COURSE OUTLINE

(1) GENERAL

SCHOOL	
ACADEMIC UNIT	**Interdisciplinary Graduate Programme in the BRAIN and MIND sciences**
LEVEL OF STUDIES	7
COURSE CODE	**B&M-R-133**

COURSE CODE			SEMESTER	depending on availability
B&M-R-133				

COURSE TITLE	Brain Circuits

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
laboratory exercises	6	9-27
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, skills development
PREREQUISITE COURSES:	CS-588 Brain Network Analysis and Modeling
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=4462

(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*

Upon completion of the laboratory internship, the student will be able to:

- Reproduce current knowledge and theories in the field of computational neuroscience and brain networks
- Apply analytical approaches described in the literature
- Design and develop new methods for analyzing experimental biological data (collected using various imaging tools, with an emphasis on 2-photon imaging/mesoscope)
- Critically evaluate original literature relevant to the subject of their research internship
- Write a research paper presenting the research hypothesis, results, and their connection to the current literature

- Collaborate harmoniously with the laboratory team and contribute responsibly to the research work carried out in the lab
- Communicate clearly and accurately to both specialist and non-specialist audiences conclusions and knowledge that may result from original research or professional experience

If the laboratory internship constitutes a Master's thesis, the student will additionally be able to:

- Provide comprehensive answers to research questions in the field of the internship
- Formulate original and innovative research questions in the field of computational neuroscience and brain networks
- Approach research questions in the context of the thesis with creativity and thoroughness
- Produce new knowledge independently
- Formulate new hypotheses and design comprehensive approaches for their examination
- Defend, before a specialized audience, their research results and their implications

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…*
	…….

- 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
- Showing social, professional and ethical responsibility and sensitivity to gender issues
- Criticism and self-criticism
- Production of free, creative and inductive thinking

(3) SYLLABUS

The aim of this course is an in-depth study of selected topics in the field of Computational Neuroscience, with an emphasis on brain neural networks and the principles governing the architecture of functional connectivity and neural activity under various conditions and neurological disorders. The course seeks to equip participants with the necessary tools for con-

ducting research and preparing a research project in Computational Neuroscience. The selection of thematic areas is determined each time based on current trends in the international literature, as well as the specific research interests of the instructor and students.

The general areas from which the specific topics of the course are chosen include: detection of various correlations in neural activity; analysis of the architecture of functional networks in different brain regions under various conditions; information transmission between regions and cortical layers using concepts and algorithms from graph theory, information theory, and machine learning. Finally, topics will also address the impact of features of biological functional network architectures on the performance of cognitive and biologically inspired artificial intelligence systems (e.g., in the field of computer vision).

(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 online platforms for sharing analysis code • Use of publishers' databases / electronic repositories of scientific articles

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*	Activity	Semester workload
	Study and analysis of bibliography	50-150
	project	100-300
	essay writing	25-75
	non-directed study	50-150
	Course total	**225-675**

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.*	Evaluation Language: English Evaluation Criteria: The student's dedication to conducting the study, autonomy and independence, critical review and analysis of the literature, progress over time, and the quality of the report are evaluated. Evaluation criteria are outlined in the study guide and communicated to students at the beginning of the course.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Scientific articles published in reputable conferences and scientific journals in the field of research interests related to computational neuroscience, brain networks, biological data analysis, analysis and modeling of neural circuits and/or mechanisms associated with visual cortex functions, and relevant to the subject of the assigned project. The research also examines the functioning of brain networks in the context of various neurological disorders (e.g., epilepsy, Alzheimer's disease). Study of the principles governing the architecture of biological neural networks and their connection to the performance of artificial neural networks.