SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	**Faculty of Automotive Engineering, Mechatronics and Mechanics**
1.3	Department	**Automotive Engineering and Transportation**
1.4	Field of study	**Automotive Engineering**
1.5	Cycle of study	**Master in Science**
1.6	Program of study/Qualification	**Advanced Techniques in Automotive Engineering/Engineer**
1.7	Form of education	Full time
1.8	Subject code	1.00

2. Data about the subject

2.1	Subject name			Bases and Fundamentals of Artificial Intelligence			
2.2	Subject area			Engineering			
2.3	Course responsible/lecturer			Prof. PhD Habil.Eng. Florin MARIASIU- florin.mariasiu@auto.utcluj.ro			
2.4	Teachers in charge of seminars			Assist.Eng. Thomas BUIDIN-thomas.buidin @auto.utcluj.ro			
2.5 Year of study	1	2.6 Semester	1	2.7 Assessment	Ex	2.8 Subject category	DA/DI

3. Estimated total time

3.1 Number of hours per week	3	3.2 of which, course:	2	3.3 applications:	1
3.4 Total hours in the curriculum	42	3.5 of which, course:	28	3.6 applications:	14
Individual study					hours
Manual, lecture material and notes, bibliography					20
Supplementary study in the library, online and in the field					20
Preparation for seminars/laboratory works, homework, reports, portfolios, essays					11
Tutoring					5
Exams and tests					2
Other activities					0

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	N/A
5.2	For the applications	N/A

6. Specific competences

Professional competences	• Define and describe Artificial Intelligence • Describe the levels of Artificial Intelligence • Define and describe of Machine/Deep Learning • Differentiate between structured and unstructured data • Describe how Machine Learning structures data and unstructured data • Describe how Machine Learning uses probabilistic calculation to solve problems • Describe methods by which Machine/Deep Learning analyzes data • Create and use a simple Machine/Deep Learning model • Work in an multi- and interdisciplinary environment
Cross competences	• Use appropriate and effective methods and techniques of modern learning; • Appropriate use of specific technical terms, in oral and written communication in a European language (English); • Develop skills and abilities for teamwork, • Develop skills of analysis and decision • Using information and communication technology (ICT).

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

7.1	General objective	Developing expertise, competences and specific abilities in artificial intelligence to be use in automotive engineering domain, with detailed knowledge of an area of specialization (IC engine management) to support vocational training
7.2	Specific objectives	•Assimilation of theoretical knowledge about Artificial Intelligence •Obtaining necessary skills to work with Artificial Intelligence •Make calculations, demonstrations and applications, by using of specific software to create an machine learning model •Development of technical and/or research primary projects

8. Contents

8.1 Lecture	Hours	Teaching methods	Observations
Introduction to Artificial Intelligence	2	Exposure and applications. Case studies.	onsite
Evolvement process of Artificial Intelligence	2		
Structure and analyze of data	2		
Evaluation test#1	2		
Natural language processing and computer vision	2		
Image classification using Artificial Intelligence	2		
Machine Learning and Deep Learning	2		

Evaluation test#2	2		
Generative Artificial Intelligence	2		
Artificial Intelligence Ethics, Risks and Opportunities	2		
Artificial Intelligence applications in automotive engineering	2		
Evaluation test#3	2		
The future and challenges of Artificial Intelligence	2		
Recapitulation. Presentation of examination conditions.	2		

References

- S. Russel and P. Norvig, Artificial Intelligence: A Modern Approach (Pearson Series in Artificial Intelligence) (3rd edition), ISBN-978-0136042594
- J. Dummies, GENERATIVE AI - Comprehensive Guide for Beginners: Mastering Artificial Intelligence, Deep Learning, and Business Applications with ChatGPT, ISBN- 978-0136042594, 2023.
- R.S. Sutton, A.G. Barto, Reinforcement Learning, second edition: An Introduction (Adaptive Computation and Machine Learning series), 2nd Edition, 2021
- K. P. Murphy, Probabilistic Machine Learning: An Introduction, ISBN-978-0262046824, Publisher MIT Press, 2022
- T. Hastie, R. Tibshirani, J. Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd Edition, 978-0387848570, Springer, 2016
- G. James, D. Witten, T. Hastie, R. Tibshirani, An Introduction to Statistical Learning: with Applications in R, 2nd ed., Springer Texts in Statistics, 2021, ISBN 978-1071614174
- H. Wickham et al., R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, 2nd Edition, ISBN 978-1492097402, 2023.
- Lecture notes

8.2 Laboratory	Hours	Teaching methods	Observations
1. Presentation of laboratory work and requirements of practical activities. Installation and preparation of the software environment.	2	Exposure and applications. Case studies.	onsite
2. Regression models.	2		
3. Classification models.	2		
4. Decision tree model	2		
5. Clustering model	2		
6. SVM (Support Vector Machines) model	2		
7. Presentation of laboratory work for evaluation	2		

Bibliography

- Mastering Machine Learning: A Step-by-Step Guide with MATLAB (https://www.mathworks.com/campaigns/offers/mastering-machine-learning-with-matlab.html)
- Lecture notes

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

The skills and competences gained will be required by employees who work in: Design, Calibration, Optimization of engineering issues related to automotive domain using AI; Numerical modelling and simulation methods applied using Artificial Intelligence; Data analyse and statistics etc.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Participation in all periodical evaluation tests or Exam	The average of the grades obtained in the evaluation tests or grid test final examination	70%

	with solving theory topics specific to the discipline		
10.5 Applications	Appreciation of the work during the laboratories	Check and evaluation of the laboratory work	30%
10.6 Minimum standard of performance			
Minimum knowledge: Complete understanding of basics and fundamentals of Artificial Intelligence. Minimal skills: Creating and use a simple machine learning model - minimum grade 5 (five) Each subject in the test must be resolved - minimum grade 5 (five)			

Date of filling in:		**Title Surname Name**	**Signature**
18.06.2025	Lecturer	Prof. PhD Habil. Eng. Florin MARIASIU	
	Teachers in charge of application	Assist. Eng. Thomas BUIDIN	

Date of approval in the department ART 24.06.2025	Head of department Prof.dr.ing. Istvan BARABAS
Date of approval in the faculty ARMM 25.06.2025	Dean Prof.dr.ing. Nicolae FILIP