

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-120	SEMESTER	depending on availability
COURSE TITLE	Computational Neuroscience and Neurooncology		
INDEPENDENT TEACHING ACTIVITIES		WEEKLY TEACHING HOURS	CREDITS
<i>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</i>			
laboratory exercises		6	9-27
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE	Special background, skills development		
<i>general background, special background, specialised general knowledge, skills development</i>			
PREREQUISITE COURSES:	B&M-103 Introduction to Computational Neuroscience E&N-231 Brain Connectivity Analysis Using EEG/ MEG Also recommended: B&M 232 Introduction to Statistics and Programming B&M -236 Introduction to signal processing with applications in the analysis of discrete and continuous neuronal signals		
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=4459		

(2) LEARNING OUTCOMES

Learning outcomes <i>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.</i> <i>Consult Appendix A</i> <ul style="list-style-type: none"> • 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
<p>The internship takes place at the Computational Biomedicine Laboratory, which is part of the Institute of Computer Science (ICS) of the Foundation for Research and Technology – Hellas (FORTH). The Computational Biomedicine Laboratory specializes, among other areas, in the following key fields related to computational neuroscience and oncology:</p> <ul style="list-style-type: none"> • The development of functional human–computer interfaces (Brain–Computer Interfaces),

- Functional analysis and mapping of the brain, and
- Mathematical modeling of malignant brain neoplasms, specifically gliomas.

Within this framework, postgraduate students will be exposed to techniques for data analysis and processing, as well as computational modeling using specialized computational tools.

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

- Apply and integrate the knowledge acquired from the compulsory and elective courses of the program that are relevant to the subject of the internship,
- Use the acquired knowledge as a basis for original ideas and research,
- Think conceptually, develop, and elaborate arguments,
- Analyze and carry out complex scientific work,
- Collaborate effectively with colleagues and supervisors,
- Communicate conclusions and knowledge—arising from original research, self-study, or experience—clearly and accurately to both specialist and non-specialist audiences.

If the laboratory internship develops into a Master’s thesis, the student’s further engagement with the research topic will enable them to:

- Independently complete fundamental research based on methodological knowledge,
- Contribute originally to the development and application of ideas in the research field,
- Recognize the limitations of existing knowledge in their scientific domain and at the interface between neighboring scientific fields, adapting their actions accordingly,
- Identify and analyze complex problems and solve them strategically and creatively,
- Take responsibility for managing complex processes,
- Communicate in a targeted manner with colleagues, both specialists and non-specialists, as well as supervisors, depending on the context, using conventions relevant to the field of knowledge.

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?

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

- 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

Specifically, with regard to the field of computational neuroscience, the student will be trained in one or more of the following areas:

- Processing and analysis of recordings, specifically electroencephalography (EEG) data
- Understanding and use of biosignal analysis tools
- Modeling of the brain functional network
- Experimental setup and procedures for recording and analyzing evoked potentials
- The internship may also include the recording (in addition to the use) of actual EEG signals

Specifically, with regard to the field of neuro-oncology, the student will be trained in one or more of the following areas:

- Processing and analysis of biological data such as microscope images
- Use of tools that simulate the growth of a cancer cell population (e.g., cellular automata incorporating rules for cell proliferation, infiltration, and death) on both simple and complex substrates
- Methods for parameterizing computational models based on biological experiments (e.g., *in vitro* cell cultures)
- Modification of various parameters and biological mechanisms involved (e.g., genetic/phenotypic heterogeneity, plasticity, adaptability, cell–cell communication, neuron–cancer cell communication, migration, and infiltration)
- Understanding and modeling the response of a cancer cell population to various treatments, as well as learning methods for optimizing therapeutic regimens

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY <i>Face-to-face, Distance learning, etc.</i>	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	Use of shared analysis codes. Use of publisher databases/electronic repositories of scientific articles	
TEACHING METHODS <i>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</i>	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 <i>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.</i>	<p>Evaluation Language: English</p> <p>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.</p> <p>Evaluation criteria are outlined in the study guide and communicated to students at the beginning of the course.</p>	

(5) ATTACHED BIBLIOGRAPHY

<p>- Suggested bibliography:</p> <ul style="list-style-type: none"> • Scientific articles published in reputable scientific journals relevant to the subject of the internship • Technical manuals for the use of specialized software
