



## Subject card

Subject name and code	, PG_00071246						
Field of study	Mechanical Engineering						
Date of commencement of studies	February 2025	Academic year of realisation of subject			2025/2026		
Education level	second-cycle studies	Subject group					
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	2	Language of instruction			Polish		
Semester of study	3	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Division of Fluid-Flow Machinery -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Krzysztof Kosowski					
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	0.0	0.0	5.0	5
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	5		0.0		45.0	50
Subject objectives	The aim of the lecture is to provide advanced theoretical and engineering knowledge in the field of electrohydrodynamic propulsion, covering the physical foundations of thrust generation, modeling of coupled phenomena (electric fieldflow interaction), analysis of energy efficiency, and evaluation of potential applications in atmospheric and low-pressure conditions.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W04] demonstrates knowledge covering selected topics of advanced specific knowledge, in particular methods, techniques, tools specific to Mechanics and Mechanical Engineering processes, systems and equipment	Student is familiar with modeling methods for EHD propulsion systems and understands the energy-related and efficiency limitations of EHD systems.	[SW2] Assessment of knowledge contained in presentation
	[K7_W01] explains and describes, on the basis of general knowledge of the scientific disciplines forming the theoretical basis of Mechanics and Mechanical Engineering, the structure and principles of operation of mechanical systems and processes	Student possesses advanced knowledge of electrohydrodynamics and corona discharge physics.	[SW2] Assessment of knowledge contained in presentation
	[K7_W81] has knowledge of complex grammatical structures and diverse lexical resources needed to communicate in foreign language in terms of general and specialist language related to field of study	Student is able to conduct a substantive, technical discussion on emerging propulsion technologies.	[SW2] Assessment of knowledge contained in presentation
	[K7_U81] is able to communicate with ease in foreign language at B2+ level of the Common European Framework of Reference for Languages (CEFR) in everyday life, in academic and professional environments	Student communicates fluently in English, both orally and in writing	[SU2] Assessment of ability to analyse information
	[K7_W101] is able to make an in-depth identification of key objects and phenomena related to the field of study, as well as theories that describe them and applicable analytical and design methods	Student understands the mechanisms of force and thrust generation in EHD propulsion systems and comprehends the relationships between the electric field, charge transport, and fluid flow.	[SW2] Assessment of knowledge contained in presentation
Subject contents	<p>Course content – seminar</p> <p>Definition of electrohydrodynamics, Maxwell equations in dielectric media, Charge transport in weakly conducting fluids, Space charge formation, Force generation mechanisms, Corona discharge physics, Ion drift and momentum transfer, Thrust estimation models, Liquid-phase EHD propulsion, Vacuum / low-pressure EHD systems, Electrode configurations, Power supply considerations, Performance metrics, Micro-scale systems, Large-area propulsion concepts</p> <ul style="list-style-type: none"> <li>•</li> </ul>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	presentation	60.0%	100.0%
Recommended reading	Basic literature	<p>Antonio Castellanos - Electrohydrodynamics; 978-3-211-83137-3; 27.10.1998</p> <p>Cagnoni, D.; Agostini, F.; Christen, T.; de Falco, C.; Parolini, N.; Stefanovic, I. - Multiphysics simulation of corona discharge induced ionic wind; 4.07.2013</p>	
	Supplementary literature	<p>William S. Franklin - Advanced Theory of Electricity and Magnetism</p> <p>Boucif Abdesselam - Introduction to Classical Electrodynamics 1; 9781394372706; 2025</p> <p>S. L. Kakani, C. Hemrajani - Electromagnetism theory and problems electrodynamic and plasma physics; 81-239-0871-7; 2002</p>	
	eResources addresses		

Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"><li>1. Explain the thrust generation mechanism in an electrohydrodynamic propulsion system operating in atmospheric air. Discuss the role of corona discharge, ion drift, and momentum transfer to neutral particles.</li><li>2. Present a simplified analytical model of an EHD propulsion system and discuss the dependence of thrust on supply voltage, electrode geometry, and medium properties. Provide a qualitative assessment of the systems energy efficiency.</li><li>3. Compare electrohydrodynamic propulsion with conventional ion propulsion used in space applications. Identify differences in operating principles, power requirements, and potential applications.</li></ol>
Practical activities within the subject	Not applicable

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