

Warsaw University of Technology | Doctoral School No. 4

Course offered in the Doctoral School No. 4
– Spring semester of the 2021/2022 academic year

TITLE
Applied Gas Dynamics and Turbocharging Systems for Internal Combustion Engines
CONDUCTING UNIT
Doctoral School No. 4
SCIENTIFIC DISCIPLINE
Mechanical engineering
IMPLEMENTING UNIT
115000 - Faculty of Automotive and Construction Machinery Engineering
SUMMARY DESCRIPTION
Studying the fundamental theory of turbocharging including specific gas dynamics processes that are taking place in the turbocharging systems of internal combustion engines. Transformation of the theoretical knowledge into relevant practical skills. Scientific tools used for turbocharging systems analysis and optimization.
FULL DESCRIPTION
<p>Lectures:</p> <ul style="list-style-type: none">• Fundamentals of Gas Dynamics• Fundamentals of turbocharging systems for ICE• Turbocharging systems for ICE: current solutions and future trends• CFD as an engineering tool for design and analysis of turbocharging systems• Scientific tools used for turbocharging systems analysis and optimization <p>Class exercises on 3D Flow simulations: 3D simulations and flow analysis in the turbocharging systems units and stages.</p> <p>Evaluation methods. Theory - written test on skills and knowledge concerning the scope of the course. Practice - project on analysis and optimization of turbocharging system for ICE</p>
LITERATURE
<ol style="list-style-type: none">1. Fundamentals of Compressible Fluid Mechanics, Minneapolis, MN55414-2411, 2013, 400p.2. Computational Fluid Dynamics Second Edition. T. J. CHUNG, Cambridge university press, 2010, 1034p.3. Fluid Mechanics and Thermodynamics of Turbomachinery Seventh Edition. University of Cambridge. UK, 2014, 535p.

4.	Michael J. Moran, Howard N. Shapiro. Fundamentals of engineering thermodynamics. John Wiley& Sons Ltd, England 2006
5.	Samoilenko D. Variable geometry radial inflow turbines with vaneless distributor: theory, research and application. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2019.

LEARNING OUTCOMES

Knowledge on fundamental gas dynamic processes that are taking place in the compressor and turbine stage of turbocharging systems used in internal combustion engines.

Application of CFD tools. A critical approach in analysis of obtained CFD simulations results. Ability to deliver recommendations in design improvements based on the knowledge related to technical problems solving in machines and vehicles engineering. Ability to conduct research on turbocharging systems development and optimization using scientific tools.

ASSESSMENT METHODS AND CITERIA; COURSE COMPLETION FORM

Theory - written test on skills and knowledge concerning the scope of the course.
Practice - project on analysis and optimization of turbocharging system for ICE. Final grade from the course is based on scores got from the theoretical test and positive project mark.

LANGUAGE OF THE COURSE		ECTS CREDITS	
English		4	
TYPE OF CLASSES	NUMBER OF HOURS	COURSE INSTRUCTOR	
Lecture (WYK), Computer classes (ZKO)	30	Dmytro Samoilenko, dr hab. inż., prof. uczelni	