Course name: Introduction to Machine Learning with Python

ECTS	*4*
Course status	*facultative*
Course final assessment /evaluation of outcomes	*graded credit*
Prerequisite	*mathematics*

Main field of study: Landscape Architecture

Educational profile	*General academic*
Code of studies and education level	*bachelor*
Semester of studies	*summer*
Language of instruction	*English*

Course offered by:

Name of faculty offering the course	*Faculty of Environment Engineering and Land Surveying*
Name of department offering the course	*Hydraulic Engineering and Geotechnics*
Course coordinator	*Tymoteusz Zydroń, PhD.*

Learning outcomes:

Symbol of outcome	Description of the learning outcome	Reference to main field of study outcomes	Area symbol*
KNOWLEDGE – student knows and understands:			
SKILLS – student is able to:			
PYT_U01	prepare scripts and functions in Python using operations on different data types to engineering calculations; Student is able to create visualizations of the analysis results using selected visualization libraries	IS1_U02 IS1_U03	TS
PYT_U02	prepare and process data using advanced tools for handling large data sets, and then use supervised machine learning techniques to solve selected classification and regression problems	IS1_U02 IS1_U03	TS
SOCIAL COMPETENCIES – student is ready to:			
PYT_K01	continuous education and improvement of professional competences in the use of programming in the preparation and processing of engineering data	IS1_K01	TS

Teaching contents

Lectures:		0 hours
Topics		
Accomplished learning outcomes		
Means of verification, rules and criteria of assessment		
Classes:		45 hours
Topics	1. *Installation of Python interactive notebook. Variables and basic data types in Pythons: text, numeric types, lists, tuples, dictionaries, sets.* 2. *Operations on strings, lists, tuples, dictionaries and sets.* 3. *Arithmetic, assignment, comparison and logical operators.* 4. *Conditions and If … Else statements. While and for loops.* 5. *Functions, anonymous function lambda. Classes.*	

6. *Numpy library: array creation, data types, indexing and slicing, basic operators, array shape manipulation, basic linear algebra operations.*
7. *Pandas library: series, data frames – creation, basic operations, reading csv and excel files. Operations in pandas library: grouping, merging, pivoting, handling missing data.*
8. *Visualization of data in matplotlib and seaborn libraries.*
9. *Basics of machine learning in sklearn and sktime libraries. Preprocessing - standardization, encoding categorical features, imputation of missing, values.*
10. *Supervised learning: classification and regression. Logistic regression, decision trees and ensemble models, support vector machine, nearest neighbors method, neural network models. Undersampling and oversampling of imbalanced datasets in imbalanced-learn library.*
11. *Time series analysis in sktime library.*

Accomplished learning outcomes	*PYT_U01, PYT_U02, PYT_K01*
Means of verification, rules and criteria of assessment	*Projects evaluation – a grade from exercises is an arithmetic average of formative grades*

Field practicals:		0 hours
Topics		
Accomplished learning outcomes		
Means of verification, rules and criteria of assessment		

References:

Basic	McKinney W. 2018. Python for data analysis: data wrangling with Pandas, Numpy and IPython. O'Reilly. Géron A. 2020. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow.O'Reilly.
Supplementary	Raschka S., Mirjalili V. 2019. Python. Machine learning i deep learning. Biblioteki scikit-learn i TensorFlow 2. Packt. Lutz M. 2007. Learning Python. O'Reilly.

Structure of learning outcomes

Area of academic study: R – Agricultural, forestry and veterinary sciences	0.0	ECTS **
Area of academic study: T – technical sciences	4.0	ECTS**

Structure of student activity

Contact hours	50	hrs.	2.0	ECTS**
Including: lectures		hrs.		
classes and seminars	45	hrs.		
consultations	5	hrs.		
participation in research		hrs.		
obligatory field trips		hrs.		
participation in examination		hrs.		
e-learning		hrs.		ECTS**
student own work	50	hrs.	2.0	ECTS**

*Areas of academic study in the fields of: A – the arts; H – humanities; M – medical, sport and health sciences; N – natural sciences; P – biological sciences; R – agricultural, forestry and veterinary sciences; S – social studies; T – engineering and technology

** stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25–30 hours of classes