COURSE OUTLINE

(1) GENERAL

SCHOOL			
ACADEMIC UNIT	**Interdisciplinary Graduate Programme in the BRAIN and MIND sciences**		
LEVEL OF STUDIES	7		
COURSE CODE	**B&M-231**	SEMESTER	**Fall**
COURSE TITLE	Brain Connectivity Analysis Using EEG MEG		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	WEEKLY TEACHING HOURS	CREDITS
lectures	3	6
Presentation and discussion of scientific articles	3	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	B&M-103 Introduction to Computational Neuroscience B&M-232 Introduction to Statistics and Programming Recommended also: B&M-236 Introduction to Signal Processing for Neural Signal Analysis
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://elearn.uoc.gr/enrol/index.php?id=4433

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

In this course, students will first be introduced to the different methods for recording and quantifying brain function. The focus will be on learning, understanding, and analyzing electroencephalography (EEG) and magnetoencephalography (MEG), which are characterized by their non-invasive nature and high temporal resolution. After presenting the basic principles of brain neurophysiology, the course will cover the detection of brain processes and events using EEG and MEG. Specific applications of these imaging techniques will then be explored in problems reflecting both cognitive brain functions and certain pathologies.

By the end of the course, students will have acquired specialized knowledge in:

- the generation of potentials recorded via EEG,
- the experimental procedure and the various methodologies for recording EEG signals from the brain, including different protocols for resting-state EEG and evoked potentials,
- the analysis of these signals using modern signal processing and modeling techniques,
- the different ways of imaging brain function,
- the quantification of correlations between different brain regions and the analysis of brain topographic maps using graph-theoretical approaches,
- the localization and imaging of brain sources of electromagnetic signals,
- the development of brain–computer interfaces and specific applications thereof.

Upon successful completion of the course, students:

- demonstrate an overall understanding of the knowledge comprising the subject of the unit,
- understand the basic theories, concepts, and analytical procedures underlying the EEG method,
- possess practical training and the potential for further specialization in these technologies.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Team work
- Working in an interdisciplinary environment
- Production of new research ideas
- Criticism and self-criticism
- Production of free, creative and inductive thinking

(3) SYLLABUS

- Brain mapping: a brief historical overview
- Functional imaging: methods for recording and quantifying brain function
- EEG I: Basic principles / generation of potentials in electroencephalography (EEG) and magnetoencephalography (MEG)
- EEG II: Experimental procedure / recording protocols
- EEG III: Evoked potentials
- Analysis I: Monopolar measurements and methods of spatiotemporal analysis
- Analysis II: Bipolar measurements and multivariate analysis methods

- Analysis III: Causal correlations between regions
- Analysis IV: Source localization methods
- Analysis V: Characterization and visualization of brain networks / graph-theoretical metrics
- Brain–computer interfaces and applications

(1) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• Use of slides/films for teaching
• Use of an online platform for posting lectures and assignments
• Communication via the course website and email
• Use of publishers' databases/electronic repositories of scientific articles.</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>5</td></tr>
<tr><td>Study and analysis of bibliography</td><td>45</td></tr>
<tr><td>non-directed study</td><td>100</td></tr>
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<tr><td>Course total</td><td>150</td></tr>
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<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>Language: English.

At the beginning of the course, different project topics are announced. These projects are presented and evaluated based on their accuracy and completeness. The evaluation criteria are explicitly stated in the Study Guide and communicated to students at the start of the course.</td></tr>
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(2) ATTACHED BIBLIOGRAPHY

- Tong, S., & Thakor, N. V. (2009). Quantitative EEG analysis methods and clinical applications. In Artech House eBooks (Issue 1). http://ci.nii.ac.jp/ncid/BB16635374
- Wallisch, P., Lusignan, M., Benayoun, M., Baker, T. I., Dickey, A. S., & Hatsopoulos, N. G. (2008). MATLAB for Neuroscientists: An Introduction to Scientific computing in MATLAB. http://ci.nii.ac.jp/ncid/BA88010181
- Scientific articles published in reputable scientific journals in the broader field of neuroscience