Basic data of the subject	
University:	**University of Applied Sciences in Ferizaj**
Academic unit:	**Faculty of Engineering and Informatics**
Program:	**Applied Informatics**
Title of the subject:	**Machine Learning**
Level:	**Bachelor**
Course Status:	**Obligatory**
Year of studies:	**III, Semester VI**
Number of hours per week:	**3**
Value of Credits - ECTS:	**5**
Time / location:	
Course lecturer:	
Contact details:	
Course Description:	*This course provides students with the knowledge of the main models and algorithms for regression, classification, clustering and probabilistic classification. Topics such as linear and logistic regression, regularisation, probabilistic (Bayesian) inference, SVMs and neural networks, clustering and dimensionality reduction. The module will use primarily the Python programming language and assumes familiarity with linear algebra, probability theory, and programming in Python.*
Objectives of the course:	*Grasp the fundamental concepts of data analysis by understanding regression, classification, clustering, and probabilistic classification, establishing a robust foundation for practical application.* *Gain hands-on experience implementing essential models – linear and logistic regression, regularization, Bayesian inference, Support Vector Machines (SVMs), and neural networks – using the Python programming language.* *Apply acquired knowledge to solve real-world problems in prediction, classification, clustering, and decision-making, utilizing data analysis techniques for practical solutions.* *Fine-tune models effectively by exploring and applying regularization techniques, ensuring robust performance in both regression and classification tasks while addressing overfitting.* *Cultivate the ability to make informed decisions in uncertain situations by incorporating Bayesian inference into data analysis, navigating complexities and understanding probabilities for nuanced decision-making.*
Expected learning outcomes:	*Upon successful completion of this course, student will be able to:* • *Develop an appreciation for what is involved in Learning models from data* • *Understand a wide variety of learning algorithms* • *Understand how to evaluate models generated from*

	data • *Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models*
Prerequisites	*Basic knowledge of statistical analysis and programming in Python*

Contribution to the student load (which must correspond with learning outcomes)			
Activity	**Hour**	**Day/Week**	**In total**
Lectures with numerical exercises	3	15	45
Internship			
Contacts with teacher / consultations			
Field exercises			
Midterm, seminars and projects.	3	2	6
Homework			
Self-learning time student (at the library or at home)	3	15	45
Final preparation for the exam	7	2	14
Time spent on evaluation (tests, quiz and final exam)			
Projects and presentations.	3	5	15
Total			**125**

Teaching methodology:	*Lectures and exercises combined with case studies and class discussions, as well as active collaboration in student teams*
Assessment methods:	*The student can choose to be assessed one of the two forms of assessment, given below:* *1. Form 1: Evaluation with two tests and the Project* *2. Form 2: Evaluation of the final exam.* ***Form 1:*** *In the first form of assessment "Assessment with two tests and project" the student is assessed in four activities that are carried out during the lectures:* *1. Test 1 (30%), individual assessment* *2. Test 2 (30%), individual assessment* *3. Class activity (10%), individual assessment* *4. Project (30%), group assessment.* ***Additional clarification:*** *If the student in each activity above reaches the maximum points, then he will be evaluated with 100 points.* *Students who pass the exam according to Form 1 of the assessment, are released from the obligation to take the final exam. Only if the student is not satisfied with the grade achieved according to form 1, then he can undergo the final exam to obtain a higher grade.*

	Form 2: *In the second form of evaluation, "Evaluation with the final exam", the student will undergo the exam which will be held after the end of the course lectures and is organized in the exam deadlines, determined by the University Senate.* *Through the final exam, the student can achieve a maximum of 70% of the points from the total of 100 points.* *The rest of the 30% points must be completed through group work on the Project, an activity carried out during the lectures.* *In Test 1, Test 2, and the final exam, the evaluation of the students will be done through an evaluation form, which must be completed individually by the student. The evaluation form will contain objective and subjective questions through which the student's learning outcomes will be evaluated:* • *The objective questions will be of the following types: (1) Multiple choice questions, (2) True/False, (3) Completion, and (4) Composition/Matching; questions that will be used to assess the student's abilities to recall and recognize the concepts and material of the course.* • *The subjective questions will be of the Essay/written task type that will be used to assess the student's understanding and abilities to apply the knowledge gained in the analysis, synthesis, and evaluation of the problem, from the answers prepared by the student to the question of submitting.* *Activity in the class means the student's engagement in dealing with the issues discussed in the class, during the lectures* *Project (30%), group assessment: it is an activity in which students apply the acquired knowledge in a concrete project. It is carried out in groups of 2 or 3 students who are obliged to carry out the activity, document it, and present it to the subject professor.* *For the form of realism and documentation of the activity, all members of the group will be evaluated with the same point (20%), while the evaluation of the presentation skills of the activity is individual and includes 10%.* ***Rating:*** *91-100 points – graded 10 (ten)* *81-90 points – graded 9 (nine)* *71-80 points – grade 8 (eight)* *61-70 points – grade 7 (seven)* *51-60 points – grade 6 (six)* *0-50 points – The student repeats the exam.*
The ratio of theory and practice:	70% theory with exercises and 30% laboratory work..

Literature	
Basic Literature:	1. *D. Barber, Bayesian Reasoning and Machine Learning, 2012* 2. *S. Rogers and M. Girolami, A first course in Machine Learning, CRC Press, 2011*
Additional Literature:	1. *C. Bishop, Pattern Recognition and Machine Learning, 2007* 2. *Duda, Hart and Stork, Pattern Classification, Wiley-Interscience.*
Designed learning plan	
Week:	**Lectures and exercises to be held**
Week one:	*Introduction to the course*
Week two:	*Decision Trees*
Week three:	*Linear regression: OLS, regularization, linear classifiers*
Week four:	*Logistic Regression, Multi-class logistic regression Ranking Support Vector Machines*
Week five:	*Feature selection latent factor models (PCA)*
Week six:	*Clustering (k-means, soft k-means)*
Week seven:	*Test 1*
Week eight:	*Ensemble methods such as Random Forest and Ada Boost*
Week nine:	*Probabilistic methods (Bayesian view)*
Week ten:	*Model evaluation and model selection*
Week eleven:	*Introduction to neural networks and convolutional neural networks*
Week twelve:	*Autoencoders*
Week thirteen:	*Presentation*
Week fourteen:	*Presentation*
Week fifteen:	*Test 2*
Academic policies and rules of conduct	
Regular attendance of lectures and exercises is necessary, as well as active participation with discussion and solution of tasks. Not impeding the progress required for learning using mobile phones turned off or in silent mode.	