

**DOCTORAL SCHOOL OF WROCLAW UNIVERSITY OF SCIENCE AND  
TECHNOLOGY**

SUPERVISOR/TEAM/ DECLARING/CONDUCTING COURSE: prof. dr hab. inż. Zbigniew Gnutek  
 DEPARTMENT: Faculty of Mechanical and Power Engineering W9  
 SCIENTIFIC DISCIPLINE: Environmental Engineering, Mining and Energy

**COURSE CARD**

**Course name in Polish:** Termodynamika- zagadnienia wybrane

Course name in English: Selected problems of thermodynamics

**Course language Polish / English\***

**The course is intended for all PhD students: YES / NO**

**1) BASIC COURSE**

~~**2) SPECIALIST COURSE**~~

~~**3) SEMINAR**~~

~~**4) HUMANISTIC COURSE**~~

~~**5) LANGUAGE**~~

**Subject code:** IGQ000002W

\* delete as applicable

	Lecture	Foreign language course	Seminar	Mixed forms
Number of hours of organized classes in university (ZZU)	30			
Grading	Exam	Exam	Oral presentation	Exam, inspection, evaluation classes

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

Competences in the field of thermodynamics, mathematical analysis, differential equations..

**COURSE OBJECTIVES**

C1 – to provide an extended knowledge of the phenomena and processes in classical thermodynamics

**PROGRAM CONTENTS**

Form of classes – lecture (Lec)		Number of hours
Lec1	Modern thermodynamic theories. Methodology of research.	2
Lec2	The system of primary thermodynamic concepts. Thermodynamic parameters and functions.	2
Lec3	Work and heat. Zeroth law of thermodynamics.	2
Lec4	The first law of thermodynamics for an extended concept of work. Processes and transformations. Cycles.	2

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Lec5	The second law of thermodynamics. Entropy. T-s chart.	2
Lec6	Irreversible processes, exergy. Samy-Shargut's rules.	2
Lec7	Thermodynamics of systems with a variable amount of substance.	2
Lec8	Thermal properties of the substance. Real gases. Steam. Steam tables. Calculation programs.	2
Lec9	Transformations and phase equilibria. Solutions and mixtures.	2
Lec10	Selected issues of fluid flow.	2
Lec11	Basics of low temperature technology. Superficiality and superconductivity.	2
Lec12	Thermodynamics of non-equilibrium processes.	2
Lec13	Elements of thermal machines.	2
Lec14	Cogeneration and multigeneration systems.	2
Lec15	Heat recovery and storage.	2
	Total hours:	<b>30</b>

**TEACHING TOOLS USED**

N1. Lecture  
N2. Consultations

**ACHIEVED SUBJECT LEARNING OUTCOMES**

Type of learning outcome	Code of learning outcome	Assessment of learning outcome
Knowledge	P8S_WG	- has well-established knowledge of basic subjects: mathematics, physics, chemistry or other - has advanced knowledge of a basic nature for the field related to the area of scientific research, including the latest research methods and verification of achieved results

**PRIMARY AND SECONDARY LITERATURE**

**PRIMARY LITERATURE:**

- [1] Szargut J., *Termodynamika techniczna*, Wyd. V, wyd. PŚl., Gliwice 2010
- [2] Cengel Y. A., Boles M. A., *Thermodynamics An Engineering Approach*, Wyd. V, Mc Graw Hill Higher Education, Boston 2006
- [3] Wiśniewski S., *Termodynamika techniczna*, Wyd. II, WNT, Warszawa 1987
- [4] Szargut J., *Egzergia. Poradnik obliczenia i stosowanie.*, Wyd. PŚl., Gliwice 2007

**SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)**

**Prof. zw. dr hab. inż. Zbigniew Gnutek, zbigniew.gnutek@pwr.edu.pl**