

POLITECHNIKA KRAKOWSKA IM. TADEUSZA KOŚCIUSZKI

KARTA PRZEDMIOTU

obowiązuje studentów rozpoczynających studia w roku akademickim 2022/2023

Wydział Inżynierii Środowiska i Energetyki

Kierunek studiów: Energetyka

Profil: Ogólnoakademicki

Forma studiów: stacjonarne

Kod kierunku: 11

Stopień studiów: II

Specjalności: Energy systems and machinery

1 INFORMACJE O PRZEDMIOCIE

NAZWA PRZEDMIOTU	Applied Thermodynamics
NAZWA PRZEDMIOTU W JĘZYKU ANGIELSKIM	Applied Thermodynamics
KOD PRZEDMIOTU	WIŚIE EN oIIS C9 22/23
KATEGORIA PRZEDMIOTU	Przedmioty kierunkowe
LICZBA PUNKTÓW ECTS	3.00
SEMESTRY	2

2 RODZAJ ZAJĘĆ, LICZBA GODZIN W PLANIE STUDIÓW

SEMESTR	WYKŁAD	CWICZENIA	LABORATORIA	LABORATORIA KOMPUTERO- WE	PROJEKT	SEMINARIUM
2	15	30	0	0	0	0

3 CELE PRZEDMIOTU

Cel 1 The course includes lectures and classes. The objectives of the Heat Transfer course are: -To cover all necessary principles of thermodynamics; -Acquainting students with the necessary terminology, theory, quantity and units related to thermodynamics; -Presents engineering thermodynamics applied examples and tasks to give students a understanding of engineering practice; -Develop skills in solving thermodynamics design problems. The course covers topics of thermodynamics with an emphasis on physics and real-world applications.

The approach is more in line with students intuition and makes learning the subject matter much easier. Students will gain new knowledge as well as develop computational and design skills.

4 WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I INNYCH KOMPETENCJI

1 The student need to have appropriate background in mathematics, physics and engineering mechanics.

5 EFEKTY KSZTAŁCENIA

EK1 Wiedza To give the basic principles of thermodynamics, heat transfer and fluid mechanics

EK2 Umiejętności Rewrite many computational examples from the field of thermodynamics to give the student an idea of how the science of thermodynamics is applied in practice.

EK3 Wiedza To familiarize students with thermodynamic cycles so that they can solve problems from power plants, refrigeration, air conditioning, heat pumps and others related to their major of study.

EK4 Umiejętności Master computational examples in order to develop skills for fast and rough engineering calculations.

6 TREŚCI PROGRAMOWE

ĆWICZENIA		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
C1	Basic concepts of thermodynamics	4
C2	Properties of substances	4
C3	Energy, Heat and Work	5
C4	First Law of Thermodynamics	5
C5	Second Law of Thermodynamics	4
C6	Power and Refrigeration Cycles	5
C7	Psychrometrics	3

WYKŁAD		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
W1	Basic concepts of thermodynamics	2
W2	Properties of substances	2
W3	Energy, Heat and Work	2

WYKŁAD		
LP	TEMATYKA ZAJĘĆ OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH	LICZBA GODZIN
W4	First Law of Thermodynamics	2
W5	Second Law of Thermodynamics	2
W6	Power and Refrigeration Cycles	3
W7	Psychrometrics	2

7 NARZĘDZIA DYDAKTYCZNE

N1 Lectures

N2 Whiteboard activities - classes

8 OBCIĄŻENIE PRACĄ STUDENTA

FORMA AKTYWNOŚCI	ŚREDNIA LICZBA GODZIN NA ZREALIZOWANIE AKTYWNOŚCI
Godziny kontaktowe z nauczycielem akademickim, w tym:	
Godziny wynikające z planu studiów	45
Konsultacje przedmiotowe	4
Egzaminy i zaliczenia w sesji	3
Godziny bez udziału nauczyciela akademickiego wynikające z nakładu pracy studenta, w tym:	
Przygotowanie się do zajęć, w tym studiowanie zalecanej literatury	12
Opracowanie wyników	12
Przygotowanie raportu, projektu, prezentacji, dyskusji	5
SUMARYCZNA LICZBA GODZIN DLA PRZEDMIOTU WYNIKAJĄCA Z CAŁEGO NAKŁADU PRACY STUDENTA	81
SUMARYCZNA LICZBA PUNKTÓW ECTS DLA PRZEDMIOTU	3.00

9 SPOSOBY OCENY

OCENA FORMUJĄCA

F1 Test 1 - material from classes 1-4

F2 Test 2 - material from classes 5-7

OCENA PODSUMOWUJĄCA

P1 Written tests - Lectures, The final grade is the average of the exercises and the exam.

WARUNKI ZALICZENIA PRZEDMIOTU

W1 The student must receive a positive grade from the exercises in order to take the exam. The final grade is the average of the exam and exercises.

KRYTERIA OCENY

EFEKT KSZTAŁCENIA 1	
NA OCENĘ 2.0	Student does not know: the basic law of thermodynamic, basic physical quantities and units
NA OCENĘ 3.0	Student is able to list three principles of thermodynamics and illustrate them with examples.
NA OCENĘ 3.5	Student is able to list three principles of thermodynamics and illustrate them with examples. Student is familiar with the forms of energy, closed system, open system, thermodynamic equilibrium.
NA OCENĘ 4.0	Student is able to list three principles of thermodynamics and illustrate them with examples. Student is familiar with the forms of energy, closed system, open system. Student knows heat transfers basic laws and can give practical examples to illustrate them.
NA OCENĘ 4.5	Student is able to list three principles of thermodynamics and illustrate them with examples. Student is familiar with the forms of energy, closed system, open system. Student knows heat transfers basic laws. Student knows basic Student is able to list three principles of thermodynamics and illustrate them with examples. Student knows power and refrigeration cycles.
NA OCENĘ 5.0	Student is able to list three principles of thermodynamics and illustrate them with examples. Student is familiar with the forms of energy, closed system, open system. Student knows heat transfers basic laws. Student knows basic Student is able to list three principles of thermodynamics and illustrate them with examples. Student knows power and refrigeration cycles and can illustrate them with applicable examples.
EFEKT KSZTAŁCENIA 2	
NA OCENĘ 2.0	The student is not able to solve basic tasks learned during classes. Student does not know the units of thermodynamic quantities.
NA OCENĘ 3.0	The student is able to solve basic tasks learned during classes. The student knows well the units of thermodynamic quantities.
NA OCENĘ 3.5	The student is able to solve basic and advanced tasks learned during classes. The student knows well the units of thermodynamic quantities. Minor mistakes are acceptable.
NA OCENĘ 4.0	The student is able to solve basic and advanced tasks learned during classes. The student knows well the units of thermodynamic quantities.

NA OCENĘ 4.5	The student is able to solve advanced tasks learned during classes. Student is able to solve interdisciplinary asks including various branch of thermodynamics. Minor mistakes are acceptable.
NA OCENĘ 5.0	The student is able to solve advanced tasks learned during classes. Student is able to solve interdisciplinary asks including various branch of thermodynamics.
EFEKT KSZTAŁCENIA 3	
NA OCENĘ 2.0	The student is not able to demonstrate the knowledge of the Carnot Cycle, Rankine Cycle.
NA OCENĘ 3.0	The student must demonstrate the knowledge of the Carnot Cycle, Rankine Cycle.
NA OCENĘ 3.5	The student must demonstrate the knowledge of the Carnot Cycle, Rankine Cycle, Refrigerators and heat pump cycles.
NA OCENĘ 4.0	The student must demonstrate the knowledge of the Carnot Cycle, Rankine Cycle, Refrigerators, heat pump cycles, Brayton Cycle and knows the ways to increase efficiency of Rankine Cycle.
NA OCENĘ 4.5	The student must demonstrate the knowledge of the Carnot Cycle, Rankine Cycle, Refrigerators and heat pump cycles. Student must know various vapor power cycles, need to know deviations of actual power cycles from idealized ones. Minor errors are allowed.
NA OCENĘ 5.0	The student must demonstrate the knowledge of the Carnot Cycle, Rankine Cycle, Refrigerators and heat pump cycles. Student must know various vapor power cycles, need to know deviations of actual power cycles from idealized ones.
EFEKT KSZTAŁCENIA 4	
NA OCENĘ 2.0	The student is not able to demonstrate the ability to select appropriate formulas, sizes and their units to solve basic problems related to steady-flow engineering devices (pump, turbine, valve, nozzle, heat exchanger)
NA OCENĘ 3.0	The student must demonstrate the ability to solve basic problems related to steady-flow engineering devices (pump, turbine, valve, nozzle, heat exchangers)
NA OCENĘ 3.5	The student must demonstrate the ability to solve basic and advanced problems related to steady-flow engineering devices (pump, turbine, valve, nozzle, heat exchangers) minor mistakes are acceptable.
NA OCENĘ 4.0	The student must demonstrate the ability to solve basic and advanced problems related to steady-flow engineering devices (pump, turbine, valve, nozzle, heat exchangers).
NA OCENĘ 4.5	The student must demonstrate the ability to solve basic and advanced problems related to steady-flow engineering devices (pump, turbine, valve, nozzle, heat exchangers). Student is able to solve tasks with use of energy balance for unsteady-flow processes. Minor mistakes are acceptable.

NA OCENĘ 5.0	The student must demonstrate the ability to solve basic and advanced problems related to steady-flow engineering devices (pump, turbine, valve, nozzle, heat exchangers). Student is able to solve tasks with use of energy balance for unsteady-flow processes. Minor mistakes are acceptable.
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10 MACIERZ REALIZACJI PRZEDMIOTU

EFEKT KSZTAŁCENIA	ODNIESIENIE DANEGO EFEKTU DO SZCZEGÓŁOWYCH EFEKTÓW ZDEFINIOWANYCH DLA PROGRAMU	CELE PRZEDMIOTU	TREŚCI PROGRAMOWE	NARZĘDZIA DYDAKTYCZNE	SPOSOBY OCENY
EK1	K2_W02 K2_W03 K2_U04 K2_U10 K2_U11	Cel 1	W1 W2 W3 W4 W5 W6 W7	N1	P1
EK2	K2_W02 K2_W03 K2_U19	Cel 1	C1 C2 C3 C4 C5 C6 C7 W1 W2 W3 W4 W5 W6 W7	N1 N2	F1 F2 P1
EK3	K2_W02 K2_W10 K2_U17 K2_U21	Cel 1	W1 W2 W3 W4 W5 W6 W7	N1	P1
EK4	K2_W05 K2_W06 K2_W14 K2_U20	Cel 1	C1 C2 C3 C4 C5 C6 C7 W1 W2 W3 W4 W5 W6 W7	N1 N2	F1 F2 P1

11 WYKAZ LITERATURY

LITERATURA PODSTAWOWA

- [1] Y. A. engel and M. A. Boles, — *Thermodynamics: An Engineering Approach*, 5th, Miejscowość, 2006, McGraw-Hill,

LITERATURA UZUPEŁNIAJĄCA

- [1] M.J. Moran, H. N. Shapiro — *Fundamentals of Engineering Thermodynamics*, NY, 2010, ohn Wiley & Sons

[2] J. Szargut — *Termodynamika*, Warszawa, 2019, PWN

12 INFORMACJE O NAUCZYCIELACH AKADEMICKICH

OSOBA ODPOWIEDZIALNA ZA KARTĘ

dr hab. inż. Atrur Cebula (kontakt: acebula@pk.edu.pl)

OSOBY PROWADZĄCE PRZEDMIOT

1 dr hab. inż. Atrur Cebula (kontakt: acebula@pk.edu.pl)

13 ZATWIERDZENIE KARTY PRZEDMIOTU DO REALIZACJI

(miejscowość, data)

(odpowiedzialny za przedmiot)

(dziekan)

PRZYJMUJĘ DO REALIZACJI (data i podpisy osób prowadzących przedmiot)

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