COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Sciences		
ACADEMIC UNIT	Department of Computer Science		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	503SBOB	**SEMESTER**	5
COURSE TITLE	INTRODUCTION TO COMPUTATIONAL INTELLIGENCE		

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	2	5
Exercises	1	
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*	General Background, Skills Development
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	

(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 purpose of the course is to introduce to the scientific area of Computational Intelligence by presenting its historical development, studying mature technologies, and describing modern trends regarding a wide range of practical applications.
The course material aims to introduce students to basic concepts of fuzzy sets and systems, neural networks as well as evolutionary computation. Emphasis is given to the description of systems that cooperatively use the aforementioned technologies to solve practical problems mainly of clustering, classification, and regression. In this sense, the course is the basis on which specific methodologies and techniques will be developed in special courses.
It also refers to issues of expert rule systems as well as issues of developing mathematical models from numerical data.
The aim of the course is for the students to understand the importance of fuzzy inferences, the convergence with neural architectures as well as the optimization with evolutionary computation

techniques.
Also, the aim of the course is for students to understand concepts related to Interval Numbers (ID) with the aim of a unifying approach to computational intelligence.
Finally, the aim of the course is the students' understanding of the importance of computational intelligence technologies in IT and the evolution of Computational Intelligence into a distinct scientific field.

Upon successful completion of the course, the student will be able to:
• Has understood basic and critical elements of fuzzy set theory and fuzzy logic, basic neural network architectures and basic evolutionary computation techniques.
• Can describe and ultimately choose an expert system, a fuzzy system and/or a neural system as needed by assessing its potential for optimization.
• Can estimate in order to generalize mathematical models of computational intelligence.
• Recognize and understand in order to be able to develop, possibly combining, appropriate mathematical models of computational intelligence from numerical data.
• Recognize and understand the multiple benefits of an integrative approach to computational intelligence.

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, analysis and synthesis of data and information, using the necessary technologies
• Adaptation to new situations
• Decision making
• Autonomous Work
• Teamwork
• Generation of new research ideas
• Production of free, creative and inductive thinking

(3) SYLLABUS

1. Εισαγωγή στο αντικείμενο. Συσχέτιση με άλλες επιστημονικές περιοχές. Απαρίθμηση των βασικών εργαλείων
2. Έμπειρα συστήματα
3. Ανάπτυξη μαθηματικών μοντέλων από αριθμητικά δεδομένα
4. Στοιχεία/τελεστές ασαφούς λογικής, ασαφή σύνολα, συστήματα ασαφών κανόνων
5. Ασαφείς συνεπαγωγές: θεωρία και εφαρμογές, ασαφή συστήματα τύπου Mamdani και Sugeno
6. Τεχνητά νευρωνικά δίκτυα (δίκτυα perceptrons, δίκτυα οπισθόδρομης μάθησης, αυτό-οργανούμενοι χάρτες, κλπ)
7. Νευρο-ασαφή συστήματα, υπολογισμός με λέξεις, μηχανές διανυσμάτων στήριξης
8. Εξελικτικός υπολογισμός (γενετικοί αλγόριθμοι, βελτιστοποίηση σμήνους σωματιδίων)
9. Μια ενοποιητική προσέγγιση στην υπολογιστική νοημοσύνη: Αριθμοί Διαστημάτων (ΑΔ), εναλλακτικές αναπαραστάσεις, ερμηνείες και βασικοί υπολογισμοί

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>In class</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Software platform MATLAB. Electronic communication (e-mail) according to the needs.</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>39</td></tr>
<tr><td>Exercises that focus on applications</td><td>26</td></tr>
<tr><td>Bibliography study (group)</td><td>20</td></tr>
<tr><td>Individual Exercises</td><td>20</td></tr>
<tr><td>Project</td><td>20</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<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>I. Final written exam (70%) including problem solving
II. Final Lab Exam (30%) involving problem solving

The evaluation criteria are as follows:
• Problem Analysis Ability
• Ability to Design Solutions
• Ability to Implement Solutions

Oral final exam (100%), for those with dyslexia</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

Haykin Simon, Neural Networks and Learning Machines, 2009

Applied Soft Computing
IEEE Transactions on Fuzzy Systems
IEEE Transactions on Neural Networks and Learning Systems
IEEE Transactions on Evolutionary Computation
Neural Networks
Neurocomputing