COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Financial and Management Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	MH0115	SEMESTER	9
COURSE TITLE	Deep Machine Learning		

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
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).	3	5

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Elective Course
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*

At the end of the course, students are able to

- Understand core machine learning concepts (machine learning paradigms, training methods, performance/accuracy metrics)
- Understand different regression methods
- Understand core neural networks and support vector machine concepts
- Understand core clustering concepts and be familiar with the most important clustering algorithms
- Understand core feature selection and dimensionality reduction methods
- Understand most important deep learning concepts, as well as fundamental deep learning architectures (convolutional neural networks, recurrent neural networks, etc.)
- Use modern deep learning tools (Tensorflow, keras) to solve practical problems with different machine learning approaches

- Select the most appropriate machine learning model/methodology according to the task at hand
- Recognize and mitigate the effect of common issues of machine learning models (e.g., over-fitting)

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
- Adapting to new situations
- Decision-making
- Working independently
- Working in an interdisciplinary environment
- Production of new research ideas

(3) SYLLABUS

- Introduction to Machine Learning: Machine Learning Paradigms, Training Methods, Metrics, Forecasting, Classification.
- Regression Methods: Linear Regression, Logarithmic Regression, Ridge Regression, Static/Dynamic Autoregression, Spectal Analysis.
- Neural Networks: Models and Architectures, Feedfordward models (backpropagation and multilayer perceptron).
- Support Vector Machines: Linear Regression, Kernel Functions, Multi-class classification
- Clustering: Definition, Algorithms, Distance metrics, Similarity Metrics, Partitional clustering, Hierarchical clustering.
- Feature selection: Filtering, Wrapper methods, Other embedded feature selection methods.
- Dimensionality reduction: Principal Component Analysis, Linear Discriminant Analysis, Low dimensional embeddings.
- Deep Neural Network Architectures: Definitions and properties
- Recurrent Neural Network Architectures: Training deep recurrent architectures, backpropagation through time
- Convolutional Neural Networks and Deep Learning: Feature Extraction with Deep Learning
- Python for Deep Learning: Machine learning tools and Deep Learning frameworks (Tensorflow and Keras)

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In class teaching
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of ICT in communication with students, Python Notebooks
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.*	*Language of evaluation:* Greek *Method of evaluation:* Projects 50% Final Exams 50%

Activity	*Semester workload*
Lectures	39 hours (1.56 ECTS)
Personal study - Projects	83 hours (3.32 ECTS)
End of semester exam	3 hours (0.12 ECTS)
Course total	*125 hours (5 ECTS)*

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Haykin Simon, Νευρωνικά δίκτυα και μηχανική μάθηση, Παπασωτηρίου
- Διαμαντάρας Κ., Μπότσης Δ., Μηχανική Μάθηση, Κλειδάριθμος
- Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press
- Christopher M. Bishop, Pattern Recognition and Machine Learning