COURSE SPECIFICATION

Course code	full-time programme:	**M#2-S1-ME-602**
	part-time programme:	
Course title in Polish	**Termodynamika I**	
Course title in English	**Thermodynamics I**	
Valid from (academic year)	**2024/2025**	

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**first-cycle**
Type of education	**academic**
Mode of study	**full-time programme**
Specialism	**all**
Department responsible	**Department of Mechanics and Heat Transfer**
Course leader	**dr hab. Robert Pastuszko, prof. PŚk**
Approved by	**dr hab. Jakub Takosoglu, prof. PŚk, Dean of the Faculty of Mechatronics and Mechanical Engineering**

COURSE OVERVIEW

Course type		**programme-specific**
Course status		**compulsory**
Language of instruction		**English**
Semester of delivery	full-time programme	**Semester VI**
	part-time programme	
Pre-requisites		
Examination required (YES/NO)		**NO**
ECTS value		**2**

Mode of instruction		**lecture**	**class**	**laboratory**	**project**	**seminar**
No. of hours per semester	full-time programme	**15**	**15**			
	part-time programme					

LEARNING OUTCOMES

Category of outcome	**Outcome code**	**Course learning outcomes**	**Corresponding programme outcome code**
Knowledge	W01	On completion of the course, students will have basic knowledge on energy, thermodynamic system and thermodynamic parameters, thermodynamic equilibrium, work and heat as methods of energy transport between systems.	MiBM1_W02 MiBM1_W16

	W02	Students will have skills concerning the first law of thermodynamics for closed and open (control volume) systems.	MiBM1_W02 MiBM1_W16
	W03	Students will have fundamental knowledge of the ideal gas equation, polytropic processes, and characteristic processes.	MiBM1_W02 MiBM1_W16
	W04	Students understand the concept of heat engine and refrigeration/heat pump cycle	MiBM1_W02 MiBM1_W16
	W05	Students will be familiar with the following terms: phase change processes, critical parameters, and triple point.	MiBM1_W02 MiBM1_W16
	W06	Students have a basic understanding of renewable energy sources.	MiBM1_W02 MiBM1_W16
Skills	U01	Students will have the skills to utilise the procedures for energy balance and the methods of energy transport between systems.	MiBM1_U01 MiBM1_U03 MiBM1_U04 MiBM1_U20 MiBM1_U21
	U02	Students will be able to utilise mathematical tools to solve problems related to the principles of thermodynamics. A student can interpret the results.	MiBM1_U01 MiBM1_U03 MiBM1_U04 MiBM1_U20 MiBM1_U21
	U03	Students will have the skills to compute in the field of typical issues of heating of a system by work transfer or by heat transfer.	MiBM1_U01 MiBM1_U03 MiBM1_U04 MiBM1_U20 MiBM1_U21
	U04	Students will have the ability to utilize the ideal gas equation.	MiBM1_U01 MiBM1_U03 MiBM1_U04 MiBM1_U20 MiBM1_U21
	U05	Students will be able to present graphs of thermodynamic processes	MiBM1_U01 MiBM1_U03 MiBM1_U04 MiBM1_U20 MiBM1_U21
Competence	K01	Students will be aware of the method of generating energy and the operation of energy devices (heat engines, etc.) in the natural environment.	MiBM1_K02 MiBM1_K03 MiBM1_K06
	K02	Students are aware of the need to follow the rules of teamwork.	MiBM1_K02 MiBM1_K03 MiBM1_K06

COURSE CONTENT

Type of instruction lecture	Topics covered

lecture	Basic terms and definitions: energy, thermodynamic system, properties, state and thermodynamic equilibrium, units. The zeroth law of thermodynamics. Processes and cycles, types of processes. Work and heat, moving boundary work. Ideal gas equation of state, enthalpy, internal energy, and specific heat. The first law of thermodynamics for closed systems. The first law of thermodynamics for open systems (control volume). Entropy, reversible and irreversible processes, the second law of thermodynamics, entropy as a function of the state. Carnot cycle and reversed Carnot cycle, the Carnot heat engine, refrigeration and heat pump cycles. Phases of a pure substance, saturated liquid, saturated liquid-vapour mixture, saturated vapour, superheated vapour, saturation temperature and saturation pressure, property diagrams for phase-change processes. Unconventional energy sources.
class	Thermodynamic parameters, physical properties of fluids, units used in thermodynamics. Basic energy balances. Ideal gas equation of state. Heat and work. Processes of ideal gases. The first law of thermodynamics for closed systems - the use of specific heat to calculate changes in internal energy and enthalpy The first law of thermodynamics for open systems: the law of conservation of energy, flow machines: nozzle, turbine. Carnot cycle, heat engine cycles.

ASSESSMENT METHODS

Outcome code	Methods of assessment *(Mark with an X where applicable)*					
	Oral examination	Written examination	Test	Project	Report	Other
W01			x			
W02			x			
W03			x			
W04			x			
W05			x			
W06			x			
U01			x			
U02			x			
U03			x			
U04			x			
U05			x			
K01						x
K02						x

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	non-examination assessment	The pass mark is a minimum of 50% for the final in-class test.
class	non-examination assessment	The pass mark is a minimum of 50% for all the in-class tests.

OVERALL STUDENT WORKLOAD

ECTS weighting

No.	Activity type	Student workload										Unit
		full-time programme					part-time programme					
1.	Scheduled contact hours	L	C	Lb	P	S	L	C	Lb	P	S	h
		15	15									
2.	Other contact hours (office hours, examination)	2	2									h
3.	**Total number of contact hours**	**34**										h
4.	**Number of ECTS credits for contact hours**	**1,4**										ECTS
5.	**Number of independent study hours**	**16**										h
6.	**Number of ECTS credits for independent study hours**	**0,6**										ECTS
7.	**Number of practical hours**	**25**										h
8.	**Number of ECTS credits for practical hours**	**1,0**										ECTS
9.	**Total study time**	**50**										h
10.	**ECTS credits for the course** *1 ECTS credit = 25-30 hours of study time*	**2**										ECTS

READING LIST

1. Whaley P.B., Basic Engineering Thermodynamics, Oxford Science Publications, Oxford 1999
2. Logan E., Jr., Thermodynamics and Applications, Marcel Dekker, Inc., 1999
3. Cengel Y.A., Boles M.A.: Thermodynamics – an Engineering Approach, McGraw-Hill, 2015
4. van Wylen G., Sonntag R., Borgnakke C., Fundamentals of Classical Thermodynamics, IV ed., John Wiley & Sons, 1993
5. Bayazitoglu, Y. Ozisik, Necati M.: Elements of Heat Transfer . McGraw-Hill Book Company, New York, 1988
6. Howell, J. R. : Fundamentals of engineering thermodynamics, New York McGraw-Hill Book Company, 1987
7. Moran M. J., Shapiro H. N.: Fundamentals of engineering thermodynamics, John Wiley & Sons, 1998