Program	Level	First cycle			
	Name of the program	Theoretical Computer Science, Applied Mathematics			
COURSE					
Course title	**Machine Learning**				
Course code	Semester	Course status		ECTS	Contact hours (L+AE+LE)
CS 360	VI	Mandatory course/Elective course		5	2+0+2
Lecturer					
Course Goals	The purpose of this introductory course is to introduce the students to many concepts, techniques, and algorithms in machine learning, beginning with topics such as classification and linear regression and ending with more recent issues such as boosting, support vector machines, hidden Markov models, and Bayesian networks. The course will give the student the basic ideas and intuition behind modern machine learning methods and a more formal understanding of how, why, and when they work. The underlying theme of the course is statistical inference, as it provides the foundation for most of the methods covered.				
Learning Outcomes	At the end of this course, students should be able to apply the necessary knowledge about machine learning algorithms while solving specific problems from practice.				

COURSE CONTENT

- Introduction to machine learning. Supervised and Unsupervised Machine Learning Algorithms. Reinforcement learning. Evolutionary learning.
- Linear classification. Perceptron update rule. Perceptron convergence. Generalization. Linear regression. Estimator bias and variance. Active learning.
- Maximum margin classification. Classification errors. Regularization. Logistic regression.
- Non-linear predictions. Kernal regression. Kernels.
- Support vector machine (SVM) and kernels. Kernel optimization.
- Combining classifiers, boosting, margin and complexity.
- Mixtures and the expectation maximization (EM) algorithm. Regularization, clustering. Spectral clustering.
- Markov models. Hidden Markov models (HMMs).Bayesian networks. Learning Bayesian networks.
- The use of Python while developing projects based on machine learning algorithms.

LITERATURE

[1] Ethem Alpaydin, Introduction to Machine Learning; (2009), The MIT Press.
[2] Christopher M. Bishop, Pattern Recognition and Machine Learning,(2007), Springer.
[3] Simon Rogers, Mark Girolami, A first course in Machine Learning, (2012), CRC Press.
[4] Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, (2001), MIT Press.

STUDENT WORKLOAD (hours in a semester)

Lectures	30	Exercises	30	Individual work	65	T o t a l	125

GRADING			**REMARKS**
Criterion	Maximum points	Minimum points	
Midterm exams	20	10	
Assignments	10	5	
Projects	30	15	
Seminar paper	10	5	
Final exam	30	20	
T o t a l	100	55	