

## COURSE OUTLINE

### (1) GENERAL

<b>SCHOOLS</b>	NATURAL SCIENCES		
<b>ACADEMIC UNIT/UNITS</b>	MATHEMATICS		
<b>TITLE OF MASTER'S DEGREE</b>	COMPUTATIONAL AND STATISTICAL DATA ANALYTICS (MCDA)		
<b>LEVEL OF STUDIES</b>	POSTGRADUATE		
<b>COURSE CODE</b>	MCDA211	<b>SEMESTER</b>	B
<b>COURSE TITLE</b>	MACHINE LEARNING		
<b>INDEPENDENT TEACHING ACTIVITIES</b> <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>		<b>WEEKLY TEACHING HOURS</b>	<b>CREDITS</b>
Lectures		2	7.5
Laboratory exercises		1	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
<b>COURSE TYPE</b> <i>general background, special background, specialised general knowledge, skills development</i>	Special background		
<b>PREREQUISITE COURSES:</b>	MCDA201		
<b>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</b>	Greek		
<b>IS THE COURSE OFFERED TO ERASMUS STUDENTS</b>	Yes		
<b>COURSE WEBSITE (URL)</b>	<a href="https://eclass.upatras.gr/courses/MATH1084/">https://eclass.upatras.gr/courses/MATH1084/</a>		

### (2) LEARNING OUTCOMES

<p><b>Learning outcomes</b> <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></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> <li>• <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i></li> <li>• <i>Descriptors for Levels 6, 7 &amp; 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i></li> <li>• <i>Guidelines for writing Learning Outcomes</i></li> </ul> <p>With this course, the student will be able to use machine learning methods to solve the real problems of Data Science. At the end of this course the student will further develop the following skills:</p> <ul style="list-style-type: none"> <li>• to prepare, clean and visualize data using Python,</li> <li>• to understand the methods of supervised, deep and active learning,</li> <li>• to distinguish differences between learning methods in order to be able to choose the most appropriate for the specific problem,</li> <li>• to apply machine learning methods in real data using Python.</li> </ul> <p>After successfully attending the course, the student will be able to solve real problems using a suitable method of machine learning.</p>
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### 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.
- Project planning and management.
- Working in an interdisciplinary environment.
- Production of free, creative and inductive thinking.

### (3) SYLLABUS

#### **PART A: Theory**

(i) Supervised Learning: Support Vector Machines, Ensemble Methods, Hyper-parameters optimization, Handling Imbalanced Datasets. (ii) Time Series Using Regression Methods: Model trees, Neural Networks. (iii) Semi-Supervised Learning: Self-trained models, Active Learning. (iv) Text Classification, Image Classification, Sound Classification. (v) Deep Learning: Convolutional Neural Networks, Recurrent Networks. (vi) Reinforcement Learning.

#### **PART B: Laboratory**

Python for Data Science, Python libraries: scikit-learn, orange, imbalanced-learn, pandas, statsmodels, h2o, libact, nltk, scikit-image, SpeechRecognition, tensorflow, keras, keras-rl.

#### (4) TEACHING and LEARNING METHODS - EVALUATION

<b>DELIVERY</b> <i>Face-to-face, Distance learning, etc.</i>	Lectures (face to face)	
<b>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</b> <i>Use of ICT in teaching, laboratory education, communication with students</i>	<ul style="list-style-type: none"> <li>• PowerPoint slides</li> <li>• Support Learning through the <i>eClass</i> platform.</li> </ul>	
<b>TEACHING METHODS</b> <i>The manner and methods of teaching are described in detail.</i> <i>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.</i>  <i>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>	<i>Activity</i>	<i>Semester workload</i>
	Lectures	26
	Laboratory	13
	Study (no driven)	100
	Solving suggested exercises	45
	Final examination	2.5
	Laboratory examination	1
	<b>Total number of hours for the Course (25 hours of work-load per ECTS credit)</b>	<b>187.5</b>
<b>STUDENT PERFORMANCE EVALUATION</b> <i>Description of the evaluation procedure</i>  <i>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</i>  <i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i>	<b>Assessment Language:</b> Greek <b>Assessment Language for Erasmus students:</b> English  <b>Assessment methods:</b> <ul style="list-style-type: none"> <li>• Written examination (50%)</li> <li>• Laboratory examination (25%)</li> <li>• Exercises (25%)</li> </ul> <b>Minimum passing grade:</b> 5 <b>Maximum passing grade:</b> 10	

#### (5) ATTACHED BIBLIOGRAPHY

<ul style="list-style-type: none"> <li>• Chollet, F. (2017). <i>Deep learning with Python</i>. Manning Publications Co.</li> <li>• Raschka, S. and Mirjalili, V. (2017). <i>Python Machine Learning</i>. Packt Publishing Ltd.</li> <li>• Shukla, N. (2017). <i>Machine learning with TensorFlow</i>. O'Reilly Media.</li> </ul> <p>(in Greek)</p> <ul style="list-style-type: none"> <li>• Zaki, M.J. and Wagber, M. Jr. (2017). <i>Εξόρυξη και Ανάλυση Δεδομένων: Βασικές Έννοιες και Αλγόριθμοι</i>. Εκδόσεις Κλειδάριθμος ΕΠΕ.</li> </ul>
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