COURSE OUTLINE

(1) GENERAL

SCHOOL			
ACADEMIC UNIT	**Interdisciplinary Graduate Programme in the BRAIN and MIND sciences**		
LEVEL OF STUDIES	7		
COURSE CODE	**B&M-235**	SEMESTER	**Fall**
COURSE TITLE	Principles of the Functional Imaging of Brain Mechanisms Applied to fMRI data		

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	9
30 hours in total		
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-102, B&M-102A, B&M-107, B&M-103
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://elearn.uoc.gr/course/view.php?id=4443

(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:

- Acquire basic knowledge of the principles and technical concepts underlying the two main methods of functional brain imaging in humans (magnetoencephalography and functional magnetic resonance imaging), as well as the advantages and disadvantages of each method.
- Become familiar with the logic of experimental design for applying these two techniques to investigate the brain mechanisms responsible for psychological functions.
- Learn and practice independently the use of the fMRI data analysis packages **SPM** and **CONN** for the preprocessing and analysis of experimental data provided for this purpose by the instructors.
- Understand the interdisciplinary nature of functional imaging studies, as they systematically integrate brain systems, brain activity recordings, activation maps generated through various algorithms, and psychological functions.

Upon successful completion of the course, students will:

- Have a comprehensive overview of the two most widely used functional brain imaging techniques in humans.
- Understand the basic principles that govern each method, as well as their limitations in capturing brain activity elicited during specific psychological functions.
- Be able to reproduce the knowledge they have acquired and communicate it clearly to both specialized and non-specialized audiences.
- Consolidate the ability to apply fMRI data analysis procedures (task-related and resting-state) to new datasets.
- Acquire the capacity to critically assess the validity and reliability of results obtained from the application of functional imaging techniques in the study of psychological phenomena.

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

- Emphasis is placed on developing the ability to think and work in an interdisciplinary environment, and on the use of modern research methods and technologies.
- Opportunities are provided to practice problem-solving skills at both the technical and conceptual level.
- Critical thinking is fostered for the evaluation of new methods in studying brain function and its relationship to behaviour and psychological processes.
- The value of synthesizing ideas through critical group discussion is reinforced.

(3) SYLLABUS

The lectures and exercises of the course cover the following thematic units:

1. Basic principles of functional brain imaging
2. Functional imaging with fMRI and MEG
3. Experimental design and hypothesis testing
4. fMRI data preprocessing – Lecture
5. fMRI data preprocessing – Exercise
6. fMRI data analysis – Statistical methods (single-subject) – Lecture
7. fMRI data analysis – Statistical methods (single-subject) – Exercise
8. fMRI data analysis – Hypothesis testing (group-level) – Lecture
9. fMRI data analysis – Hypothesis testing (group-level) – Exercise
10. fMRI data analysis – Hypothesis testing (group-level, regressors and covariates) – Lecture
11. fMRI data analysis – Hypothesis testing (group-level, regressors and covariates) – Exercise
12. fMRI data analysis – Special applications and issues – 1
13. fMRI data analysis – Special applications and issues – 2
14. fMRI data analysis – Functional connectivity analyses (CONN)
15. Submission and review of laboratory exercise report and final examination

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of slides for teaching. Use of MATLAB, SPM, and CONN packages both in group sessions and individually. Use of an online platform for posting lectures and exercises. Communication via the course website and e-mail.
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*	
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.*	Short final written examination (50%) Performance in laboratory data analysis exercises using SPM (50%) A passing grade is required in each component. Evaluation criteria are outlined in the study guide and communicated to students at the beginning of the course.

Activity	*Semester workload*
Lectures	45
study	180
Course total	***225***

(5) ATTACHED BIBLIOGRAPHY

- **Suggested bibliography:**

- Huettel, S. Funstional Magnetic Resonance Imaging, 3rd Edition. Oxford University Press, 2014.
- Ashby, FG. Statistical analysis of fMRI data, 2nd Edition. MIT Press, 2019.