SYLLABUS

1. Information about the program

1.1 Higher education institution	Universitatea Politehnica Timișoara
1.2 Faculty[1] / Department[2]	ELECTRONICS, TELECOMUNICATON AND INFORMATION TECHNOLOGIES
1.3 Field of study (name/code[3])	ELECTRONIC ENGINEERING, TELECOMUNICATION AND INFORMATION TECHNOLOGIES / 20/20/10
1.4 Study cycle	Master
1.5 Study program (name/code/qualification)	Automotive Electronic Systems /20/20/10 / 2152

2. Information about discipline

2.1a Name of discipline/The educational classe[4]	Arhitectures for Intelligent Data Processing						
2.1b Name of discipline in Romanian							
2.2 Coordinator (holder) of course activities	Jivet Ioan						
2.3 Coordinator (holder) of applied activities[5]	Elisei-Stefan Ilies						
2.4 Year of study[6]	1	**2.5** Semester	2	**2.6** Type of evaluation	E	**2.7** Regime of discipline[7]	DOP

3. Total estimated time (direct activities (fully assisted), partially assisted activities and unassisted activities[8])

3.1 Number of hours fully assisted/week	4 ,of which:	course	2	seminar/laboratory/project			2
3.1* Total number of hours fully assisted/sem.	56 ,of which:	course	28	seminar/laboratory/project			14
3.2 Number of on-line hours fully assisted/sem	0 ,of which:	course	0	seminar/laboratory/project			0
3.3 Number of hours partially assisted/week	,of which:	project, research		training		hours designing M.A. dissertation	
3.3* Number of hours partially assisted/ semester	,of which:	project of research		training		hours designing M.A. dissertation	
3.4 Number of hours of unassisted activities/ week	7.71 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field					2.5
		Study using a manual, course materials, bibliography and lecture notes					2.5
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays					2.71
3.4* Total number of hours of unasssited asctivities/ semester	108 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field					35
		Study using a manual, course materials, bibliography and lecture notes					35
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays					38
3.5 Total hrs./week[9]	11.71						
3.5* Total hrs./semester	150						
3.6 No. of credits	6						

4. Prerequisites (where applicable)

4.1 Curriculum	• Basics of Microprocessors and Machine Learning
4.2 Learning outcomes	• -

5. Conditions (where applicable)

5.1 of the course	• Video-projector, Internet connection
5.2 to conduct practical activities	• PC's with Software Tools, Electronic Basic Tools

6. Learning outcomes acquired through this discipline

Knowledge	C10. The student/graduate explains design methods and manufacturing techniques employed in the development of electronic, mechanical, and optical microsystems. C16. The student/graduate demonstrates advanced knowledge of the operating principles, typologies, and applications of sensors. C17. The student/graduate explains methods and techniques for designing sensors and integrated sensor systems within complex products. •
Skills	A3. The student/graduate designs electronic systems, including circuits, equipment, and applications in fields such as automotive and instrumentation. A18. The student/graduate designs and develops microsystems using dedicated simulation and modeling tools. A23. The student/graduate designs sensors, selecting appropriate materials and technologies for specific applications. •
Responsibility and autonomy	RA1. The student/graduate assumes responsibility for coordinating and approving engineering projects, assessing the technical, economic, and environmental impact of proposed solutions. RA3. The student/graduate ensures quality and professional ethics in the design and testing of electronic systems, in compliance with international and national regulations. RA13. The student/graduate coordinates and contributes to research and development teams, fostering collaboration and knowledge exchange. •

7. Objectives of the discipline (based on the grid of learning outcomes acquired)

- Understand the concepts behind high performance computing architectures required for the processing of the high volume of data in intelligent systems. Understand the concepts for data protection in complex architecture that ensure the safety requirements for automotive software design
- Good understanding of high performance computing for Neural Networks. Good understanding of Multi-processor system and on-chip communication infrastructure. Good understanding of GPUs and data parallel processing.

8. Content

8.1 Course	Number of hours	Of which online	Teaching methods
L1. Introduction to Architectures for DNN	2	0	Theoretical presentation with questions and discussions, correlating concepts with real-world applications.
L2. DNN Inference comes to the Edge	2	0	
L3. Set up of Imagination NN Tools	2	0	
L4. OpenCV Image processing for Application Deployment	2	0	
L5. DNN model recompile for Imagination GPU	2	0	
L6. Nvidia GPU architecture and performence	2	0	
L7. Google TPU TOPS/W using Systolic processing	2	0	
L8. Online free IDE for DNN end to end development	2	0	
L9. Max 78000 in audio KWS applications	2	0	
L10. IMU sensors on Syntiant neural processors	2	0	
L11 Spiking NN, multiple layer distributed inference and memory coupled architectures for DNN L12 Spiking NN, multiple layer distributed inference	2 2	0	

and memory coupled architectures for DNN L13 Spiking NN, multiple layer distributed inference and memory coupled architectures for DNN L14 Spiking NN, multiple layer distributed inference and memory coupled architectures for DNN	2 2		

	Bibliography[10] 1. Online Cource: Edge Impulse NN Course , eBook (.pdf) D. Situnayake **AI at the Edge** 2. Whitepaper-neirompрfing-computing-in-netherlands, 3. Edge-AI_NVIDIA_Advantech_Whitepaper-A4-2022-1

8.2 Applied activities[11]	Number of hours	Of which online	Teaching methods
Lab1. Experience DNN with a Demo using OpenCV	1		Hands-on experimenting on programing NN, sensors and Boards
Lab2. Experiencing CUDA Programming on NV Jetson Nano Lab3. Experiencing CUDA Programming on NV Jetson Nano	1 1		
Lab 4 OpenCV on ESP32_cam	1		
Lab5 Experiencing Google TPU on Linux	1		
Lab 6. Edge Impulse from Model to Deployment Lab 7. Edge Impulse from Model to Deployment Lab 8. Edge Impulse from Model to Deployment	1 1 1		
Lab 9. KWS on Arduino Nano Sense	1		
Lab10. Demo KWS on Max78000	1		
Lab 11 Special topics to experiment on Edge Impulse with: Syntiant, RPI Pico and Sensors and Displays Lab 12. Special topics to experiment on Edge Impulse with: Syntiant, RPI Pico and Sensors and Displays Lab 13. Special topics to experiment on Edge Impulse with: Syntiant, RPI Pico and Sensors and Displays Lab 14. Special topics to experiment on Edge Impulse with: Syntiant, RPI Pico and Sensors and Displays	1 1 1 1		

	Bibliography[12] 1. Online Cource: Edge Impulse NN Course , eBook (.pdf) D. Situnayake **AI at the Edge** 2. Whitepaper-neirompрfing-computing-in-netherlands, 3. Edge-AI_NVIDIA_Advantech_Whitepaper-A4-2022-1

9. Evaluation

Type of activity	**9.1** Evaluation criteria[13]	**9.2** Evaluation methods	**9.3** Share of the final grade
9.4 Course	Verification of theoretical knowledge about architectures for neural networks.	Writter Test	66%
9.5 Applied activities	**S:**		

	L: Verification of the ability to implement and test neural networks on platforms and explain the functioning of the developed applications.	Q&A	34%
	P:		
	Pr:		
	Tc-R[14]:		
9.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified[15]			
• The student must demonstrate understanding of the fundamental concepts of neural networks.			

Date of completion 24.09.2025	**Course coordinator (signature)**	**Coordinator of applied activities (signature)**
Head of Department (signature)	**Date of approval in the Faculty Council** [16] 7.10.2025	**Dean (signature)**