COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Mechanical Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	ΕΠ0903	**SEMESTER**	9th
COURSE TITLE	Introduction to Artificial 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 fo the whole of the course, give the weekly teaching hours and th total credits	**WEEKLY** TEACHIN HOURS	CREDITS
Lectures	5	6
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, specialized general knowledge, skills development	Special background
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek or English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (tutoring)
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*

This course is an introduction to artificial intelligence. It covers the fundamentals principles and methods for developing artificial intelligence and machine learning systems and presents applications to mechanical engineering problems.

By the end of this course, the students should be able to:

- Understand the basic concepts and principles underlying artificial intelligence.
- Describe the basic categories of problems for using large-scale data (prediction, classification, regression, clustering, estimation, decision making).
- Describe and use basic machine learning techniques (supervised learning, unsupervised learning, reinforcement learning, neural networks, and deep learning)
- Use machine learning methods that can learn from data and make predictions about it in mechanical engineering problems.

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
- Teamwork
- Application of theory to practice
- Production of new research ideas
- Project planning and management

(3) SYLLABUS

The introduction to artificial intelligence course covers the following modules:

- Introduction to Artificial Intelligence (AI) and Machine Learning (ML) (learning in higher organisms, machine learning; logic, trees and decision making, search algorithms and games, propositional logic, algorithms based on nature analogs, statistical learning).
- Supervised Learning (prediction problem, classification, logistic regression, maximum likelihood estimation, Support Vector Machines (SVM), decision trees).
- Optimization Tools in AI and ML (optimization, iterative search algorithms, stochastic maximum descent algorithms and adaptive learning, entropy, KL-divergence).
- Artificial Neural Networks (ANN) and Deep Learning (Multilayer Neural Networks, Backpropagation algorithm, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Long and Short-Term Memory Neural Networks (LSTM)).
- Reinforcement Learning (search in the space of optimal policies, search in the space of prices).
- Unsupervised Learning (creating models from data and recognizing patterns, Data Clustering, Hierarchical Clustering, Clustering with k-means; Probabilistic models: Gaussian kernels and mixtures, parameter estimation via the EM algorithm, Bayesian networks).
- Applications of prediction, classification, grouping/clustering, decision-making in mechanical engineering problems.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY ***Face-to-face, Distance learning, etc.***	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Introduction to Python and libraries for solving problems in data science, AI and ML. • Use of libraries for training Artificial Neural Networks (TensorFlow, PyTorch) • Use of internet for notes and additional material on AI • Communication with students via the eclass platform
TEACHING METHODS *The manner and methods of teaching are described in detail.*	

Activity	*Semester workload*
Lectures	40
Tutorials	12

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*	Laboratory work	6
	Coursework/Project work (at home)	42
	Private study	50
	Course total	*150*

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 (or English) **Assessment:** • Examination (70%) • Coursework and/or laboratory work (30%) **Description of Coursework and/or laboratory work** • Coursework: 6 sets of exercises.

(5) **ATTACHED BIBLIOGRAPHY**

Βιβλία

− S. Russell, P. Norvig. Artificial Intelligence: A Modern Approach, 3rd Edition. Prentice-Hall, Englewood Cliffs, NJ, 2009.
− K.P. Murphy. Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
− M. Mohri, A. Rostamizadeh, and A. Talwalkar. Foundations of Machine Learning, MIT Press, 2012.
− R.S. Sutton, A.G. Barto. Reinforcement Learning: An Introduction, 2nd Edition, MIT Press, 2018.
− I. Goodfellow, Y. Bengio, and A. Courville. Deep Learning, MIT Press, 2016.
− C.M. Bishop. Pattern Recognition and Machine Learning, Springer 2007.
− T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, Springer, 2011.
− S. Haykin. Neural Networks and Learning Machines, Pearson, 2008.
− W. McKinney. Python for Data Analysis, 2nd Edition. O'Reilly Media, 2017.

Περιοδικά

− Artificial intelligence
− IEEE Transactions on Neural Networks and Learning Systems
− IEEE Transactions on Pattern Analysis and Machine Intelligence
− IEEE Transactions on Evolutionary Computation
− IEEE Transactions on Fuzzy Systems
− IEEE Computational Intelligence Magazine
− Journal of Machine Learning Research
− Pattern Recognition
− Neural Networks
− Information Sciences
− Machine Learning
− Annals of Statistics
− Journal of the Royal Statistical Society. Series B: Statistical Methodology