VU VRIJE UNIVERSITEIT AMSTERDAM

Non-Invasive Brain Stimulation: Foundations for Designing and Implementing Research

SYLLABUS

VU Amsterdam Summer School

20th to 24th July 2026

Any general questions for the Summer School support team? Contact amsterdamsummerschool@vu.nl.

Course Details

Title	Non-Invasive Brain Stimulation: Foundations for Designing and Implementing Research
Coordinator(s)	Tulika Nandi, Ysbrand van der Werf, Emile d'Angremont, Sophie Fitzsimmons
Other lecturers	Odile van den Heuvel, Willem de Haan, Tim van Balkom, Coen Coomans, Hidde Woerdman, Eric van Exel, Eva Oostra, Celine Dietz, Nikki van Sante
Form(s) of tuition	On campus Lectures, lab sessions and group discussions
Approximate contact hours	25
Approximate self-study hours	10

Teaching staff (in order of appearance)

Ysbrand van der Werf
Emile d'Angremont
Tulika Nandi
Sophie Fitzsimmons

Course description

Non-invasive brain stimulation (NIBS) is a powerful tool which can be used to ask questions about cause-and-effect relationships in the brain of healthy and pathological populations. It can also be used as a treatment in various psychiatric and neurological conditions. To harness the full potential of NIBS and use it optimally, it is essential to have a strong theoretical foundation. After following this course, you will be able to determine whether NIBS is a suitable technique for your research question and make informed decisions about the study design. You will also receive some hands-on training.

Learning objectives

By the end of this course, you will be able to:

1. Critically evaluate studies using NIBS.
2. Design well-controlled NIBS studies, using the appropriate protocols for their own research questions.
3. Assess safety when choosing protocols and recruiting participants or patients.
4. Interpret NIBS data to make well-justified inferences and conclusions.
5. Perform basic procedures of NIBS.

Assignments and Assessment

The assessment will include a presentation (50%) and a written assignment (50%). Both assignments are completed and graded individually. Both assignments will be graded on a 10-point scale. A combined score of 6 or higher is required to pass the course. There is no minimum grade requirement for the individual assignments.

For the written assignment, the deadline can be extended until 14th August, 10 am, only in case of illness or other extenuating circumstances. An extended deadline is not possible for the presentation. Instead, an additional written assignment will be provided.

Presentation (50% of total course grade; last day of course)

Please design your own non-invasive brain stimulation (NIBS) study and present it to the group in 6 minutes, with 3 minutes for questions. Please note that the presentation will be assessed mainly for the suitability and rigor of the NIBS methods, and not for the novelty and appropriateness of the research question in the context of your specific field.

- Background and research question (10 %)
- Why is NIBS an appropriate tool for this question? (10%)
- What NIBS modality, protocol(s) and parameters do you plan to use? (25%)
- Justify the risk-benefit ratio for your chosen protocol(s) and population. (10%)
- Describe the study design and lab set-up (10%)
- Discuss the hypothesized findings and their interpretation (20%)
- Presentation visuals and delivery (15%)

Percentages represent the proportion of the grade for the presentation, which is 50% of the total course grade. This assignment directly addresses learning goal 2.

Written assignment (50% of total course grade)

You plan to apply for ethical approval for the study you have designed. Please write the 'inclusion/ exclusion criteria' (30%) and the 'benefits and risk assessment' (70%) sections of your ethical application. For the latter, the Dutch template provides the following explanation: 'For studies with capacitated adults and therapeutic research with minors and incapacitated participants, it should be explained why the risk to and burden for the participant will be in proportion to the potential value of the research and, if applicable, it should be stated to which extent the research may be beneficial to the participant.'

Grading will be based on information related to the use of NIBS, and other criteria specific to your study are not required for this assignment. Please limit the assignment to 2-pages. It is due on 28th July 2026, at 10:00. Percentages represent the proportion of the grade for the written assignment, which is 50% of the total course grade. This assignment directly addresses learning goal 3.

Additional written assignment if presentation is missed (50% of total course grade)

You plan to preregister your study on the Open Science Platform. Please write the Methods section of the preregistration document. Please see here for general guidelines and templates for preregistration.

Grading will be based on information related to the use of NIBS, and other criteria specific to your study are not required for this assignment. Please limit the assignment to 2-pages, including figures. It is due on 4th August 2026, at 10:00. This assignment directly addresses learning goal 2.

Provisional reading list

1. Rossini, Paolo Maria, et al. "Non-invasive electrical and magnetic stimulation of the brain, spinal cord, roots and peripheral nerves: Basic principles and procedures for routine clinical and research application. An updated report from an IFCN Committee." *Clinical neurophysiology* 126.6 (2015): 1071-1107.
2. Klomjai, Wanalee, Rose Katz, and Alexandra Lackmy-Vallée. "Basic principles of transcranial magnetic stimulation (TMS) and repetitive TMS (rTMS)." *Annals of physical and rehabilitation medicine* 58.4 (2015): 208-213.
3. Woods, Adam J., et al. "A technical guide to tDCS, and related non-invasive brain stimulation tools." *Clinical neurophysiology* 127.2 (2016): 1031-1048.
4. Parkin, Beth L., Hamed Ekhtiari, and Vincent F. Walsh. "Non-invasive human brain stimulation in cognitive neuroscience: a primer." *Neuron* 87.5 (2015): 932-945.

Reference list (not essential reading)

1. Rossi, Simone, et al. "Safety, ethical considerations, and application guidelines for the use of transcranial magnetic stimulation in clinical practice and research." *Clinical neurophysiology* 120.12 (2009): 2008-2039.
2. Antal, Andrea, et al. "Low intensity transcranial electric stimulation: safety, ethical, legal regulatory and application guidelines." *Clinical neurophysiology* 128.9 (2017): 1774-1809.
3. Lefaucheur, Jean-Pascal, et al. "Evidence-based guidelines on the therapeutic use of repetitive transcranial magnetic stimulation (rTMS)." *Clinical neurophysiology* 125.11 (2014): 2150-2206.
4. Lefaucheur JP, et al. Evidence-based guidelines on the therapeutic use of repetitive transcranial magnetic stimulation (rTMS): An update (2014-2018). Clin Neurophysiol. 2020 Feb;131(2):474-528. doi: 10.1016/j.clinph.2019.11.002. Epub 2020 Jan 1.
5. Fregni, Felipe, et al. "Evidence-based guidelines and secondary meta-analysis for the use of transcranial direct current stimulation in neurological and psychiatric disorders." *International Journal of Neuropsychopharmacology* 24.4 (2021): 256-313.
6. Cocchi, L., & Zalesky, A. (2018). Personalized Transcranial Magnetic Stimulation in Psychiatry. Biological psychiatry. Cognitive neuroscience and neuroimaging, 3(9), 731–741. https://doi.org/10.1016/j.bpsc.2018.01.008

7. Ziemann, U., et al. (2026). Clinical utility and prospective of TMS–EEG: Updated review from an international expert group. Clinical Neurophysiology, 2111487.

Course Schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
09:00-09:30	Summer School opening and campus tour	Discussion session (students introduce themselves, flipped classroom methods)	tES Clinical applications, including headset demonstration	Study design	Recent advances (TUS)
09:30-10:00	Summer School opening and campus tour				
10:00-10:30	Welcome General introduction to NIBS - History - Overview of research and clinical applications - Safety - Introduce assignment Fill in safety screening forms	tES protocols and effects	rTMS PhD projects	TMS Clinical applications I Depression	Presentations
10:30-11:00					
11:00-11:30	TMS protocols and effects	Coffee break	Coffee break	Coffee break	Coffee break
11:30-12:00		Study design + research applications	Combining NIBS with other techniques	TMS Clinical Applications II	Presentations

12:00-12:30	Lunch break			OCD/Anxiety	
12:30-13:00		Lunch break	Lunch break	Lunch break	Lunch break
13:00-13:30	Lab visit (2 parallel sessions) Single pulse TMS + neuronavigation: demonstration and individual practice (ZH 2A68) Or: Paired pulse TMS (MF C472)				
13:30-14:00		Animal/ in-vitro research	Free	Lab visit 3 (2 parallel sessions, 45 mins each) TMS + EEG (ZH) Or: H-coil (O2)	Presentations
14:00-14:30		Safety			
14:30-15:00	Free				
15:00-15:30		Coffee break		Coffee break	Free
15:30-16:00		Lab visit (2 parallel sessions) Single pulse TMS + neuronavigation: demonstration and		Variability in NIBS outcomes (includes E-field modelling) Network effects	
16:00-16:30					

16:30-17:00		individual practice (ZH 2A68) Or: Paired pulse TMS (MF C472)		Recent advances (c/xTMS etc.)