility Studies
Nazwa przedmiotu	Analizy energetyczne i studia wykonalności

ECTS points	2	Subject type	K
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	C.4.1.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	Understanding fundamental principles of physics, especially those related to energy, work, power, and energy transformations. Familiarity with various forms of energy and their properties.
		2	Understanding of fundamental economic concepts, such as cost-benefit analysis, project valuation, risk analysis, and investment profitability assessment.
		3	Knowledge of energy markets and energy policy is also beneficial.
	Skills	1	Ability to analyze data, draw conclusions, and formulate recommendations based on energy analysis.
		2	Proficiency in using tools and computer programs for modeling energy systems and assessing the feasibility of energy projects.
	Social Competence	1	Student correctly identifies engineering problems as well as economic issues of energy conversion cases.
		2	

Course Goals To provide students with knowledge of energy analyzes and techno-economic feasibility studies in particular.

Programme content Methods and tools used in analyzing energy consumption and production. Assessment of energy efficiency of existing and planned facililty and systems. Methods of cost-benefit analysis for energy projects. Evaluation of investment returns in various energy technologies. Considering economic factors in decision-making for energy projects.Discounted method of C&B analysis.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broadened knowledge of conventional and alternative energy sources and of technical and technological possibilities of generating, converting and application.	IS_K2_W03	W P	C K L M O
	2	Student knows numerical and computer methods and tools useful in solving engineering tasks in the field of environmental engineering.	IS_K2_W05	W P	C K L M O
	3	Student has knowledge of preparation and application of investment documentation, organization of construction and installation works.	IS_K2_W07	W P	C K L M O
	4	Student knows the principles of processes, objects and systems of environmental engineering systems design, including their influence on the environment, reliability and safety of use.	IS_K2_W12	W	C
Skills	1	Student can recognize the system and non-technical aspects during formulating and solving engineering tasks.	IS_K2_U09	P	C K L M O
	2	Student can use the investment documentation, evaluate the costs of investment, apply the priciples of the organization of installation works.	IS_K2_U10	P	C K L M O
	3	Student can make a preliminary economic analysis of engineering activities.	IS_K2_U10	P	C K L M O
Social Competence	1	Student can prepare in Polish and in a foreign language, considered as basic, a set problem of environmental engineering.	IS_K2_K01	P	K L M
	2	Student understands the importance of necessity to provide safe working environment	IS_K2_K02	W P	C K L M
	3	Student can correctly identify engineering problems and is able to set priotities for professional activities.	IS_K2_K03	W P	C K L M
	4	Student is aware of the importance and it can understand the non-technical aspects and effects of engineering actions, including their impact on the environment, and the associated responsibility for decisions.	IS_K2_K05	W P	C K L M

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan

The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr inż. Tańczuk Mariusz
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	15	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	15
Seminar (S)	0
Preparation for classes	6
Preparation of a report/paper/ project/presentation	12
Independent study of the course topics	0
Examination or final colloquium	2
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

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Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	First
Course Title	Environmental Analytics

Nazwa przedmiotu	Analityka środowiskowa		
ECTS points	2	Subject type	K
Language of lecture	angielski	Mode of completing the course	Course credit
Course code	B.4.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	S/he has extended and deepened knowledge of mathematics, physics, chemistry and other areas appropriate for the field of study useful for formulating and solving complex tasks related to the field of study.
		2	
	Skills	1	S/he able to obtain information from the literature, databases and other properly selected sources in English.
		2	S/he is able to plan and carry out experiments, inrpret the results and draw conclusions.
	Social Competence	1	S/he understands the need for the lifelong leraning.
		2	

Course Goals The aim of the course is to familiarize students with the basic issues of environmental analytics.

Programme content The subject provides knowledge on issues related to analytical methods used in environmental engineering. During the module, the student acquires knowledge and skills in the field of, among others, analytical methods such as gravimetric analysis, titration, electrochemistry, spectrophotometry and chromatography. The acquired knowledge allows for its practical use and evaluation of various environmental samples using the known analytical methods.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broadened and deepened knowledge of chemistry and earth science in terms necessary to describe phenomena and processes related to environmental engineering technology.	IS_K2_W01	W L	C F H
	2	Student knows methods, techniques and equipment for analyzing chemical phenomena from the perspective of engineering and environmental protection	IS_K2_W10	L	F H R
Skills	1	Student obtains information from literature, databases and other sources related to environmental analytics	IS_K2_U01	W	C
	2	Student can use statistical methods in data development and environmental analysis	IS_K2_U02	L	F H
Social Competence	1	Student can understand the necessity of further training, of improving professional skills	IS_K2_K01	W L	C F H
	2	Student can understand the importance of necessity to provide safe working environment	IS_K2_K02	L	F H R

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr hab. inż. Guziałowska-Tic Joanna
Calculation class (C)	0	
Laboratory class (L)	15	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	15
Project (P)	0

Seminar (S)	0
Preparation for classes	7
Preparation of a report/paper/ project/presentation	7
Independent study of the course topics	6
Examination or final colloquium	0
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

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Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Third
Course Title	Environmental Fluid Transport
Nazwa przedmiotu	Transport płynów w Inżynierii Środowiska

ECTS points	3	Subject type	K
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	C.2.2.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	Student has knowledge of selected fields of mathematics, physics, Fluid Mechanics
		2	
	Skills	1	Student can uses computer programs to solve engineering tasks
		2	
	Social Competence	1	Student can correctly identify engineering problems and it is able to set priotity of professional activities
		2	

Course Goals Preparing students to use CFD software

Programme content The basics of physical and mathematical modeling, as well as numerical methods and solving algebraic equations. Problems of pneumatic and hydraulic transport.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broadened and deepened knowledge of selected fields of mathematics, physics, chemistry, biology and earth science in terms necessary to describe phenomena and processes related to environmental engineering technology	IS_K2_W01	W L P	C H K L
	2	Student knows statistical methods of data analysis and measurement results development.	IS_K2_W04	W L P	C H K L
	3	Student knows numerical methods and specialized programs for flow calculations	IS_K2_W06	W L P	C H K L
Skills	1	Student can use the measurement devices, is able to estimate errors.	IS_K2_U07	L P	H K L
	2	Student uses computer programs to solve engineering tasks	IS_K2_U08	L P	H K L
Social Competence	1	Student can understand the necessity of further training, of improving professional skills, is able to inspire and organize learning process of others	IS_K2_K01	W L P	C H K L
	2	Student is able to interact and work in a group performing different roles; Student can uderstand the importance of collective action	IS_K2_K04	W L P	C H K L

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan

The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr inż. Borsuk Grzegorz
Calculation class (C)	0	
Laboratory class (L)	15	
Project (P)	15	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	15
Project (P)	15
Seminar (S)	0
Preparation for classes	10
Preparation of a report/paper/ project/presentation	0
Independent study of the course topics	18
Examination or final colloquium	2
Additional contact hours	0
Total student workload	75
Number of contact hours (from the study plan)	45

* hour (class) means 45 minutes

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Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	First
Course Title	Environmental Statistics

Nazwa przedmiotu	Statystyka w Inżynierii Środowiska		
ECTS points	2	Subject type	P
Language of lecture	angielski	Mode of completing the course	Course credit
Course code	A.1.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	Student has knowledge of selected fields of mathematics and physics to extent necessary to describe phenomena and processes related to environmental engineering technology
		2	
	Skills	1	Student can use computer programs to solve engineering tasks
		2	
	Social Competence	1	Student can correctly identify engineering problems and it is able to set priotity of professional activities
		2	

Course Goals to know basic knowledge of statistics

Programme content Basics of descriptive statistics, probability distributions, correlation, regression, and binomial distributions.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broadened and deepened knowledge of selected fields of mathematics, physics, chemistry, biology and earth science in terms necessary to describe phenomena and processes related to environmental engineering technology	IS_K2_W01	W L	C H
	2	Student knows statistical methods of data analysis and measurement results development.	IS_K2_W04	W L	C H
Skills	1	Student can use statistical methods in data development and environmental analysis	IS_K2_U02	W L	C H
	2	Student can use computer programs to solve engineering tasks	IS_K2_U06	W L	C H
Social Competence	1	Student can understand the necessity of further training, of improving professional skills, is able to inspire and organize learning process of others.	IS_K2_K01	W L	C H
	2	Student is able to interact and work in a group performing different roles; Student can uderstand the importance of collective action.	IS_K2_K04	W L	H

Methods of verification of learning outcomes: A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr inż. Borsuk Grzegorz
Calculation class (C)	0	
Laboratory class (L)	15	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	15
Project (P)	0
Seminar (S)	0
Preparation for classes	4
Preparation of a report/paper/ project/presentation	10
Independent study of the course topics	4
Examination or final colloquium	2
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

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Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering

Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	First

Course Title	Heat and Mass Transfer Processes Design
Nazwa przedmiotu	Projektowanie procesów wymiany ciepła i masy

ECTS points	5	Subject type	K
Language of lecture	angielski	Mode of completing the course	Examination

Course code	B.1.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	The student has a fundamental understanding of thermodynamics, fluid dynamics, and mechanical engineering principles.
		2	
	Skills	1	The student is capable of analyzing information gathered from various sources and conducting process calculations.
		2	
	Social Competence	1	The student recognizes the need for continuous learning and personal development.
		2	The student understands the societal role of an engineer, acknowledging their responsibility in meeting social needs, contributing to technological advancement, and promoting sustainable development.

Course Goals The aim of the subject is to provide comprehensive knowledge regarding the application of thermal and diffusive processes in various industrial devices and installations.

Programme content The subject provides knowledge about mechanism of heat and mass transfer processes and the devices used for their implementation in industry. Students acquire the skills necessary for design devices and installations in which heat and mass transport processes occur. The acquired knowledge enables students to use a systemic approach to ensuring the continuity and safety of processes in the designed industrial installations and devices, thus strengthening their sense of engineering responsibility.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	The student knows the expanded design principles of devices and equipment used in environmental engineering, especially those related to heat and mass transfer, and is familiar with the development trends in the construction of environmental protection installations.	IS_K2_W05	W C P	A C L
	2	Student knows the broadened rules of engineering design and computer programmmes which support designing of environmental infrustructure.	IS_K2_W08	W C P	A C L
	3	Student knows broadened methods, techniques, tools and materials used in solving complex engineering tasks in the field of environmental engineering.	IS_K2_W13	C P	C L
Skills	1	The student gathers information from literature, databases, and other sources related to technical sciences, especially devices for heat and mass transfer. The student can integrate the acquired information, interpret it, draw conclusions, and formulate opinions.	IS_K2_U01	C P	C L
	2	Student is able to carry out the analysis of engineering tasks and apply simulation methods leading to the solution, interpret the results, draw conclusions and test the hypothesis.	IS_K2_U08	C P	C L
	3	Student can - in accordance with set specification - design and implement a simple device, object, system or process typical for environmental engineering using appropriate methods, techniques	IS_K2_U12	C P	C L
Social Competence	1	Student can correctly identify engineering problems and is able to set priotities for professional activities.	IS_K2_K01	W C P	A C L
	2	The student is able to interact and work effectively within a group, assuming different roles as necessary. Furthermore, the student understands the importance of collective action in the design of installations and devices for heat and mass transfer processes	IS_K2_K04	C P	A C L
	3	Student can think and act in a creative, innovative and entrepreneurial way.	IS_K2_K07	W C P	A C L

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	30	dr inż. Płaczek Małgorzata
Calculation class (C)	15	
Laboratory class (L)	0	
Project (P)	15	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	30
Calculation class (C)	15
Laboratory class (L)	0
Project (P)	15
Seminar (S)	0
Preparation for classes	35
Preparation of a report/paper/ project/presentation	22
Independent study of the course topics	6
Examination or final colloquium	2
Additional contact hours	0
Total student workload	125
Number of contact hours (from the study plan)	60

* hour (class) means 45 minutes

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Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Third

Course Title	Master`s Thesis			
Nazwa przedmiotu	Praca magisterska			
ECTS points	15	Subject type		W-K
Language of lecture	angielski	Mode of completing the course		Examination
Course code	C.6.2	Subject related to scientific research/pract. profess. prepar. (Y/N)		T

Preliminary requirements of the course	Knowledge	1	Student has knowledge acquired during the previous period of education especially connected with identification of environmental engineering problems
		2	
	Skills	1	Student has skills acquired during the previous period of education
		2	
	Social Competence	1	Student has competences acquired during training
		2	

Course Goals Completion of the final version of the diploma thesis with the support of the assigned supervisor.

Programme content Implementation of tasks arising from the Topic Card of the Diploma Thesis

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has expanded and deepened knowledge of selected areas of mathematics, physics, chemistry, biology and earth sciences to describe phenomena and processes related to environmental engineering technologies	IS_K2_W01	P	B R
	2	Student specialized knowledge to solve environmental engineering problems	IS_K2_W11	P	B R
	3	Student has extensive knowledge of phenomena and processes and knows how to perform measurements of characteristic sizes that are important for environmental engineering; Knows the methods, techniques, and apparatus for testing physical, chemical and biological phenomena, and has basic knowledge of the life cycle of devices, facilities, and systems	IS_K2_W10	P	B R
	4	student has knowledge to understand the fundamental dilemmas of modern civilization	IS_K2_W14	P	B R
Skills	1	Student acquires data from literature, databases and other sources suitable to the MSc thesis	IS_K2_U01	P	B R
	2	Student can use the measuring equipment	IS_K2_U07	P	B R
	3	Student is able to solve complex engineering tasks and simple research tasks and critically analyze how work, as well as assess existing environmental engineering solutions, including the research component, and assess the suitability of the various methods and tools for solving the problems	IS_K2_U10	P	B R
Social Competence	1	Student is aware of the importance of fair dealing in his professional activities	IS_K2_K05	P	B R
	2	Student thinks and works in a creative and entrepreneurial way	IS_K2_K07	P	B R
	3	Student is aware of the importance of professional conduct, respect for professional ethics and respect for diversity of views and opinion	IS_K2_K02	P	B R

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan

The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	0	dr hab. inż. Wzorek Małgorzata
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	0
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	0
Seminar (S)	0
Preparation for classes	73
Preparation of a report/paper/ project/presentation	50
Independent study of the course topics	250
Examination or final colloquium	2
Additional contact hours	0
Total student workload	375
Number of contact hours (from the study plan)	0

* hour (class) means 45 minutes

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Politechnika Opolska
Wydział Mechaniczny
Karta Opisu Przedmiotu

Kierunek studiów	Environmental Engineering
Profil kształcenia	Ogólnoakademicki
Poziom studiów	Studia drugiego stopnia
Specjalność	Advanced Technologies in Environmental Engineering
Forma studiów	Studia stacjonarne
Semestr studiów	Drugi
Nazwa przedmiotu	Master`s Thesis

Subject Title	Praca magisterska		
Liczba punktów ECTS	5	Typ przedmiotu	W-K
Język wykładowy	polski	Tryb zaliczenia przedmiotu (E/Z)	Egzamin

Kod przedmiotu	C.6.1.	Przedmiot powiązany z badaniami naukowymi/ prakt. przygot. zawodowym (T/N)	T

Oczekiwania wstępne w zakresie przedmiotu	Wiedza	1	Student has knowledge acquired during the previous period of education
		2	
	Umiejętności	1	Student has skills acquired during the previous period of education
		2	
	Kompetencje społeczne	1	Student has social skills acquired during the previous period of education
		2	

Cele przedmiotu: The aim of the course is to conduct a literature review and gather initial data for the diploma thesis being undertaken.

Treści programowe zapewniające uzyskanie efektów uczenia się dla przedmiotu: Completion of the first stage of the diploma thesis with the support of the assigned supervisor.

Efekty uczenia się dla przedmiotu - po zakończonym cyklu studiów			Odniesienie do kierunkowych efektów uczenia się	Formy realizacji (W, C, L, P, S)	Formy weryfikacji efektów uczenia się
Wiedza	1	Student has an in-depth knowledge of basic sciences, which is useful for carrying out the diploma thesis.	IS_K2_W01	P	D R
	2	Student has in-depth knowledge of tools useful in solving engineering problems in environmental engineering	IS_K2_W05	P	D R
	3	Student possesses in-depth knowledge of observing phenomena and processes and is familiar with methods of conducting measurements characteristic of environmental engineering for physical quantities	IS_K2_W10	P	D R
	4	Student possesses advanced knowledge enabling the solving of environmental engineering problems	IS_K2_W13	P	D R
Umiejętności	1	Student gathers information from literature, databases, and other sources relevant to the diploma thesis.	IS_K2_U01	P	D R
	2	Student is able to operate measuring equipment	IS_K2_U07	P	D R
	3	Student is able to use technical documentation	IS_K2_U10	P	D R
Kompetencje społeczne	1	Student is aware of the importance of ethical conduct in their professional activities.	IS_K2_K06	P	D R
	2				

Formy weryfikacji efektów uczenia się:

A-egzamin pisemny, B-egzamin ustny, C-zaliczenie pisemne, D-zaliczenie ustne, E-na podstawie ocen cząstkowych z odpowiedzi ustnych, F-na podstawie ocen cząstkowych z odpowiedzi pisemnych, G-praca kontrolna, H-ocena ze sprawozdań, I-ocena z przebiegu ćwiczeń, J-ocena z przygotowania do ćwiczeń, K-ocena z przebiegu realizacji projektu, L-ocena pisemnej realizacji projektu, M-ocena z obrony projektu, N-ocena formy prezentacji, O-ocena treści prezentacji, P-obserwacja aktywności na zajęciach, R-obserwacja systematyczności.

Godziny w planie studiów		
Forma zajęć	Liczba godzin zajęć w semestrze	Opiekun (koordynator) przedmiotu (tytuł/stopień naukowy/ tytuł zawodowy, imię i nazwisko)
Wykład	0	dr hab. inż. Wzorek Małgorzata
Ćwiczenia	0	
Laboratorium	0	
Projekt	0	
Seminarium	0	

Nakład pracy studenta

Rodzaje zajęć studenta*	Średnia liczba godzin* przeznaczonych na zrealizowane aktywności
Wykład	0
Ćwiczenia	0
Laboratorium	0
Projekt	0
Seminarium	0
Przygotowanie do zajęć	0
Przygotowanie sprawozdania/referatu/ projektu/prezentacji	0
Samodzielne studiowanie tematyki zajęć	125
Egzamin lub kolokwium zaliczeniowe	0
Dodatkowe godziny kontaktowe	0
Łączny nakład pracy studenta	125
Liczba godzin kontaktowych (z planu studiów)	0

* godzina (lekcyjna) oznacza 45 minut

dr hab. inż. Hapanowicz Jerzy
Kierownik jednostki organizacyjnej/bezpośredni przełożony
(pieczęć/podpis)

dr inż. Wydrych Jacek
Dziekan Wydziału
(pieczęć/podpis)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Third

Course Title	Modelling of Energy Systems
Nazwa przedmiotu	Modelowanie systemów energetycznych

ECTS points	2	Subject type	K
Language of lecture	angielski	Mode of completing the course	Examination

Course code	C.4.3.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	Understanding basic concepts related to energy, work, power, and thermodynamics.
		2	Knowledge of different forms of energy and energy transformations
	Skills	1	Basic skills of computer programming and simulation techniques for implementing energy system models.
		2	Making energy balances
		3	Using statistical methods and data analysis techniques for validating energy system models and interpreting simulation results
	Social Competence	1	Student posseses a self-learning skills and is able to work both individually and in a team
		2	

Course Goals Getting familliar with methodoloygy and tools for modelling of basic energy systems for heat and electricity generation

Programme content Overview of energy conversion processes and energy flow within systems. Emergy systems modelling possibilities and tools. Energy systems operational hour-by-hour simulations. Analytic project where students develop and analyze energy system models based on real-world scenarios.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broadened knowledge of conventional and alternative energy sources and of technical and technological possibilities of generating, converting and application.	IS_K2_W01	W P	A K L M O
	2	Student knows numerical and computer methods and tools useful in solving engineering tasks in the field of energy generation and conversion engineering.	IS_K2_W05	W P	A K L M O
	3	Student has broadened knowledge of how to design processes and instalations for energy conversion systems.	IS_K2_W07	W P	A K L M O
	4	Student knows methods, techniques and equipment for analyzing physical, chemical and biological phenomena from the perspective of engineering and environmental protection, has basic knowledge of life cycle of equipment, objects and technical systems	IS_K2_W10	W P	A K L M O
Skills	1	Student uses computer programs to solve engineering tasks.	IS_K2_U02	P	K L M O
	2	Student is able to communicate in the range relating to environmental engineering using different techniques in various environments, also in a foreign language.	IS_K2_U06	P	K L M O
	3	Student uses information and communication techniques necessary for the implementation of typical engineering activities	IS_K2_U08	P	K L M O
	4	Student can - in accordance with set specification - design and implement a simple device, object, system or process typical for environmental engineering using appropriate methods, techniques and tools.	IS_K2_U12	P	K L M O
Social Competence	1	Student understands the necessity of further training, of improving professional skills, is able to inspire and organize learning process of others.	IS_K2_K01	W P	A K L M O
	2	Student correctly identifies engineering problems and is able to set priotities for professional activities.	IS_K2_K03	W P	A K L M O
	3	Student is able to interact and work in a group performing different roles; Student can uderstand the importance of collective action.	IS_K2_K04	W P	A K L M O

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr inż. Tańczuk Mariusz
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	15	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	15
Seminar (S)	0
Preparation for classes	5
Preparation of a report/paper/ project/presentation	11
Independent study of the course topics	0
Examination or final colloquium	4
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic

Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Third

Course Title	Modelling of Pollutant Propagation in Atmosphere
Nazwa przedmiotu	Modelowanie rozprzestrzeniania zanieczyszczeń w atmosferze

ECTS points	2	Subject type	K
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	C.2.3.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	Bases of GIS
		2	Gas dynamics
	Skills	1	S/he proficient computer skills
		2	S/he creates, edits, and uses the basic attributes of vector layers in GIS program
		3	S/he creats base forms of gas conservation equations
	Social Competence	1	S/he notes the complexity of pollutant propagation problems.
		2	S/he is persistent in the study of pollutant transport in atmosphere.

Course Goals The course aims to give the students an overview of the air pollutant issue (gases, particles, smell). The main focus will be on chemical and noise related aspects in the air pollutant issue. Chemical transformation of gases in the atmosphere and the dispersion of pollution at the local and global scale (processes and dispersion calculations).

Programme content Students learn of the types of pollutants emitted into the air from natural and anthropogenic sources and the effects of air pollution. They know the factors that influence the spread of pollutants in the atmosphere and can choose the appropriate method of modeling the propagation of pollutants in the atmosphere depending on the type of emitter and emitted pollutants.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Students have broadened their knowledge of the types of pollutants emitted into the air from natural and anthropogenic sources and the effects of air pollution.	IS_K2_W12	W L	C H I J
	2	The student knows the factors that influence the spread of pollutants in the atmosphere.	IS_K2_W01	W L	C H I J
Skills	1	Students can interpret the results of their research.	IS_K2_U08	L	H I J
	2	Students can choose the appropriate method of modeling the propagation of pollutants in the atmosphere depending on the type of emitter and emitted pollutants.	IS_K2_U06	L	H I J
Social Competence	1	Student is aware of the effects of air pollution and the need to reduce emissions.	IS_K2_K05	W L	C H I J
	2	Student understands the need for continuous monitoring of regulatory changes and self-education in new technologies.	IS_K2_K01	W L	C H I J

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr inż. Wydrych Jacek
Calculation class (C)	0	
Laboratory class (L)	15	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	15
Project (P)	0

Seminar (S)	0
Preparation for classes	2
Preparation of a report/paper/ project/presentation	10
Independent study of the course topics	7
Examination or final colloquium	1
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Kłosok-Bazan Iwona
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Third
Course Title	Modelling of Water Distribution Systems
Nazwa przedmiotu	Modelowanie systemów zaopatrzenia w wodę

ECTS points	2	Subject type	K
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	C.1.3.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	Knowledge of the basic physical laws of hydrostatics and hydrodynamics
		2	Basic knowledge of flow in pipes
	Skills	1	Working with computer
		2	
	Social Competence	1	Capacity for undertaking continuous learning and adapting to new circumstances
		2	

Course Goals This course provides an introduction to the hydraulic modelling of water distribution systems. This is followed by an introduction to using EPANET as a calculation tool (EPANET is used as demonstration software although the basic principles taught are applicable to any water distribution modelling software). The course covers the basic theory followed by practical computer sessions strengthening the material covered.

Programme content Simulation model concept, brief history. Fluid properties, statics & dynamics, energy losses, friction, resistance coefficients. Computer simulation of pipe network systems (EPANET or similar software). Analysis of various water distribution systems.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broadened knowledge of methods, techniques and software used in designing of water networks	IS_K2_W09	W L	C H
	2				
Skills	1	Student can formulate and solve engineering tasks and simple problems relating to water networks analysis and simulation	IS_K2_U08	L	H P
	2				
Social Competence	1	Student can think and act in a creative, innovative and entrepreneurial way.	IS_K2_K07	W L	H P
	2				

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname

Lecture (W)	15	dr inż. Spyra Andrzej
Calculation class (C)	0	
Laboratory class (L)	15	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	15
Project (P)	0
Seminar (S)	0
Preparation for classes	7
Preparation of a report/paper/ project/presentation	7
Independent study of the course topics	6
Examination or final colloquium	0
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Kłosok-Bazan Iwona
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering		
Profile of Education	General Academic		
Level of study	Second Cycle Studies		
Specialization	Advanced Technologies in Environmental Engineering		
Form of Study	Full-Time Studies		
Semester	First		
Course Title	Modern Materials in Engineering Applications		
Nazwa przedmiotu	Nowoczesne materiały w zastosowaniach inżynierskich		
ECTS points	1	Subject type	P

Language of lecture	angielski	Mode of completing the course	Course credit
Course code	A.3.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	A student knows basic natural and man-made materials
		2	
	Skills	1	A student has the ability to acquire knowledge and learn independently
		2	
	Social Competence	1	Student wants to improve the competences
		2	

Course Goals Providing information about modern materials used in engineering practice. Developing the ability to apply the principles of a circular economy in the design, operation and recycling of modern engineering materials.

Programme content The subject provides knowledge about the properties of modern materials used in industrial and engineering practice. During the module, the student acquires knowledge about the relationship between product durability and the characteristics of materials. The acquired knowledge allows you to take into account the aging of materials in changing environmental conditions.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has deep knowledge in the field of innovative technologies used in environmental engineering , knows the principle of sustainable development.	IS_K2_W12	W	C
	2	Student knows methods, techniques and materials used in solving complex engineering tasks in the field of environmental engineering.	IS_K2_W13	W	C
Skills	1				
	2				
Social Competence	1	Student can correctly identify engineering problems and is able to set priotities for professional activities.	IS_K2_K03	W	C
	2	Student can understand the social role of an engineer and can understand the need for reliable public information about the achievements of engineering.	IS_K2_K04	W	C

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr hab. inż. Król Anna
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	0
Seminar (S)	0
Preparation for classes	0
Preparation of a report/paper/ project/presentation	0
Independent study of the course topics	10
Examination or final colloquium	0
Additional contact hours	0
Total student workload	25
Number of contact hours (from the study plan)	15

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic

Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	First

Course Title	Module I: Communication and Negotiations in Business
Nazwa przedmiotu	Komunikacja i negocjacje w biznesie

ECTS points	3	Subject type	W-HS
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	E.1.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	In aacordance with PRK level 6
		2	
	Skills	1	In aacordance with PRK level 6
		2	
	Social Competence	1	In aacordance with PRK level 6
		2	

Course Goals The aim of the subject is to impart knowledge in the field of communication process and negotiation.

Programme content The subject encompasses familiarization with content enabling the acquisition of knowledge and practical skills in the following areas: a) communication, including the communication process, verbal and nonverbal communication, communication errors; b) negotiation process, including key negotiator skills and negotiation techniques.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broadened knowledge about understanding social, economical and law aspects in the filed of communication and negotiations	IS_K2_W15	W	C P R
	2				
Skills	1	-			
	2				
Social Competence	1	Student understands importance of good communication in the group.	IS_K2_K04	W	C P R
	2				

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	30	dr inż. Klemens Brygida
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	30
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	0
Seminar (S)	0
Preparation for classes	25
Preparation of a report/paper/ project/presentation	0
Independent study of the course topics	20
Examination or final colloquium	0
Additional contact hours	0
Total student workload	75
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. Solga Brygida
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic

Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	First

Course Title	Module I: Ethics in Business
Nazwa przedmiotu	Etyka biznesu

ECTS points	3	Subject type	W-HS
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	E.1.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	According to the Polish Qualifications Framework, level 6.
		2	
	Skills	1	According to the Polish Qualifications Framework, level 6.
		2	
	Social Competence	1	Before beginning to study the subject, the student should have the basic skills of teamwork.
		2	

Course Goals The overall objective of this classes is to make students aware of the ethical dimension of economy, management and business.

Programme content The concept of moral norms and ethics. Philosophical realism and idealism, ethical absolutism and ethical relativism. The concept and types of responsibility. The importance of ethics in decision-making. Ethical problems in business. Ways to solve ethical problems.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student knows and understands the fundamental dilemmas of modern civilization, in particular (s)he knows the notion of corporate social responsibility.	IS_K2_W14	W	C P
	2	Student has broadened knowledge of the application of laws, norms and guidelines in the design and operation of technical objects as well as the understanding of social, economic, legal and other non-technical determinants of engineering activity, in particular (s)he knows various ethical positions.	IS_K2_W15	W	C P
Skills	1	not applicable			
	2				
Social Competence	1	Student is aware of the importance and understanding of the non-technical aspects and effects of engineering activities, including its environmental impact and the resulting responsibility for its decisions, in particular, (s)he knows the different concepts of responsibility and ways of solving moral dilemmas in business and engineering.	IS_K2_K05	W	C P
	2	Student is able to think and act in a creative, innovative and entrepreneurial way and critically evaluate the content he receives, in particular (s)he understands the notion of creativity and innovation and can think independently.	IS_K2_K07	W	C P

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	30	dr Zamelski Piotr
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	0	
Seminar (S)	0	

Student workload

Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	30
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	0
Seminar (S)	0
Preparation for classes	20
Preparation of a report/paper/ project/presentation	0
Independent study of the course topics	25
Examination or final colloquium	0
Additional contact hours	0
Total student workload	75
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. Solga Brygida
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second

Course Title	Module II: Creativity Training
Nazwa przedmiotu	Trening kreatywności

ECTS points	2	Subject type	W-HS
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	E.2.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	The student has general knowledge in the field of technical operations
		2	
	Skills	1	The student can gather and analyze information.
		2	
	Social Competence	1	Student understands the need to improve competencies
		2	

Course Goals The aim of the classes is to familiarize students with methods of creative thinking in engineering applications.

Programme content The course content includes introducing students to various methods of creative thinking, tools, and techniques that develop the ability to think "outside of the box," which is used to generate innovative ideas.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has the broadened knowledge necessary to understand non-technical conditions of engineering activities	IS_K2_W15	L	I P
	2				
Skills	1	Student is able to perceive system and non-technical aspects of formulating and solving engineering tasks in accordance with the principle of sustainable development.	IS_K2_U09	L	I P
	2				
Social Competence	1	Student can think and work in a creative way	IS_K2_K07	L	D I P
	2				

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname

Lecture (W)	0	dr hab. inż. Wzorek Małgorzata
Calculation class (C)	0	
Laboratory class (L)	30	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	0
Calculation class (C)	0
Laboratory class (L)	30
Project (P)	0
Seminar (S)	0
Preparation for classes	10
Preparation of a report/paper/ project/presentation	5
Independent study of the course topics	5
Examination or final colloquium	0
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second
Course Title	Module II: Design Thinking
Nazwa przedmiotu	Myślenie projektowe

ECTS points	2	Subject type	W-HS

Language of lecture	angielski	Mode of completing the course	Course credit
Course code	E.2.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	The student is familiar with the methods, techniques, and tools required for solving engineering tasks
		2	
	Skills	1	The student possesses the ability to analyze data and draw conclusions
		2	The student adeptly presents the results of their work and can justify the choice of adopted solutions and tools used
	Social Competence	1	The student has the ability to work in teams and communicate effectively
		2	

Course Goals The purpose of the course is to familiarize students with the Design Thinking method.

Programme content The course content includes an introduction to design using the Design Thinking method. This method emphasizes creativity, empathy, and iterative solution testing. Understanding the principles of creating innovative and sustainable solutions.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student knows the methods, techniques, tools and materials used to solve complex engineering tasks in the field of environmental engineering	IS_K2_W13	L	C P R
	2				
Skills	1	Student can perform an engineering task analysis and apply different methods to solve them	IS_K2_U08	L	C P R
	2	Student according to the specification - design and implement a simple device, system typical of environmental engineering using appropriate methods, techniques and tools.	IS_K2_U12	L	C P R
Social Competence	1	Student properly identifies engineering problems and is able to prioritize occupational activities	IS_K2_K03	L	C P R
	2	Student is aware of the importance and understanding of non-technical aspects of engineering activities	IS_K2_K05	L	C P R

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	0	dr hab. inż. Wzorek Małgorzata
Calculation class (C)	0	
Laboratory class (L)	30	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	0
Calculation class (C)	0
Laboratory class (L)	30
Project (P)	0
Seminar (S)	0
Preparation for classes	5
Preparation of a report/paper/ project/presentation	10
Independent study of the course topics	5
Examination or final colloquium	0
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
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dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic

Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second

Course Title	Module III: Enviromental Law and Policy
Nazwa przedmiotu	Prawo i normy ochrony środowiska

ECTS points	1	Subject type	W-HS
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	E.3.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	General knowledge of environmental protection
		2	
	Skills	1	The ability to think critically
		2	
	Social Competence	1	A student understands the need to improve professional skills
		2	

Course Goals This course provides an introduction to European environmental law, regulation, and policy

Programme content The subject includes such issues as water law, protection of the earth's surface, waste law, and air emissions.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Studen has broadened knowledge of the application of environmental law and the understand the legal and non-technical conditions of engineering activities	IS_K2_W15	W	D
	2				
Skills	1	do not concern			
	2				
Social Competence	1	Student is aware of the importance of the effects of the engineering activity, including its environmental impact and the resulting responsibility for its decisions	IS_K2_K05	W	D
	2				

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr hab. inż. Kłosok-Bazan Iwona
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	0
Seminar (S)	0
Preparation for classes	5
Preparation of a report/paper/ project/presentation	0
Independent study of the course topics	5
Examination or final colloquium	0
Additional contact hours	0
Total student workload	25
Number of contact hours (from the study plan)	15

* hour (class) means 45 minutes

dr hab. inż. Kłosok-Bazan Iwona
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dr inż. Wydrych Jacek
Dean of Faculty
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Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic

Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second

Course Title	Module III: Sustainable Development for Engineers
Nazwa przedmiotu	Zrównoważony rozwój dla inżynierów

ECTS points	1	Subject type	W-HS
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	E.3.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	Specialized knowledge to solve problems related to environmental engineering
		2	
	Skills	1	A student can speak a foreign language at the B2+ level of the Common European Framework of Reference for Languages and at a higher level of specialized terminology
		2	
	Social Competence	1	A student understands the need for further education.
		2	

Course Goals Basic terms connected with Sustainable Development rules implementation. Product life cycle, sustainable design, environmental impact assesment.

Programme content Sustainable Development goals, product life cycle, sustainable design, environmental impact assessment.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has specialized knowledge to solve problems related to environmental engineering, especially sustainable development	IS_K2_W11	W	C
	2				
Skills	1	do not concern			
	2				
Social Competence	1	Student is aware of the importance of professional conduct, respect for professional ethics and respect for diversity of views and opinions	IS_K2_K06	W	C
	2				

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr hab. inż. Kłosok-Bazan Iwona
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	0
Seminar (S)	0
Preparation for classes	5
Preparation of a report/paper/ project/presentation	0
Independent study of the course topics	5
Examination or final colloquium	0
Additional contact hours	0
Total student workload	25
Number of contact hours (from the study plan)	15

* hour (class) means 45 minutes

dr hab. inż. Kłosok-Bazan Iwona
Head of the organizational unit
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dr inż. Wydrych Jacek
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Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic

Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second

Course Title	Renewable Energy Technologies
Nazwa przedmiotu	Technologie Odnawialnych Źródeł Energii

ECTS points	4	Subject type	K
Language of lecture	angielski	Mode of completing the course	Examination

Course code	B.2.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	Student knows the potential of fossil fuels and renewable energy sources locally and globally. He knows the economic and social role of using renewable energy sources
		2	
	Skills	1	Student is able to analyze existing technical solutions used in environmental engineering
		2	Student has the ability to self-education; Works individually and in team
	Social Competence	1	Student properly identifies engineering problems
		2	

Course Goals The aim of the course is to provide basic knowledge about non-conventional generation of heat and electricity from renewable energy sources such as wind, solar, hydro, geothermal and biomass.

Programme content The course provides extensive knowledge of modern technologies using renewable energy sources, such as solar, wind, hydroelectric, geothermal and biomass. Students in the course acquire the skills necessary to design, implement and evaluate the efficiency of energy systems based on renewable sources. Special attention is paid to the technical, economic and environmental analysis of aspects of the use of renewable energy sources, as well as issues related to energy storage and the integration of these systems with existing energy infrastructure. The course program also includes a discussion of challenges and opportunities related to energy transition, energy policy and sustainable development. By combining theoretical knowledge with practical case studies, the course aims to equip students with the competencies to actively participate in the energy transition process, promoting innovative and sustainable approaches to energy issues.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has extensive and deep knowledge of selected disciplines in mathematics, physics and earth sciences to the extent necessary to describe phenomena and processes related to RES technologies and has basic knowledge of spatial planning	IS_K2_W01	W L	B C
	2	Student has expertise in conventional and renewable energy, technical and technological capabilities for their acquisition, conversion and application	IS_K2_W04	W L	B C
	3	Student has broadened knowledge in modeling processes, phenomena and devices; Knows numerical and IT methods and tools useful for solving engineering tasks in RES	IS_K2_W05	W L	B C
	4	Student has a structured, theoretically developed general knowledge covering key RES issues and innovative technologies. He has knowledge of the role of man in the natural environment, he is aware of threats and knows the methods of their identification and limitation	IS_K2_W12	W L	B C
Skills	1	Student can use the achievements of other authors with respect for copyrights; Using literature, databases and other sources related to technical sciences, it can integrate the information obtained, interpret it, draw conclusions and formulate opinions.	IS_K2_U01	W L	B C
	2	Student is able to use RES measuring instruments with the ability to estimate errors, plan and conduct experiments, interpret the results and formulate conclusions.	IS_K2_U07	W L	B C
	3	Student can carry out an analysis of the RES engineering task and apply simulation methods leading to their solution, interpret the results and draw conclusions, test the hypothesis	IS_K2_U08	W	B

Social Competence	1	Student understands the need for further education in the field of RES, the raising of professional competences; He can inspire and organize the learning process of others	IS_K2_K01	W L	B
	2	Student can cooperate and work in a group, taking on different roles; Understands the importance of teamwork and is able to plan, execute and direct others in lifelong learning. Understands the social role of an engineer and understands the need to provide reliable information to the public on RES achievements	IS_K2_K04	L	C

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan

The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	30	dr inż. Anweiler Stanisław
Calculation class (C)	0	
Laboratory class (L)	15	
Project (P)	0	
Seminar (S)	0	

Student workload

Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	30
Calculation class (C)	0
Laboratory class (L)	15
Project (P)	0
Seminar (S)	0
Preparation for classes	30
Preparation of a report/paper/ project/presentation	8
Independent study of the course topics	15
Examination or final colloquium	2
Additional contact hours	0
Total student workload	100
Number of contact hours (from the study plan)	45

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	First

Course Title	Safety and Reliability of Engineering Systems
Nazwa przedmiotu	Niezawodność i bezpieczństwo systemów inżynierskich

ECTS points	1	Subject type	P
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	A.4.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	Basic knowledge of the construction and operating principles of industrial equipment
		2	Basics of physical chemistry and knowledge of the properties of chemically active substances, so-called dangerous substances
	Skills	1	Ability to perceive formal and non-technical aspects in engineering issues
		2	
	Social Competence	1	Awareness of the hazards of machinery, equipment and hazardous substances used and processed in industrial processes
		2	

Course Goals Describe the principles of design and operation of equipment used in environmental engineering, taking into account the principles of safe operation of the apparatus and its reliability. Evaluating the nature of operational hazards and discussing the risks associated with the operation of industrial installations.

Programme content As part of the course, students will acquire knowledge in the field of technical reliability of technical facilities and industrial safety. They will learn the basics of reliability theory, how to determine reliability, and the principles of building and analyzing structural schemes. They learn about the risks associated with the implementation of industrial processes, with particular emphasis on explosions, fires and releases of hazardous substances. They will gain knowledge in the field of counteracting these threats, through the management of process security and the use of technical safeguards. Understand the basics of process risk analysis and assessment.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student knows rules of identifying danger, security, hygiene of work and ergonomics during the construction and installation operations used in environmental engineering.	IS_K2_W02	W	C
	2	Student has broadened knowledge of using legal regulations, norms and guidelines in designing and operation of technical objects.	IS_K2_W15	W	C
Skills	1	do not concern			
	2				
Social Competence	1	A student understands the importance of ensuring safe working conditions for people operating industrial equipment and devices and other people exposed to the effects of possible industrial accidents	IS_K2_K02	W	C
	2	A student is aware of the importance and understands non-technical aspects and consequences of engineering activities, including its impact on the environment and the related responsibility for decisions made	IS_K2_K05	W	C

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr hab. inż. Dyga Roman
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	0

Project (P)	0
Seminar (S)	0
Preparation for classes	0
Preparation of a report/paper/ project/presentation	0
Independent study of the course topics	10
Examination or final colloquium	0
Additional contact hours	0
Total student workload	25
Number of contact hours (from the study plan)	15

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
Head of the organizational unit
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dr inż. Wydrych Jacek
Dean of Faculty
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Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	First
Course Title	Technical Foreign Language
Nazwa przedmiotu	Język obcy techniczny

ECTS points	2	Subject type	W
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	D.1.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	The student has lexical and grammar knowledge at B2+ level according to the the Common European Framework of Reference for Languages (CEFR)
		2	
	Skills	1	The student can use the English language at B2+ level according to the Common European Framework of Reference for Languages (CEFR)
		2	
	Social Competence	1	Students are able to evaluate their performance against the background of other students and are aware of the means of expression requiring further improvement
		2	Students are aware of their level of competence and prformance

Course Goals Acquiring language skills appropriate for the studied field of Science in accordance with the standards set for C level of the Common European Framework of Reference for Languages

Programme content In the course students acquire technical vocabulary in the area of Environmental Engineering as well as the language of work environment. As part of the module, the student acquires real-world knowledge, develops four language skills - listening, speaking, reading and writing, and extends the ability to seek, use and select tinformation from different sources .The course is focused on active implementing technical and academic vocabulary with the view of students' future business and scientific careers.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Students have got extended lexical and grammatical knowledge of the English Language appropriate for the studied field of Science at C level as described in the CEFR and can express dilemmas regarding the environment	IS_K2_W 14	L	C E F N O P
	2				
Skills	1	Students can give presentations in the English Language and make written studies regarding problems included in the content of studies.	IS_K2_U 03	L	C E F N O P
	2	Students possess language skills appropriate for the requirements set for C level of the CEFR	IS_K2_U 04	L	C E F N O P
Social Competence	1	Students are able to evaluate obtained information scrutinizingly and independently	IS_K2_K 07	L	P
	2				

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	0	mgr Kowalczyk Bogusława
Calculation class (C)	0	
Laboratory class (L)	30	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	0
Calculation class (C)	0
Laboratory class (L)	30
Project (P)	0
Seminar (S)	0
Preparation for classes	8
Preparation of a report/paper/ project/presentation	4
Independent study of the course topics	8
Examination or final colloquium	0
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr Świerczewska Beata
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dr inż. Wydrych Jacek
Dean of Faculty
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Politechnika Opolska
Wydział Mechaniczny
Karta Opisu Przedmiotu

Kierunek studiów	Environmental Engineering
Profil kształcenia	Ogólnoakademicki
Poziom studiów	Studia drugiego stopnia
Specjalność	Advanced Technologies in Environmental Engineering
Forma studiów	Studia stacjonarne
Semestr studiów	Pierwszy

Nazwa przedmiotu	Technical Foreign Language			
Subject Title	Język obcy techniczny			
Liczba punktów ECTS	2	Typ przedmiotu		W
Język wykładowy	polski	Tryb zaliczenia przedmiotu (E/Z)		Zaliczenie na ocenę
Kod przedmiotu	D.1.		Przedmiot powiązany z badaniami naukowymi/ prakt. przygot. zawodowym (T/N)	N

Oczekiwania wstępne w zakresie przedmiotu	Wiedza	1	In accordance with the recommendations of PRK level 6.
		2	
	Umiejętności	1	In accordance with the recommendations of PRK level 6.
		2	
	Kompetencje społeczne	1	In accordance with the recommendations of PRK level 6.
		2	

Cele przedmiotu: Development of the four basic language skills (speaking, reading, writing, and listening) as well as communicative skills and competencies at level A of the Common European Framework of Reference for Languages (CEFR).

Treści programowe zapewniające uzyskanie efektów uczenia się dla przedmiotu: The course provides the student with universal linguistic knowledge: vocabulary, phrases, and structures as well as intercultural knowledge necessary for establishing and maintaining communication with target language users according to level A of the Common European Framework of Reference for Languages (CEFR). The student develops the four basic language skills - listening, speaking, reading, and writing, and learns the basic grammar (declensions, conjugations, basic parts of speech, present, past, and future tenses) required at level A according to the CEFR, and acquires the skills of searching, using and selecting information from various sources - including the use of online dictionaries and translators as well as language learning applications.

Efekty uczenia się dla przedmiotu - po zakończonym cyklu studiów			Odniesienie do kierunkowych efektów uczenia się	Formy realizacji (W, C, L, P, S)	Formy weryfikacji efektów uczenia się
Wiedza	1	A student knows and understands foreign language theory and terminology enough to use a foreign language at the B2 level of the Common European Framework of Reference for Languages	IS_K2_W05	L	C E F P
	2				
Umiejętności	1	A student has self-study skills	IS_K2_U02	L	C E F P
	2	A student is able to use a foreign language at the B2 level of the Common European Framework of Reference for Languages.	IS_K2_U03	L	C E F P
Kompetencje społeczne	1	A student is aware of the need to improve their knowledge throughout life and is able to select the appropriate learning methods for themselves and others.	IS_K2_K01	L	P
	2	A student understands the importance of teamwork and is able to take responsibility for the results of joint activities	IS_K2_K04	L	P

Formy weryfikacji efektów uczenia się:
A-egzamin pisemny, B-egzamin ustny, C-zaliczenie pisemne, D-zaliczenie ustne, E-na podstawie ocen cząstkowych z odpowiedzi ustnych, F-na podstawie ocen cząstkowych z odpowiedzi pisemnych, G-praca kontrolna, H-ocena ze sprawozdań, I-ocena z przebiegu ćwiczeń, J-ocena z przygotowania do ćwiczeń, K-ocena z przebiegu realizacji projektu, L-ocena pisemnej realizacji projektu, M-ocena z obrony projektu, N-ocena formy prezentacji, O-ocena treści prezentacji, P-obserwacja aktywności na zajęciach, R-obserwacja systematyczności.

Godziny w planie studiów		
Forma zajęć	Liczba godzin zajęć w semestrze	Opiekun (koordynator) przedmiotu (tytuł/stopień naukowy/ tytuł zawodowy, imię i nazwisko)
Wykład	0	dr Świerczewska Beata
Ćwiczenia	0	
Laboratorium	30	
Projekt	0	
Seminarium	0	

Nakład pracy studenta	
Rodzaje zajęć studenta*	Średnia liczba godzin* przeznaczonych na zrealizowane aktywności
Wykład	0
Ćwiczenia	0
Laboratorium	30
Projekt	0

Seminarium	0
Przygotowanie do zajęć	10
Przygotowanie sprawozdania/referatu/ projektu/prezentacji	0
Samodzielne studiowanie tematyki zajęć	10
Egzamin lub kolokwium zaliczeniowe	0
Dodatkowe godziny kontaktowe	0
Łączny nakład pracy studenta	50
Liczba godzin kontaktowych (z planu studiów)	30

* godzina (lekcyjna) oznacza 45 minut

dr Świerczewska Beata
Kierownik jednostki organizacyjnej/bezpośredni przełożony
(pieczęć/podpis)

dr inż. Wydrych Jacek
Dziekan Wydziału
(pieczęć/podpis)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second
Course Title	Techniques of Air Pollution Control
Nazwa przedmiotu	Techniki pomiaru zanieczyszczeń powietrza

ECTS points	4	Subject type	K
Language of lecture	angielski	Mode of completing the course	Examination

Course code	C.2.1.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	Understanding of basic physical and chemical laws
		2	Understanding of the nature of natural forces
		3	Knowledge of the basic separation methods
	Skills	1	A student is able to assess the usefulness and usability of new developments (techniques and technologies)
		2	
	Social Competence	1	Ability to verify the information received
		2	Ability to carry out practical experiments

Course Goals The aim is to familiarise students with the issues of legal and technical solutions for air protection. The course provides knowledge on the requirements for installations reducing air pollutant emissions and the methods of assessing the effectiveness of the undertaken solutions. In addition, the students are practically acquainted with ways of controlling the quality of waste gases in terms of the presence of pollutants.

Programme content The course imparts knowledge on issues related to the practical use of technologies limiting emissions of pollutants into the air. Within the module, students acquire knowledge on the characteristics of pollutants and their sources, legal guidelines for limiting emissions of substances and energy from industrial plants, and methods for collecting information on pollution emission control. Within the module, the student acquires knowledge of technological solutions for air protection and the skills conducting emission monitoring. The acquired knowledge in the identification and understanding of air protection techniques allows the student to apply a systems approach to ensure reliability and efficiency of the technical equipment learnt.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has a structured and up-to-date knowledge of metrology and measurement of quantities relevant to the range of real phenomena and processes studied	IS_K2_W04	W L	A H
	2	Student knows and understands the phenomena and processes underlying the techniques of reducing the volume of pollutants discharged into the air	IS_K2_W10	W L	A H
Skills	1	Students will be able to independently plan and carry out experiments, interpret the results obtained and formulate conclusions	IS_K2_U05	L	A H
	2				
Social Competence	1	Student understands the social role of the engineer and the need to communicate reliable information to the public about the results of his or her own engineering work	IS_K2_K06	W L	A H
	2				

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr hab. inż. Olszowski Tomasz
Calculation class (C)	0	
Laboratory class (L)	30	
Project (P)	0	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	30
Project (P)	0
Seminar (S)	0
Preparation for classes	15
Preparation of a report/paper/ project/presentation	15
Independent study of the course topics	21
Examination or final colloquium	4
Additional contact hours	0
Total student workload	100
Number of contact hours (from the study plan)	45

* hour (class) means 45 minutes

dr hab. inż. Kłosok-Bazan Iwona
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic

Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Second

Course Title	Technologies of Material Reuse
Nazwa przedmiotu	Technologie odzysku materiałowego

ECTS points	2	Subject type	K
Language of lecture	angielski	Mode of completing the course	Examination

Course code	C.3.1.	Subject related to scientific research/pract. profess. prepar. (Y/N)	N

Preliminary requirements of the course	Knowledge	1	Student knows the basic issues in waste management
		2	
	Skills	1	Student able to interpret issues and formulate conclusions
		2	
	Social Competence	1	Student is able to defend reasons related to the choice of engineering solutions
		2	

Course Goals The aim of the course is to teach students to recognize and develop technologies for waste management, with particular emphasis on functionality for waste treatment facilities and compliance with the waste hierarchy.

Programme content The subject provides knowledge on issues related to technologies used in waste management. During the course, the student acquires knowledge and skills in the field of recycling, recovery and waste disposal methods. Acquired knowledge in the field of waste identification and selection of rational technologies for their management.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broadened knowledge of phenomena and processes, observation and knows the methods of measurement of. Knows the innovation technologies	IS_K2_W12	W S	A N O
	2	Student has specialized knowledge for solving problems related to environmental engineering.	IS_K2_W13	W S	A N O
Skills	1	Student has knowledge in English about specialized technologies	IS_K2_U04	S	N O
	2	Student can make a critical analysis of the functioning and evaluate the existing technical solutions used in environmental engineering.	IS_K2_U01	S	N O
Social Competence	1	Student defines priorities in engineering solutions	IS_K2_K03	W S	A N O
	2	Student is aware of the importance and it can understand the nontechnical aspects and effects of engineering actions, including their impact on the environment.	IS_K2_K05	W S	A N O

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr hab. inż. Król Anna
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	0	
Seminar (S)	15	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	0

Seminar (S)	15
Preparation for classes	8
Preparation of a report/paper/ project/presentation	10
Independent study of the course topics	0
Examination or final colloquium	2
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
Head of the organizational unit
(stamp/signature)

dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	Third
Course Title	Waste to Energy - Application Technologies
Nazwa przedmiotu	Energetyczne wykorzystanie odpadów

ECTS points	2	Subject type	K
Language of lecture	angielski	Mode of completing the course	Course credit

Course code	C.3.2.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	The student has basic knowledge in the field of waste management and thermodynamics
		2	
	Skills	1	The student acquires information from literature, databases, and other sources and can analyze them and draw conclusions
		2	
	Social Competence	1	The student can work in a group and understands the societal role of an engineer
		2	

Course Goals The aim of the course is to familiarize students with the technologies of fuels from waste production and their applications.

Programme content The scope of the subject includes learning about waste processing technologies, production of fuels from waste, and energy processes in which they can be utilized.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broadened knowledge of conventional and alternative energy sources and of technical and technological possibilities of generating, converting and application.	IS_K2_W03	W S	C M O P R
	2	Student has knowledge of using legal regulations, norms and guidelines in designing and operation of technical objects.	IS_K2_W15	W S	C M O P R
Skills	1	Student is able to communicate in the range relating to environmental engineering using different techniques in various environments, also in English.	IS_K2_U04	S	M O P R
	2	Student can make a critical analysis of the functioning and evaluate the existing technical solutions used in environmental engineering.	IS_K2_U11	S	M O P R
Social Competence	1	Student can understand the social role of an engineer and can understand the need for reliable public information about the achievements of engineering.	IS_K2_K06	W S	C M O P R
	2	Student can correctly identify engineering problems and is able to set priotities for professional activities	IS_K2_K05	W S	C M O P R

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan

The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr hab. inż. Wzorek Małgorzata
Calculation class (C)	0	
Laboratory class (L)	0	
Project (P)	0	
Seminar (S)	15	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	0
Project (P)	0
Seminar (S)	15
Preparation for classes	5
Preparation of a report/paper/ project/presentation	10
Independent study of the course topics	5
Examination or final colloquium	0
Additional contact hours	0
Total student workload	50
Number of contact hours (from the study plan)	30

* hour (class) means 45 minutes

dr hab. inż. Hapanowicz Jerzy
Head of the organizational unit
(stamp/signature)

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Dean of Faculty
(stamp/signature)

Opole University of Technology
Faculty of Mechanical Engineering
Course Description Card

Field of study	Environmental Engineering
Profile of Education	General Academic
Level of study	Second Cycle Studies
Specialization	Advanced Technologies in Environmental Engineering
Form of Study	Full-Time Studies
Semester	First
Course Title	Water Treatment Technologies

Nazwa przedmiotu	Technologie uzdatniania wody		
ECTS points	4	Subject type	K
Language of lecture	angielski	Mode of completing the course	Examination
Course code	C.1.1.	Subject related to scientific research/pract. profess. prepar. (Y/N)	T

Preliminary requirements of the course	Knowledge	1	Basic knowledge of mathematics, chemistry and ecology.
		2	
	Skills	1	Ability to work in a group
		2	
	Social Competence	1	Student can think and work in a creative way
		2	

Course Goals The course presents technologies, installations and equipment for physical, biological and chemical water treatment. This course gives an insight into the different technologies of municipal and industrial water treatment.

Programme content Requirements for drinking and industrial water, unit water treatment processes, treatment systems for surface water and groundwater.

Learning outcomes for the course - after completing the training cycle			The reference to the learning outcomes	Form of course (W, C, L, P, S)	Methods of verification of learning outcomes
Knowledge	1	Student has broadened knowledge of the methods of measurements in the field of water technology; Knows the methods, techniques, and apparatus for physical, chemical and biological phenomena used in water technology	IS_K2_W10	W L P	A J K
	2				
Skills	1	Student is able to use measuring instruments in area of water technology, ability to estimate errors, plan and conduct experiments, interpret the results and formulate conclusions.	IS_K2_U07	L P	J K
	2				
Social Competence	1	Student identifies engineering problems inarea of water technology properly	IS_K2_K03	L P	J K
	2				

Methods of verification of learning outcomes:

A-written exam, B-oral exam, C-written assessment, D-oral assessment, E-based on partial marks of oral answers, F-based on partial marks of written answers, G-term paper, H-assessment from reports, I-assessment from realization of exercises, J-assessment from preparations for exercises, K-assessment from the project implementation, L-assessment of the written implementation of the project, M-assessment of defense of project, N-assessment of form of presentation, O-assessment of content of presentation, P-observation of students' activity, R-observation of the regularity.

Hours in the study plan		
The course format	Hours/sem. (h)	Tutor (coordinator) of the course (title/academic degree/professional title, name and surname
Lecture (W)	15	dr hab. inż. Kłosok-Bazan Iwona
Calculation class (C)	0	
Laboratory class (L)	30	
Project (P)	15	
Seminar (S)	0	

Student workload	
Types of student activities*	Average number of hours* allocated on completed activities
Lecture (W)	15
Calculation class (C)	0
Laboratory class (L)	30
Project (P)	15
Seminar (S)	0
Preparation for classes	10
Preparation of a report/paper/ project/presentation	10
Independent study of the course topics	16
Examination or final colloquium	4
Additional contact hours	0
Total student workload	100
Number of contact hours (from the study plan)	60

* hour (class) means 45 minutes

dr hab. inż. Kłosok-Bazan Iwona
Head of the organizational unit
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dr inż. Wydrych Jacek
Dean of Faculty
(stamp/signature)

Wydział Mechaniczny - lista przedmiotów na kierunku Environmental Engineering - Studia stacjonarne - Studia drugiego stopnia (od 2024) - spec. Advanced Technologies in Environmental Engineering

symbol	Advanced Environmental Chemistry	Biological Wastewater Treatment	Bioprocess Technologies in Engineering	Clean Fossil and Alternative Fuels	Computer Aided Design	Data Bases and Advanced GIS	Diploma Seminar	Elective subject: Energy Consumption of Industrial Processes	Elective subject: Engineering of Chemical Reactors	Elective subject: Mass Exchanger Design	Elective subject: Multiphase Flow in Environmental Technology	Elective subject: Spatial Planning	Elective subject: Urban design	Energy Analysis and Feasibility Studies	Environmental Analytics	Environmental Fluid Transport	Environmental Statistics	Heat and Mass Transfer Processes Design	Master`s Thesis	Master`s Thesis	Modelling of Energy Systems	Modelling of Pollutant Propagation in Atmosphere	Modelling of Water Distribution Systems	Modern Materials in Engineering Applications	Module I: Communication and Negotiations in Business	Module I: Ethics in Business	Module II: Creativity Training	Module II: Design Thinking	Module III: Enviromental Law and Policy	Module III: Sustainable Development for Engineers	Renewable Energy Technologies	Safety and Reliability of Engineering Systems	Technical Foreign Language	Technical Foreign Language	Techniques of Air Pollution Control	Technologies of Material Reuse	Waste to Energy - Application Technologies	Water Treatment Technologies
IS_K2_W01	X	.	.	.	.	.	X	X	.	.	.	X	.	.	X	X	X	.	X	X	X	X	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.
IS_K2_W02	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.
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IS_K2_W05	.	.	.	.	.	X	X	X	.	.	.	.	.	X	.	.	.	X	.	X	X	.	.	.	.	.	.	.	.	.	.	.	X	.	.	X	.	.	.
IS_K2_W06	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
IS_K2_W07	.	X	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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IS_K2_W10	X	.	.	.	.	.	X	.	.	X	X	.	X	.	X	.	.	.	X	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	X
IS_K2_W11	.	.	X	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.
IS_K2_W12	.	.	X	X	.	.	.	.	X	.	X	.	.	X	.	.	.	.	.	.	.	X	.	X	.	.	.	.	.	.	X	.	.	.	.	X	.	.	.
IS_K2_W13	.	.	X	X	.	.	.	X	X	X	.	.	.	.	.	.	.	X	.	X	.	.	.	X	.	.	.	X	.	.	.	.	.	.	.	X	.	.	.
IS_K2_W14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	X	.	.	.	.	.	.	X	.	.	.	.	.	.
IS_K2_W15	.	.	.	.	.	.	.	.	.	.	.	X	X	.	.	.	.	.	.	.	.	.	.	.	X	X	X	.	X	.	.	X	.	.	.	.	X	.	.
IS_K2_U01	X	.	X	.	.	.	X	.	X	X	X	.	.	.	X	.	.	X	X	X	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	X	.	.	.
IS_K2_U02	X	X	X	.	X	X	.	X	X	.	.	.	.	.	X	.	X	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.
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IS_K2_U04	.	.	.	X	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	X	X	.
IS_K2_U05	.	.	X	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.
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IS_K2_U07	.	X	.	.	.	.	.	.	.	.	.	.	X	.	.	X	.	.	X	X	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	X
IS_K2_U08	.	.	.	.	.	.	.	X	.	.	X	.	.	.	.	X	.	X	.	.	X	X	X	.	.	.	.	X	.	.	X	.	.	.	.	.	.	.	.
IS_K2_U09	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.
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IS_K2_U11	.	.	.	X	.	.	.	X	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.
IS_K2_U12	.	.	.	.	X	.	.	.	.	X	.	.	.	.	.	.	.	X	.	.	X	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.
IS_K2_K01	X	X	X	X	.	.	X	X	X	.	.	.	.	X	X	X	X	X	.	.	X	X	.	.	.	.	.	.	.	.	X	.	.	X	.	.	.	.	.
IS_K2_K02	X	.	.	.	.	.	.	.	.	.	.	.	.	X	X	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.
IS_K2_K03	.	X	.	X	.	.	.	X	.	X	X	.	.	X	.	.	.	.	.	.	X	.	.	X	.	.	.	X	.	.	.	.	.	.	.	X	.	X	.
IS_K2_K04	.	.	X	.	.	.	.	.	X	X	.	X	X	.	.	X	X	X	.	.	X	.	.	X	X	.	.	.	.	.	X	.	.	X	.	.	.	.	.
IS_K2_K05	.	.	X	.	X	X	.	.	.	.	.	.	.	X	.	.	.	.	X	.	.	X	.	.	.	X	.	X	X	.	.	X	.	.	.	X	X	.	.
IS_K2_K06	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	X	.	.	.	.	.	.	.	X	.	X	.	.
IS_K2_K07	.	.	.	.	.	.	X	.	.	.	X	.	.	.	.	.	.	X	X	.	.	.	X	.	.	X	X	.	.	.	.	.	.	X	.	.	.	.	.

Wiedza - efekty nie pokryte:
Brak

Umiejętności - efekty nie pokryte:
Brak

Kompetencje - efekty nie pokryte:
Brak