COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	INFORMATICS AND COMPUTER ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE		**SEMESTER**	**7/9**
COURSE TITLE	**FUZZY AND UNCERTAINTY SYSTEMS**		

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	
TUTORIALS	1	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).	4	5

COURSE TYPE general background, special background, specialised general knowledge, skills development	Science area, Skills Development
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	http://eclass.uniwa.gr

(2) LEARNING OUTCOMES

The course aims at: (a) providing a solid theoretical grounding and practical skills, along with in-depth knowledge regarding main notions of Fuzzy Logic and Fuzzy and Uncertainty Systems (b) establishing the importance of these scientific fields in computer science, as well as the wide range of their applications in computing systems. The courses objectives include introducing concepts, models, algorithms, and tools in order to develop intelligent systems. Example topics include Mamdani and Takagi-Sugeno Fuzzy Systems, Fuzzy Neural Networks, Bayesian Networks. Moreover, emphasis is put on real-world applications, along with hands-on experience and practice on dedicated software (MATLAB, OCTAVE).

Upon successful completion of the course students:

- Will acquire knowledge of the principles, procedures and applications of the scientific fields of Fuzzy and Uncertainty Systems.
- Will delved into the methods and algorithms of Fuzzy and Uncertainty Systems and acquire the appropriate skills to implement these algorithms, as well as the practical experience, having become familiar with specialized software packages.
- Will study real problems, in order to acquire specialized problem-solving skills, which are required in research and/or innovation in order to develop new knowledge and processes, especially in multidisciplinary fields.
- Will acquire the necessary learning skills that will allow them to continue their studies in the field of Fuzzy and Uncertainty Systems in an autonomous fashion, to a large extent.

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 Respect for difference and multiculturalism Respect for the natural environment

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

- Working independently
- Working in interdisciplinary environment
- Production of new research ideas
- Production of free, creative and inductive thinking

(3) SYLLABUS

- From classic set theory to fuzzy sets.
- Introductory concepts and operations of fuzzy sets.
- Properties of fuzzy sets, membership functions.
- Extension principle, α-cuts and resolution principle.
- Fuzzy relations, operations and properties.
- Composition operators, fuzzy composition, fuzzy numbers.
- Fuzzy linguistic variables, fuzzy rules.
- Implication relations, compositional rule of inference.
- Fuzzifier, fuzzy rule base, fuzzy system output.
- Defuzzification methods.
- Structure and operation of fuzzy models.
- Takagi-Sugeno models and Applications.
- Introduction to uncertainty.
- Bayesian networks.
- Dempster-Shafer.
- Certainty factors
- Knowledge representation methods.
- Influence Diagrams and Belief Networks.
- Decision-theoretic techniques in AI.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	• Face-to-face. In-class lectures with active student participation. There will be presentations and exerices on the course web-page as well as in class, as well as use of specialized software. • Project work.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	• Use of specialized software. • Use of the university's online teaching platform for posting theory and exercises. • Use of e-mail and the online teaching platform for communication with the students.
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: 39 Tutorials: 13 Projects: 28 Individual study: 45 Course total: **125**
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.	Language of evaluation: Greek The final marks will be extracted as the weighted sum of a final written exam and individual projects.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Παπαδόπουλος Β., Μποτζώρης Γ., *Ασαφής Λογική*, Σοφία ΑΕΕΕ, 2015.
2. Θεοδώρου Γ., *Εισαγωγή στην Ασαφή Λογική*, Εκδόδεις Τζιόλα, 2010.
3. Καμπουρλάζος Β., Παπακώστας Γ., *Εισαγωγή στην Υπολογιστική Νοημοσύνη*, ΣΕΑΒ, 2015.
4. Negnevitsky, Michael. *Τεχνητή νοημοσύνη : Αρχές και εφαρμογές για την ανάπτυξη συστημάτων με τεχνολογίες νοημοσύνης* , Εκδόσεις Τζιόλα, 2017.
5. Grzymala-Busse, Jerzy W., *Managing Uncertainty in Expert Systems*, Springer, 2012. E.

- Related bilbiography:

1. Ηλιάδης Λ., Παπαλεωνίδας Α., *Υπολογιστική Νοημοσύνη και Ευφυείς Πράκτορες*, Εκδόσεις Τζιόλα, 2016.

2. Castillo E., Gutierrez Z.M., Hadi A.S., *Expert Systems and Probabilistic Network Models*, Springer, 2011.
3. Ross T., *Fuzzy Logic with Engineering Applications*, John Wiley and Sons, 2010.
4. Tsoukalas L., Uhrig R., *Fuzzy and Neural Approaches in Engineering*, John Wiley and Sons, 1997.
5. Chen G., *Introduction to Fuzzy Systems*, Chapman & Hall, 2005.
6. Siddique N., Adeli H., *Computational Intelligence, John Wiley and Sons*, 2013.