



## Subject card

Subject name and code	Brain-Computer Interfaces, PG_00064472						
Field of study	Mechanical and Medical Engineering						
Date of commencement of studies	February 2024	Academic year of realisation of subject			2024/2025		
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			English		
Semester of study	3	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Zakład Ekoinżynierii i Silników Spalinowych -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jacek Kropiwnicki					
	Teachers	prof. Alexandru Ianosi					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	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	30		0.0		0.0	30
Subject objectives	The lecture introduces the basics of neurology, signal processing, machine learning and EEG measurements and experiments as part of the creation and use of brain-computer interfaces.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W09] He/she in-depth knowledge related to diagnosis techniques and medical procedures in the scope of the field of study of mechanical-medical engineering						
	[K7_W08] He/she broad knowledge related to understand social, economic, legal, ecological and other outer techniques conditions of engineering activities in mechanical-medical engineering						
	[K7_W07] He/she in-depth knowledge related to engineering materials and technologies used in mechanical-medical engineering						
	[K7_W06] He/she in-depth knowledge related to construct, design and build of mechanical devices and mechanical-medical devices						
Subject contents	Basic neuroscience; Underlying brain structures; Functions of nervous tissue; Anatomy of the brain; Electrode placement; Signal conditioning; Signal processing; Fourier transform; Wavelet transform; Hjorth parameters; Principal component analysis; Independent component analysis; Common spatial patterns; Basic machine learning techniques; Types of BCIs; Invasive and Semi-invasive BCI; Sensory Restoration.						
Prerequisites and co-requisites							
Assessment methods and criteria	Subject passing criteria	Passing threshold			Percentage of the final grade		
	Preparation of the study and presentation	50.0%			100.0%		

Recommended reading	Basic literature	<p>- Cohen, M. X. (2014). Analyzing neural time series data: Theory and practice. The MIT Press.</p> <p>- Geron, A. (2019). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems. O'Reilly Media</p> <p>- Wolpaw, J.R &amp; Wolpaw, E.W. (Eds.) (2012). Brain Computer Interfaces Principles and Practice. Oxford University Press</p>
	Supplementary literature	- Bear, M. F., Connors, B. W., & Paradiso, M. A. (2016). Neuroscience: Exploring the brain (4th edition). Wolters Kluwer.
	eResources addresses	Adresy na platformie eNauczenie:
Example issues/ example questions/ tasks being completed	<ul style="list-style-type: none"> <li>- Describe succinctly the principles behind a motor-imagery based BCI paradigm.</li> <li>- Explain 2 methods for assessing the performance of a BCI system.</li> <li>- Which area of the brain is the EEG signal sampled from for a steady-state VEP BCI paradigm?</li> <li>- What is the P300 wave and why is it significant for building a BCI?</li> <li>- Enumerate and briefly explain 3 challenges for designing a BCI system.</li> </ul>	
Work placement	Not applicable	

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