

DEEP TECH BRAIN: NEUROMODULATION

STUDY PLAN

Course type: Microcredential

Teaching modality: Distance learning

Language of instruction: English

Number of credits: 3

General features of the teaching methodology:

- 10 asynchronous theoretical sessions (2h each).
- 10 hours of practical sessions, delivered through audiovisual material for asynchronous distance learning.

TEACHING PLAN

Contents:

This course is structured into 5 theoretical thematic blocs and 3 practical sessions

Thematic blocks:

1. Basic principles of non-invasive brain stimulation (NIBS) in humans
2. Transcranial Magnetic Stimulation (TMS): neurophysiology, plasticity, and transient perturbation studies
3. TMS: Combined use with neuroimaging techniques
4. Transcranial electrical stimulation (tES): Basic principles and network modulation
5. Applications of NIBS in clinical research
 - 5.1 Cognitive aging and dementia
 - 5.2 Depression and other psychiatric disorders

Practices:

Audiovisual material, asynchronous

- P1: Transcranial Magnetic Stimulation – Motor threshold determination and localization techniques
- P2: TMS combined with EEG and MRI
- P3: Transcranial Electrical Stimulation – Basic principles and mont

Objectives:

- Understand the theoretical and physical principles underlying the main non-invasive brain stimulation techniques
- Learn about key applications of these techniques in research on the human nervous system
- Comprehend the neurophysiological and neuroimaging mechanisms explaining how these

techniques affect brain function

- Recognize the importance of individual variability in response to brain stimulation
- Learn current clinical protocols and the regulatory status of NIBS for neuropsychiatric conditions
- Critically analyze scientific findings in published work related to neuromodulation

EVALUATION

- Theoretical exam: 60%
- Practical exams (1 per lab session): 40%

Exam format:

- Multiple choice (4 options per question)
- Wrong answers deduct 0.25 points
- Grading scale: 0–4.9: Fail, 5–6.9: Pass, 7–8.9: Good, 9–10: Excellent

To pass the course:

- All four exams (1 theoretical + 3 practical) must be completed
- A minimum score of 5/10 is required in the theoretical exam to average with the practical exams and obtain the final grade.

RECOMMENDED BIBLIOGRAPHY

Bhattacharya, A., Mrudula, K., Sreepada, S. S., Sathyaprabha, T. N., Pal, P. K., Chen, R., & Udupa, K. (2022). An Overview of Noninvasive Brain Stimulation: Basic Principles and Clinical Applications. *Canadian Journal of Neurological Sciences*, 49(4), 479–492.

<https://doi.org/10.1017/cjn.2021.158>

Desarkar, P., Vicario, C. M., & Soltanlou, M. (2024). Non-invasive brain stimulation in research and therapy. *Scientific Reports*, 14(1), 29334. <https://doi.org/10.1038/s41598-024-79039-1>

Peterchev, A. V., Ziemann, U., Wassermann, E. M., Lisanby, S. H., & Siebner, H. R. (Additional key reference on NIBS fundamentals and protocols)