COURSE OUTLINE

(1) GENERAL

SCHOOL			
ACADEMIC UNIT	**Interdisciplinary Graduate Programme in the BRAIN and MIND sciences**		
LEVEL OF STUDIES	7		
COURSE CODE	**B&M-223**	SEMESTER	**Fall**
COURSE TITLE	Foundations and Unified Theories of Cognitive Science		

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	6	12
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:	
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=4415

(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*

The aim of the course is to provide a comprehensive, interdisciplinary perspective on the foundations underlying the study of intelligent systems.

Upon successful completion of the course, students will have:

- Gained an in-depth understanding of the main research questions in the foundations of the sciences of the brain and mind.
- Acquired substantial knowledge of the construction of scientific theories.

Consequently, students will have significantly enhanced their abilities in:

- Comprehension
- Independent research work
- Critical thinking

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…*
	…….

- Analysis and synthesis of conceptual categories, data, and information
- Decision-making
- Critical thinking
- Working independently
- Production of new research ideas
- Criticism and self-criticism

(3) SYLLABUS

- **Introduction:** Basic concepts, examples, and tools. Dominant theories and models. Open questions.
- **Computational knowledge representation systems:** Philosophical, neurophysiological, and computational issues, along with corresponding fundamental paradigms.
- **Brain/mind architecture:** Memory and conceptual space, experimental findings and theories. Steps toward a theory of the semantic structure of the human brain. Representation and cognition: computational and neurophysiological approaches.
- **Human language as a tool, cognitive system, and trigger of evolutionary transition:** Understanding and communication — the fundamental mechanisms of operation and structure of the human brain/mind.
- **Human and robotic emotions:** Theories, problems, and mechanisms. Theories and mechanisms of emotion interaction within the mental space of the brain.
- **Comparative examination of theories of consciousness:** Philosophical, psychological, neurophysiological, and computational perspectives. The scientific object of consciousness.
- **New foundations of Cognitive Science:** Implications for Artificial Intelligence, Psychology, Mathematics, Philosophy of Mind, and the unity of science.

(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*	Integration of ICT in teaching Utilizing the elearn platform for uploading teaching materials Communication via "e-learn" 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*	

Activity	*Semester workload*
Lectures	60
non-directed study	240
Course total	***300***

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.*	The assessment of students in this course will be based 100% on a written research paper (with an oral examination in special cases, e.g., for students with dyslexia). A passing grade is required. Evaluation criteria are outlined in the study guide and communicated to students at the beginning of the course.

(5) ATTACHED BIBLIOGRAPHY

Adolphs, R., Mlodinow, L., & Barrett, L. F. (2019) What is an emotion? *Current Biology* **29**, R1060-1064.

Anderson, J. R., & Lebiere, C. (2003). The Newell Test for a theory of cognition. *Behavioral and Brain Sciences*. **26:** 587-640 (including commentary and response by the authors).

Barron, A. B, & Klein, C. (2016) What insects can tell us about the origins of consciousness. *PNAS,* May 3 2016, vol. **113**, no. 18, pp. 4900-4908.

Bennett, M., Dennett, D., Hacker, P., & Searle, J. R. (2007). *Neuroscience and Philosophy: Brain, Mind, and Language.* Columbia University Press.

Boden, M. A. ed. (1990). *The philosophy of artificial intelligence*. Oxford University Press.

Branquinho, J. ed. (2001). *The Foundations of Cognitive Science.* Clarendon Press, Oxford.

Brette, R. (2019). Is coding a relevant metaphor for the brain? *Behavioral and Brain Sciences*. DOI: https://doi.org/10.1017/S0140525X19000049.

Craver, C. F. (2007). *Explaining the Brain: mechanisms and the mosaic unity of neuroscience*. Oxford, Clarendon.

Dautenhahn, K. (2007). Socially intelligent robots: dimensions of human–robot interaction. *Phil. Trans. R. Soc. B,* **362:** 679–704.

EU (2023) Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL LAYING DOWN HARMONISED RULES ON ARTIFICIAL INTELLIGENCE (ARTIFICIAL INTELLIGENCE ACT) AND AMENDING CERTAIN UNION LEGISLATIVE ACTS 2021/0106(COD) 20-06-2023 at 16h53 681/681.

Gelepithis, P. A. M. (2024). *Unification of Artificial Intelligence and Psychology: 8 Major consequences*

of the Theory of Noémon Systems. (Invited by Commissioning Editor of Psychology, Palgrave Macmillan, Springer Nature). Available as a pre-print, ResearchGate. **DOI:** 10.13140/RG.2.2.33364.78723. 27 November 2023.

Korn, O. (ed.) 2019. *Social Robots: Technological, Societal and Ethical Aspects of Human-Robot Interaction*. Human-Computer Interaction Series, Springer Nature Switzerland.

Leahey, T. H. (2022) *Fundamentals of Cognitive Science: Minds, Brain, Magic, and Evolution*. Routledge.

Mallatt, J., Blatt, MR, Draguhn, A, Robinson, DG, and Taiz L (2021) Debunking a myth: plant consciousness. *Protoplasma*, **258**, pp. 459-476.

Merker, B. (2007). Consciousness without a cerebral cortex: A challenge for neuroscience and medicine. *Behavioral and Brain Sciences,* **30:** 63-134

Newell, A. (1990). *Unified theories of cognition*. Harvard University Press.

Newen, A., & Bartels, A. (2007). Animal Minds and the Possession of Concepts *Philosophical Psychology,* **20,** 3, 283-308.

Seth, A. K., Baars B. J., & Edelman, D. B. (2005). Criteria for consciousness in humans and other mammals. *Consciousness and Cognition,* **14:** 119-139

Sirois, S., Spratling, M., Thomas, M. S. C., Westermann G., Mareschal, D., & Johnson M., H. (2007). Précis of: *Neuroconstructivism: How the Brain Constructs Cognition. Behavioral and Brain Sciences,* (in press).

Wang, H., Fu, T., Du, Y. *et al.* (2023) Scientific discovery in the age of artificial intelligence. *Nature* **620**, 47–60. https://doi.org/10.1038/s41586-023-06221-2.