SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Communications
1.4 Field of study	Electronic Engineering, Telecommunications and Information Technologies
1.5 Cycle of study	Master of Science
1.6 Program of study / Qualification	Telecommunications / Master Multimedia Technologies / Master Artificial Intelligence and Signal Processing in Electronics and Telecommunications / Master
1.7 Form of education	Full time
1.8 Subject code	TC-E10.00

2. Data about the subject

2.1 Subject name	Data Mining and Analytics using Python						
2.2 Subject area	Theoretical area Methodological area Analytic area						
2.3 Course responsible	Assistant Professor Camelia FLOREA, Ph.D. Camelia.Florea@com.utcluj.ro						
2.4 Teacher in charge with seminar / laboratory / project	Assistant Professor Camelia FLOREA, Ph.D. Camelia.Florea@com.utcluj.ro						
2.5 Year of study	1	2.6 Semester	1	2.7 Assessment	E	2.8 Subject category	DA/DI

3. Estimated total time

3.1 Number of hours per week	4	of which: 3.2 course	2	3.3 laboratory	1
3.4 To Total hours in the curriculum	42	of which: 3.5 course	28	3.6 laboratory	14

Distribution of time	hours
Manual, lecture material and notes, bibliography	20
Supplementary study in the library, online specialized platforms and in the field	12
Preparation for seminars / laboratories, homework, reports, portfolios and essays	20
Tutoring	3
Exams and tests	3
Other activities:	

3.7 Total hours of individual study	58
3.8 Total hours per semester	100
3.9 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 curriculum	N. A.
4.2 competence	N. A.

5. Requirements (where appropriate)

5.1. for the course	Amphitheatre, Cluj-Napoca
5.2. for the seminars / laboratories / projects	Laboratory, Cluj-Napoca

6. Specific competences

Professional competences	C1. Use of the fundamental elements related to devices, circuits, systems, instrumentation, and electronic technology. C2. Applying the basic methods for the acquisition and processing of signals C3. Application of the basic knowledge, concepts, and methods regarding the architecture of computer systems, microprocessors, microcontrollers, languages, and programming techniques C4. Design, implementation and operation of data, voice, video, and multimedia services. This is based on the understanding and the application of fundamental concepts in telecommunications and transmission of information. C5. Selecting, installing, configuring, and operating fixed or mobile telecommunications equipment. Equipping a site with usual telecommunications networks C6. Solving specific problems of the broadband communications networks: propagation in different environments, circuits, and equipment for high frequencies (microwaves and optical).
Cross competences	N.A.

7. Discipline objectives (as results from the key competences gained)

7.1 General objective	Development of professional skills in the field of data mining and analytics using Python
7.2 Specific objectives	1. Assimilation of the theoretical knowledge regarding the operation of data mining systems 2. Development of skills and abilities needed to design and implement intelligent systems, based on basic machine learning algorithms in Python

8. Contents

8.1 Lecture (syllabus)	**Teaching methods**	**Notes**
1. Introduction in Data Mining and Analytics using Python	The discipline content and the acquired skills agree with the expectations of the professional	N/A
2. Exploratory Data Analysis. Data Inspection, Cleaning, Visualization.		
3. Performance evaluation. Dataset Split.		
4. Model Evaluation. Cross Validation and Bias -Variance Trade-Off.		
5. Data Clustering Algorithms.		
6. Regression & Classification		
7. kNN Classification		
8. Decision Trees and Random Forest		
9. Support Vector Machines		

10. Neural Networks. Deep Learning.		
11. Dimensionality Reduction.		
12. Association Rule Learning.		
13. Model Selection & Boosting		
14. Course Review.		
Bibliography 1. A. Géron, "Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow", Ed. 2, O'Reilly, 2019. 2. J. Gareth, et al., "Introduction to Statistical Learning" Springer, 2021. 1. J. Portilla, Head of Data Science at Pierian Training, "Python for Data Science and Machine Learning Bootcamp"		
8.2 Laboratory	**Teaching methods**	**Notes**
1. Introduction in Data mining and Analytics using Python	Practical experiments on physical, virtual, cloud and emulator equipment.	N/A
2. Clustering, K-Means		
3. Decision Trees and Random Forest		
4. kNN Classifications		
5. Support Vector Machines		
6. Neural Networks and Deep Learning		
7. Final evaluation, make-up missed lab sessions		
Bibliography 1. A. Géron, "Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow", Ed. 2, O'Reilly, 2019. 2. J. Gareth, et al., "Introduction to Statistical Learning" Springer, 2021. 3. J. Portilla, Head of Data Science at Pierian Training, "Python for Data Science and Machine Learning Bootcamp"		

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

The discipline content and the acquired skills agree with the expectations of the professional competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The level of acquired theoretical knowledge and practical skills	Written exam including theory and problems (25 questions)	50%
10.5 Seminar/ Laboratory	The level of acquired knowledge and abilities	Multiple choice tests at the end of each lab Project	L, max. 5 pct. 25% P, max. 5 pct. 25%
10.6 Minimum standard of performance			
Qualitative point of view			

Minimal theoretical and practical knowledge:
- ✓ Understanding of the architecture, functionality of data mining and analytics systems
- ✓ Ability to perform data mining and analytics implementation in Python.

Minimal acquired competencies:
- ✓ Ability to develop simple machine learning applications.
- ✓ Ability to analyze and improve the performance of a basic data mining/ machine learning system.

Quantitative point of view
- ✓ Minimal mean at the exam 5.
- ✓ Final mark = 0.75 x Exam + 0.25 x Mean of the marks at the lab tests

Date of filling in:	**Responsible**	**Title First name SURNAME**	**Signature**
19.06.2024	Course	Assistant Professor Camelia FLOREA, Ph.D.	
	Applications	Assistant Professor Camelia FLOREA, Ph.D.	

Date of approval in the Council of the Communications Department 10.07.2024	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval in the Council of the Faculty of Electronics, Telecommunications and Information Technology 11.07.2024	Dean Prof. Ovidiu POP, Ph.D.