Card of Course

Description of course	
Code of course	MaSoSTDPiAV
Name of course	**Modelling and Simulation of Selected Thermo-dynamic Problems in Automotive Vehicles (internal combustion engine, braking system)**
Version of course	2024/2025
A. Place of the course in system of studies	
Level of education	Intermediate
Form and mode of studies	bachelor
Field of studies	Transport
Profile of studies	General academic profile
Specialisation	Main field
Place of teaching of course	Warsaw University of Technology, Faculty of Transport
Place of realization of course	Warsaw University of Technology, Faculty of Transport
Coordinator of course	Andrzej Wolff, PhD, DSc. - Faculty of Transport, Division for Construction and Operation of Transport Means
B. General characteristic of the course	
Block of courses	Main field
Group of courses	General
Level of course	Intermediate
Status of course	Faculty with limited choice
Language of course	English
Nominal semester	---------
Academic year	2024/2025
Preliminary requirements	Thermodynamics, Vehicle dynamics
Limit of students	maximum 6 students (3 groups of 1-2 persons)
C. Effects of education and manner of teaching	
Purpose of course	To familiarise the student with mathematical modelling and numerical simulation of selected thermodynamic and flow problems in automotive vehicles (internal combustion engine, braking system).
Effects of education	See Table 1.
Form of didactic studies and number of hours	
Lecture	**0**
Exercise type of course	**0**
Laboratory	**0**
Project type of course	**15** (Consultations with the person responsible for the semester project)
Contents of education	Mathematical modelling and simulation investigations of selected thermodynamic and flow problems in automotive vehicles. Individual projects (student groups of 1-2 persons) of the following subjects: 1. Numerical simulation of heat transfer process in automotive brakes; 2. Numerical simulation of a gas flow through the labyrinth seal of a piston ring pack; 3. Numerical simulation of hydrodynamic lubrication of piston rings of an internal combustion engine 4. Numerical simulation of the working cycle of an internal combustion engine 5. Numerical simulation of heat transfer in cylinder of a chosen Diesel internal combustion engine

Methods of evaluation	Computational project – checking of simulation results and a report in a written form.
Methods of verification of effects of education	See Table 1.
Exam	No
Literature	[1] Incropera F. P., DeWitt D. P., Bergman T. L, Lavine A. S., *Introduction to Heat Transfer*, John Willey & Sons, 2006. [2] Gillespie T. D., *Fundamentals of vehicle dynamics*, SAE, Inc. Warrendale 1994; [3] Heywood J. B., *Internal Combustion Engine Fundamentals*, McGrawHill Science Engineering, 1988; [4] Sonntag R.E., Borgnakke C., Van Wylen G.J., *Fundamentals of Thermodynamics*, John Willey & Sons, 2002; [5] Taylor C.F., *Internal Combustion Engine in Theory and Practice*, MIT Press, 1985; [6] John J., *Gas Dynamics*, Prentice Hall, 2006.
Website of the course	------
D. Student's activity	
Number of credits ECTS	3
Number of hours of student's job for achievement of education's effect (description):	**75 hours**, including: work with academic teacher 10 hours, studying the literature 15 hours, familiarising with software 18 hours, independently performing of the project 30 hours, defence of the project 2 hours
Number of credits ECTS on the course with direct participation of academic teacher	**0,5 ECTS points** (work with academic teacher 10 hours)
Number of credits ECTS on practical activities on the course	**3 ECTS points** (75 hours, including: work with teacher 10 hours, studying the literature 15 hours, familiarising with software 18 hours, independently performing of the project 30 hours, defence of the project 2 hours).
E. Additional information	
Notes	-----
Date of last edition	19.11.2024

Table 1. General academic profile

Course's effects		Field effects	Area effect
Knowledge			
Effect:	The student has ordered and theoretically founded knowledge concerning thermodynamic and flow phenomena in automotive vehicles	Tr1A_W08	T1A_W03
Code of effect:	W_01		
Verification:	Checking of the performed project (description and results), and oral interview (defence of the project)		
Effect:	The student knows the basic calculation methods of solving the fundamental physical processes taking place in automotive vehicles	Tr1A_W01	T1A_W07
Code of effect:	W_02		
Verification:	Checking of the performed project (description and results), and oral interview (defence of the project)		

Effect:	The student has knowledge of the design and operation of some vehicle systems (internal combustion engine, braking system). He knows the basic methods of empirical testing of vehicle systems	Tr1A_W09	T1A_W04
Code of effect:	W_03		
Verification:	Checking of the performed project (description and results), and oral interview (defence of the project)		
Skills			
Effect:	The student has the ability to obtain information from the literature, integrate information and draw conclusions and opinions	Tr1A_U01	T1A_U01
Code of effect:	U_01		
Verification:	Checking of the performed project (description and results), and oral interview (defence of the project)		
Effect:	The student is able to independently plan and conduct an experiment (physical, modelling, simulation) and interpret the results	Tr1A_U09	T1A_U08
Code of effect:	U_02		
Verification:	Checking of the performed project (description and results), and oral interview (defence of the project)		
Effect:	The student can make a critical analysis of the functionning of the existing technical solutions (range of skills and references depends on the subject of the project)	Tr1A_U17	T1A_U13
Code of effect:	U_03		
Verification:	Checking of the performed project (description and results), and oral interview (defence of the project)		
Effect:	The student can design a device / object / system / process / typical for the specialization being studied	Tr1A_U23	T1A_U16
Code of effect:	U_04		
Verification:	Checking of the performed project (description and results), and oral interview (defence of the project)		
Social competences			
Effect:	---		
Code of effect:	---		
Verification:	---		