STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Heat, Momentum and Mass Transfer		**1010635211010630266**
Field of study: **Mechanical Engineering**	Profile of study (general academic, practical): **(brak)**	Year /Semester: **1 / 1**
Elective path/specialty: **Thermal Engineering and Renewable Energy**	Subject offered in: **Polish**	Course (compulsory, elective): **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time): **part-time**	
No. of hours: Lecture: **9** Classes: **9** Laboratory: **9** Project/seminars: **-**		No. of credits: **3**
Status of the course in the study program (Basic, major, other): **(brak)**	(university-wide, from another field): **(brak)**	
Education areas and fields of science and art: **technical sciences** **Technical sciences**		ECTS distribution (number and %): **3 100%** **3 100%**

Responsible for subject / lecturer:

dr inż Robert Kłosowiak
email: robert.klosowiak@put.poznan.pl
tel. 6652331
Maszyn Roboczych i Transportu
ul. Piotrowo 3A, 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Knowledge Basic information on thermodynamics, fluidity mechanics and flow processes and thermal energy
2	**Skills**	Ability to describe and calculate basic thermodynamic processes and simple thermal energy conversion systems. The ability of effective self-education in the field related to the chosen field of study
3	**Social competencies**	Social competencies Is aware of the need to expand their competence, readiness to cooperate within the team

Assumptions and objectives of the course:

Acquainting with basic thermodynamic processes, thermodynamic transformations and energy conservation equations. Understanding the methods of description of various thermodynamic factors and thermodynamic cycles that implement the assumed processes of thermal and mechanical energy conversion in the left-side cycles. Familiarization with available forms of renewable energy and its path of conversion.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Has knowledge in the field of mathematics, including algebra, analysis, theory of differential equations, probabilistic, analytical geometry necessary for: description of the operation of discrete mechanical systems, understanding of computer graphics methods, description of the operation of electrical and mechatronic systems - [M1_W01]

2. Ma wiedzę w zakresie fizyki, obejmującą podstawy mechaniki klasycznej, optyki, elektryczności i magnetyzmu, fizyki ciała stałego, fizyki kwantowej i jądrowej, niezbędną do zrozumienia wykładów specjalistycznych w zakresie teorii materiałów konstrukcyjnych i materiałoznawstwa, teorii maszyn i mechanizmów, teorii napędów elektrycznych i układów mechatronicznych - [M1_W02]

Skills:

1. Can acquire information from literature, the internet, databases and other sources. Can integrate the information obtained and interpret conclusions and create and justify opinions - [M1_U01]

2. Has knowledge in physics, including the basics of classical mechanics, optics, electricity and magnetism, solid state physics, quantum and nuclear physics, necessary to understand specialized lectures in the theory of construction materials and materials, theory of machines and mechanisms, the theory of electric drives and mechatronic systems - [M1_U02]

Social competencies:

1. Is ready to critically evaluate your knowledge and content you receive - [M1_K01]
2. . Is ready to recognize the importance of knowledge in solving cognitive and practical problems and to consult experts in the event of difficulties in solving the problem - [M1_K02]

Assessment methods of study outcomes
-Lecture continuous assessment on each class, rewarding the activity and quality of perception and final written exam Obtaining additional points for activity during classes, especially for: proposing to discuss additional aspects of the issue; effectiveness of using the acquired knowledge while solving a given problem; ability to cooperate within a team practically performing a detailed task in a laboratory.
Course description
Introduction. Heat conduction - differential equation, boundary conditions. Thermal properties of materials. Conduction in the ribs. Conduction in transient conditions. Dimensional analysis and similarity conditions. Introduction to numerical methods. Basics of heat convection processes. Basics of Thermal radiation. Heat exchangers. Basics of diffusion and mass convection.
Basic bibliography: 1. Kostkowski E., Promieniowanie cieplne 2. Grula S.,J., Przewodzenie Ciepła 3. Wiśniewski S. Wymiana Ciepła 4. Pudlik W., Wymiana i wymienniki ciepła
Additional bibliography: 1. YUNUS A. CENGEL HEAT TRANSFER A Practical Approach

Result of average student's workload

Activity	Time (working hours)
1. Udział w wykładzie	30
2. Utrwalenie treści wykładu	5
3. Udział w zajęciach laboratoryjnych	15
4. Przygotowanie do zajęć laboratoryjnych	5
5. Przygotowanie do zaliczenia	5
6. Udział w zaliczeniu	5
7. Konsultacje	1

Student's workload

Source of workload	hours	ECTS
Total workload	67	3
Contact hours	46	2
Practical activities	15	1