GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Brain-Computer Interfaces, PG_00064472		
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	English
Semester of study	3	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Ecoengineering and Combustion Engines -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jacek Kropiwnicki	
	Teachers		

Lesson types

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

Subject contents

Course content – lecture
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

- Cohen, M. X. (2014). Analyzing neural time series data: Theory and practice. The MIT Press.

- Geron, A. (2019). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems. O'Reilly Media

- Wolpaw, J.R & Wolpaw, E.W. (Eds.) (2012). Brain Computer Interfaces Principles and Practice. Oxford University Press

Supplementary literature

- Bear, M. F., Connors, B. W., & Paradiso, M. A. (2016). Neuroscience: Exploring the brain (4th edition). Wolters Kluwer.

eResources addresses

Example issues/ example questions/ tasks being completed	- Describe succinctly the principles behind a motor-imagery based BCI paradigm. - Explain 2 methods for assesing the performance of a BCI system. - Which area of the brain is the EEG signal sampled from for a steady-state VEP BCI paradigm? - What is the P300 wave and why is it significant for building a BCI? - Enumerate and briefly explain 3 challenges for designing a BCI system.
Practical activites within the subject	Not applicable

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