COURSE OUTLINE

(1) GENERAL

SCHOOLS	NATURAL SCIENCES		
ACADEMIC UNIT/UNITS	MATHEMATICS		
TITLE OF MASTER'S DEGREE	COMPUTATIONAL AND STATISTICAL DATA ANALYTICS (MCDA)		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	MCDA212	**SEMESTER**	B
COURSE TITLE	NUMERICAL METHODS FOR DATA 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	3	7.5
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:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/MATH1069/

(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*

In this course, the interval arithmetic, a general approach for solving problems using numerical methods while exploiting the new arithmetic, and the most important interval methods for ensured finding of global solutions, are introduced. The statistical modelling methodology for interval data is presented and data approximation, prediction and analysis techniques using interval arithmetic are analysed.

Upon completing the course, the students are expected to be able to:

- exploit the advantages of interval-based methods in solving problems,
- analyse actual data in interval form and choose the appropriate prediction and/or approximation method.

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.
- Decision making.
- Working independently.
- Team work.
- Working in an interdisciplinary environment.
- Production of free, creative and inductive thinking.

(3) SYLLABUS

Interval Analysis. The interval number. The interval arithmetic. The fundamental theorem of Interval Analysis for solving problems. The interval arithmetic for problems with many variables. Convergence of interval methods. Termination criteria. Basic interval methods. Basic characteristics of interval methods for global optimization problems. Acceleration devices. Basic interval methods for finding all global solutions of an objective function.

Data Science. Simple linear regression using interval arithmetic. Non-linear and multiple regression using intervals. Auto-regressive and/or moving average models for interval arithmetic. Principal Component Analysis (PCA) and Factor Analysis (FA) using interval variables. Statistical modelling. Structural Equation Modelling.

Applications. Application on real data, i.e. satisfaction questionnaires or financial (stock-market) data. Respondents profile. Application of Regression recursive trees in order to approximate statistical models.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures (face to face)
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of ICT in teaching ✓ Electronic slide presentations, ✓ Use of computational packages in projects. • Support of the course via the online platform *eClass* of University of Patras.
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*	
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.*	**Assessment Language:** Greek **Assessment Language for Erasmus students:** English **Assessment methods:** Oral examination in written projects, announced during the lectures. No extra written exam will be conducted. Minimum passing grade: 5 Maximum passing grade: 10

Activity	*Semester workload*
Lectures	39
Study (no driven)	100
Study for homework's	45.5
Final examination	3
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***187.5***

(5) ATTACHED BIBLIOGRAPHY

- Hansen, E. (1992). *Global Optimization Using Interval Analysis*. Marcel Dekker.
- Moore, E.R. (1979). *Methods and Applications of Interval Analysis*. SIAM.
- Ratschek, H. and Rokne, J. (1988). *New Computer Methods for Global Optimization.* Ellis Horwood Books.

(in Greek)

- Aczel, A. (2016). *Στατιστική Σκέψη στον Κόσμο των Επιχειρήσεων*. BROKEN HILL PUBLISHERS LTD.
- Crawley, M.J. (2013). *Στατιστική Ανάλυση με το R*. BROKEN HILL PUBLISHERS LTD.
- Γράψα, Θ.Ν. (2012). *Εισαγωγή στην Ανάλυση Διαστημάτων - Interval Analysis*. Εκδόσεις Τζιόλα.
- Ιωαννίδης, Δ.Α. (2011). *Στατιστική Μεθοδολογία.* Εκδόσεις Ζήτη.