COURSE SYLLABUS AND COURSE REQUIREMENTS
ACADEMIC YEAR ... SEMESTER ...

Course title	*Human - Machine Interface*
Course Code	MSM616ANEG
Hours/Week: le/pr/lab	2 lectures, 2 practices / week
Credits	4
Degree Programme	
Study Mode	*Face to face*
Requirements	
Teaching Period	
Prerequisites	
Department(s)	University of Pécs, Neurosurgery Department, 3D Printing Centre
Course Director	*Luca Toth*
Teaching Staff	

COURSE DESCRIPTION

A short description of the course (max. 10 sentences).
Neptun: Instruction/Subjects/Subject Details/Basic data/Subject description

In the course of Human-Machine Interface, students gain insight into development of systems implemented between human (man) - machine, machine – human (man), and how to use them, also the most important applications. Understand the detection and interpretation of neurophysiological signals for control, with particular interest to electroencephalography (EEG), electromyography (EMG), and electroneurography (ENG). Comprehensive knowledge of different control principles and sensors. Basics and application of brain - computer interface. Bionic devices and their significance in bioengineering. Robotic devices and their application. Implantable systems. Knowledge of the basic mechanisms of cerebral plasticity. VR and AR systems.

SYLLABUS

Neptun: Instruction/Subjects/Subject Details/Syllabus

1. GOALS AND OBJECTIVES

Goals, student learning outcome.
Neptun: Instruction/Subjects/Subject Details/Syllabus/Goal of Instruction

- The goal of the subject is to introduce the students to human – machine interface systems, controls and applications.
- To understand basic control systems and clinical applications
- To get insight to virtual and diagnostic devices applied for clinical research or treatment
- To understand the basics of signal sorting and invasive signal recording

2. COURSE CONTENT

Neptun: Instruction/Subjects/Subject Details/Syllabus/Subject content

	TOPICS
LECTURE	1. *Basic principles of human – machine interface systems, Introduction to exoskeletons topic* 2. *Biomedical engineering and the application of AR and VR systems* 3. *Transcranial magnetic stimulation as a potential therapeutic system for neurologic diseases* 4. *Monitoring the activity of large neuronal populations with high spatiotemporal resolution* 5. *Functional electric stimulation with biomedical engineering applications* 6. *Principles of movement analysis systems and application as control for HMI systems* 7. *Invasive brain monitoring for therapeutic target in the intensive care unit* 8. *Spring holiday* 9. *EEG, quantitative EEG, EEG signal processing, fMRI human machine interface* 10. *Biorobotics as the science-fiction of robotics* 11. *Consultation - Neurorehabilitation with robotic devices*

12. *3D printed systems and bionic prosthetics for HMI*
13. *Presentation of the project work*
14. *Test*

PRACTICE & LABORATORY

1. *Basic principles of human – machine interface systems, Introduction to exoskeletons topic*
2. *Biomedical engineering and the application of AR and VR systems*
3. *Transcranial magnetic stimulation as a potential therapeutic system for neurologic diseases*
4. *Monitoring the activity of large neuronal populations with high spatiotemporal resolution*
5. *Functional electric stimulation with biomedical engineering applications*
6. *Principles of movement analysis systems and application as control for HMI systems*
7. *Invasive brain monitoring for therapeutic target in the intensive care unit*
8. *Spring holiday*
9. *EEG, quantitative EEG, EEG signal processing, fMRI human machine interface*
10. *Biorobotics as the science-fiction of robotics*
11. *Consultation - Neurorehabilitation with robotic devices*
12. *3D printed systems and bionic prosthetics for HMI*
13. *Presentation of the project work*
14. *Test*

DETAILED SYLLABUS AND COURSE SCHEDULE

ACADEMIC HOLIDAYS INCLUDED

LECTURE & PRACTICE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	Basic principles of human – machine interface systems Introduction to exoskeletons	Jocelyne Troccaz - Medical Robotics, 2013, ISBN-10: 1848213344	To plan a HMI system	13th week
2.	Biomedical engineering and the application of AR and VR systems	Chang S. Nam, Anton Nijholt, Fabien Lotte - Brain–Computer Interfaces Handbook: Technological and Theoretical Advances, 1st Edition. ISBN 9781498773430 - CAT# K29559		
3.	Transcranial magnetic stimulation as a potential therapeutic systems for neurologic diseases	Chang S. Nam, Anton Nijholt, Fabien Lotte - Brain–Computer Interfaces Handbook: Technological and Theoretical Advances, 1st Edition. ISBN 9781498773430 - CAT# K29559		
4.	Monitoring the activity of large neuronal populations with high spatiotemporal resolution	Chang S. Nam, Anton Nijholt, Fabien Lotte - Brain–Computer Interfaces Handbook: Technological and Theoretical Advances, 1st Edition. ISBN 9781498773430 - CAT# K29559		

5.	Functional electric stimulation with biomedical engineering applications	Chang S. Nam, Anton Nijholt, Fabien Lotte - Brain–Computer Interfaces Handbook: Technological and Theoretical Advances, 1st Edition. ISBN 9781498773430 - CAT# K29559		
6.	Principles of movement analysis systems and application as control for HMI systems	Jocelyne Troccaz - Medical Robotics, 2013, ISBN-10: 1848213344		
7.	Invasive brain monitoring for therapeutic target in the intensive care unit	Chang S. Nam, Anton Nijholt, Fabien Lotte - Brain–Computer Interfaces Handbook: Technological and Theoretical Advances, 1st Edition. ISBN 9781498773430 - CAT# K29559		
8.	Neurorehabilitation with robotic devices	Jocelyne Troccaz - Medical Robotics, 2013, ISBN-10: 1848213344		
9.	EEG, quantitative EEG, EEG signal processing, fMRI human machine interface	Chang S. Nam, Anton Nijholt, Fabien Lotte - Brain–Computer Interfaces Handbook: Technological and Theoretical Advances, 1st Edition. ISBN 9781498773430 - CAT# K29559		
10.	Biorobotics as the science-fiction of robotics	Chang S. Nam, Anton Nijholt, Fabien Lotte - Brain–Computer Interfaces Handbook: Technological and Theoretical Advances, 1st Edition. ISBN 9781498773430 - CAT# K29559		
11.	Consultation on Neurorehabilitation with robotic devices	Chang S. Nam, Anton Nijholt, Fabien Lotte - Brain–Computer Interfaces Handbook: Technological and Theoretical Advances, 1st Edition. ISBN 9781498773430 - CAT# K29559		
12.	3D printed systems and bionic prosthetics for HMI	Jocelyne Troccaz - Medical Robotics, 2013, ISBN-10: 1848213344		
13.	Presentation of the project work		Presentation of assigned HMI system planning	

14.	Test			
15.	Re-Test taking opportunity			

3. ASSESSMENT AND EVALUATION

(Neptun: Instruction/Subjects/Subject Details/Syllabus/Examination and Evaluation System)

ATTENDANCE

In accordance with the Code of Studies and Examinations of the University of Pécs, Article 45 (2) and Annex 9. (Article 3) a student may be refused a grade or qualification in the given full-time course if the number of class absences exceeds 30% of the contact hours stipulated in the course description.

Method for monitoring attendance *(e.g.: attendance sheet / online test/ register, etc.)*

Attendance sheet

ASSESSMENT

Cells of the appropriate type of requirement is to be filled out (course-units resulting in mid-term grade or examination). Cells of the other type can be deleted.

Course resulting in mid-term grade *(PTE TVSz 40§(3))*

Mid-term assessments, performance evaluation and their ratio in the final grade *(The samples in the table to be deleted.)*

Type	Assessment	Ratio in the final grade
Home assignment	*max. 25 points*	*25%*
Test	*Max 30 points*	*75%*

Opportunity and procedure for re-takes (PTE TVSz 47§(4))

The specific regulations for improving grades and resitting tests must be read and applied according to the general Code of Studies and Examinations. E.g.: all tests and assessment tasks can be repeated/improved at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.

On the last, 15th week there will be opportunity to present the assigned HMI system presentation or a test re-take opportunity

Grade calculation as a percentage

based on the aggregate performance according to the following table

Course grade	Performance in %
excellent (5)	85 % <
good (4)	70 % - 85 %
satisfactory (3)	55 % - 70 %
pass (2)	40 % - 55 %
fail (1)	below 40 %

The lower limit given at each grade belongs to that grade.

4. SPECIFIED LITERATURE

In order of relevance. (In Neptun ES: Instruction/Subject/Subject details/Syllabus/Literature)

COMPULSORY READING AND AVAILABILITY

- Jocelyne Troccaz - Medical Robotics, 2013, ISBN-10: 1848213344
- Kevin C Chui, Sheng-Che Yen, Milagros Jorge, Michelle M. Lusardi - Orthotics and Prosthetics in Rehabilitation, 4th edition
- Chang S. Nam, Anton Nijholt, Fabien Lotte - Brain–Computer Interfaces Handbook: Technological and Theoretical Advances, 1st Edition. ISBN 9781498773430 - CAT# K29559
- Dietz, Volker, and Nick S. Ward (eds), Oxford Textbook of Neurorehabilitation, 2 edn, Oxford Textbooks in Clinical Neurology (Oxford, 2020; online edn, Oxford Academic, 1 May 2020), https://doi.org/10.1093/med/9780198824954.001.0001, accessed 26 Jan. 2023.