Transilvania University of Braşov, Romania
Study program: Advanced Systems in Automation and Information Technologies
Curriculum for ERASMUS + students

Faculty: Electrical Engineering and Computer Science
Study period: 2 years (master)
Academic year structure: 2 semesters (14 weeks per semester)
Examination sessions (two): winter session (January/February)
summer session (June/July)

Courses per years (C= course; S = seminar; L = laboratory; P = project)

1st Year

No. crt.	Course	Code	Language of instruction	1st Semester					2nd Semester				
				C	S	L	P	Cred	C	S	L	P	Cred
01	Data Science	DL	Romanian	2		2		5					
02	Soft-Computing in Control Engineering	TICCP	Romanian	2		1	1	5					
03	Embedded IT Systems	SII	Romanian	2		1	1	5					
04	Embedded Systems	SI	Romanian	2		2		5					
05	Ethics and Academic Integrity	EIA	Romanian	1				2					
06	Research 1 (partially assisted research activities)	PC1	Romanian	10				8					
07	Software Systems Architecture	AS	Romanian						2		2		5
08	Multi-agent Systems	SMA	Romanian						2		2		5
09	Research 2 (partially assisted research activities)	PC2	Romanian						10				8
	Specialization 1												
10	Deep Learning	DS	Romanian						2		1	1	6
11	Variable Structure Systems	SSV	Romanian						2		1	1	6
	Specialization 2												
10	Project Management	MP	Romanian						2		1	1	6
11	Advanced Mechatronics and Robotics Systems	SMRA	Romanian						2		1	1	6

2nd Year

No. crt.	Course	Code	Language of instruction	3rd Semester					4th Semester				
				C	S	L	P	Cred	C	S	L	P	Cred
01	Research 3 (partially assisted research activities)	PC3	Romanian	10				8					
02	Research 4 (partially assisted research activities)	PC4	Romanian						12				10

03	Practical Training for Dissertation Project	PELD	Romanian						12				10
04	Dissertation Project	ELD	Romanian						2				10
	Specialization 1												
10	Natural Language Processing	DL	Romanian	2		2		5					
11	Industrial Control using Service Oriented Architectures	CAIFAOS	Romanian	2		1	1	5					
12	Cyber Security	CS	Romanian	2		1	1	6					
13	Machine Vision Based Control Systems	SRBVA	Romanian	2		1	1	6					
	Specialization 2												
10	Heterogeneous Database Systems	BDMD	Romanian	2		2		5					
11	Computer Aided Design for Products Lifecycle Management	PAMCVP	Romanian	2		1		4					
12	Video Signals Capturing and Image Processing	CSVPI	Romanian	2		1	1	6					
13	Advanced Digital Communication Technologies	TTCDA	Romanian	1		1		3					
14	Modelling and Identification of Distributed Parameters Processes	MIPPD	Romanian	1		2		4					

Transilvania University of Braşov, Romania
Study program: Advanced Systems in Automation and Information Technologies

Syllabus for ERASMUS + students

Faculty: Electrical Engineering and Computer Science
Study period: 2 years (master)

1st Year

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Data Science	DL	Romanian	5	2	-	2	-

Course description (Syllabus):

- Introduction in data science.
- Python programming language: data manipulation; data visualization.
- Extract, Transform, Load (ETL): data types; data distributions; data curation.
- Machine Learning: linear/logistic regression; support vector machines; random forests; multilayer perceptron.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Soft-Computing in Control Engineering	TICCP	Romanian	5	2	-	1	1

Course description (Syllabus):

- Intelligent techniques in control systems: fuzzy logic; neural networks; hybrid fuzzy neural systems.
- Fuzzy inference systems for control systems.
- Fuzzy control systems: linear fuzzy controllers; fuzzy PID controllers.
- Fuzzy PID controllers design methods: design guidelines; fuzzyfication of classic PID controllers; the self-learning concept and implementation.
- Neural control: direct and indirect neural control.
- Neural networks in process modeling.
- Neural networks in direct adaptive controllers.
- Fuzzy neural systems in control systems.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Embedded IT Systems	SII	Romanian	5	2	-	1	1

Course description (Syllabus):

- Elements of software engineering; phases of a software project; monitoring the development process; models of the life cycle of the software; structure of structured analysis and design.
- Verification; testing and maintenance; design correctness; process stability; capability and optimization; Taguchi methods; maintenance; availability and efficiency.

- Distributed applications; types of architectures for connecting to a server; distributed applications overview; models.
- Reliability issues; type mission critical applications; types of errors and their treatment; SCADA - data acquisition and system control.
- Software security issues; support for advanced security, data encryption, digital signatures, secure channels, key exchange, encryption key management, database security, risk analysis.
- Building security in Java; signature applet Java, client-server communication in secure software tools

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Embedded Systems	SI	Romanian	5	2	-	2	-

Course description (Syllabus):

- Introduction to embedded systems.
- I/O devices.
- Embedded systems interconnection.
- Embedded programing in C, C++.
- Embedded real time operating systems.
- Embedded applications development.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Ethics and Academic Integrity	EIA	Romanian	2	1	-	-	-

Course description (Syllabus):

- Ethical attitude and behavior in the academic space.
- Principles of good practice in academic research.
- Academic writing.
- Citation styles: APA, IEEE, Romanian Academy.
- Plagiarism. Identification of forms of plagiarism. Software tools to identify plagiarism.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Software Systems Architecture	AS	Romanian	5	2	-	2	-

Course description (Syllabus):

- Building systems of software architectures.
- Application rationalization.
- Business process management.
- Service management and deployment.
- Transformation of IT to the cloud.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Multi-agent Systems	SMA	Romanian	5	2	-	2	-

Course description (Syllabus):

- Supporting concepts.
- Intelligent agents.
- Agents' architectures.
- Multiagent systems.
- ACL Languages.

- Ontologies.
- Design issues.
- Using the JADE tool.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Deep Learning	DS	Romanian	6	2	-	1	1

Course description (Syllabus):

- Introduction to machine learning. Support vector machine, neural networks, decision trees. Supervised and unsupervised learning.
- Introduction to automatic learning.
- Prediction techniques.
- Techniques of analysis and automatic classification of information.
- Neural networks and deep learning.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Variable Structure Systems	AI0210	Romanian	6	2	-	1	1

Course description (Syllabus):

- Introduction to variable structure control theory.
- Definitions and preliminaries: system model; switching surface; sliding modes; the phenomenon of chattering.
- Conditions for the existence of a sliding mode.
- Variable structure control design procedure: sliding surface design; the method of equivalent control; controller design; diagonalization methods; method of control hierarchy.
- Sliding mode observer.
- Applications of the variable structure control system in sliding mode theory.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Advanced Mechatronics and Robotics Systems	SRMA	Romanian	6	2	-	1	1

Course description (Syllabus):

- Robotic systems – types and usability.
- Virtual Reality for robotics simulation - Coppelia Robotics v-rep.
- Artificial intelligence in robot movement.
- Artificial neural networks for robot movement and manipulation.
- Potential fields for robot movement and manipulation.
- Q-leaning for robot movement and manipulation.
- Swarm robotics for robot movement and manipulation.

2nd Year

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Natural Language Processing	DL	Romanian	5	2	-	2	-

Course description (Syllabus):

- Introduction to Natural Language Processing.
- Text preprocessing techniques.
- Word embeddings. Continuous Bag of Words model. Skip-gram model. Skip-gram with Negative Sampling.
- Recurrent neural networks (RNNs). Gated Recurrent Unit (GRU). Long-short Term Memory (LSTM).
- Bidirectional recurrent neural networks.
- Sequence to sequence models (RNN Encoder-Decoder).
- Attention mechanism. Alignment models. Transformer model.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Industrial Control using Service Oriented Architectures	CAIFAOS	Romanian	5	2	-	1	1

Course description (Syllabus):

- Introduction to service-oriented architectures.
- Constraint satisfaction problems.
- Software services.
- OPC unified architecture server.
- OPC unified architecture client.
- Industrial applications.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Cyber Security	CS	Romanian	6	2	-	1	1

Course description (Syllabus):

- Data - the modern gold.
- Common threats.
- Attacks, detection and mitigation; protection techniques.
- Digital Forensics.
- Standards and regulations.
- Data protection - a continuous process.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Machine Vision Based Control Systems	SRBVA	Romanian	6	2	-	1	1

Course description (Syllabus):

- Introduction to machine vision and image processing.
- Robust machine vision.
- Feedback control for region and edge segmentation.
- Robust estimators in image processing.
- Key-points detectors.
- Active vision.
- 3D perception.
- Visual based robotic control and visual servoing.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Heterogeneous Database	BDMD	Romanian	5	2	-	2	-

Systems							

Course description (Syllabus):

- Systems for the integration of heterogeneous, disparate data sources to present a user with a single, unified query interface.
- Computational models and software implementations that provide heterogeneous database integration.
- XML native databases.
- XQuery and XPath.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Computer Aided Design for Products Lifecycle Management	PAMCVP	Romanian	4	2	-	1	-

Course description (Syllabus):

- Software for integrated Life Cycle Modeling.
- Collaborative design.
- CATIA, PLM & field applications.
- Parametric/feature based modeling concepts.
- Customization of workbench & entering into workbench.
- CATIA sketcher; CATIA part design;
- CATIA assembly design; CATIA drafting.
- CATIA knowledge advisor.
- Analysis solutions.
- Equipment & systems engineering solutions.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Video Signals Capturing and Image Processing	CSVPI	Romanian	6	2	-	1	1

Course description (Syllabus):

- Image sensors.
- Colour spaces.
- File formats for images.
- Video cameras.
- Video containers.
- Video streams.
- MPEG4 - part 10.
- Software libraries for capturing video signals.
- Image processing techniques.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Advanced Digital Communication Technologies	TTCDA	Romanian	3	1	-	1	-

Course description (Syllabus):

- Networks, switching techniques.
- Spread spectrum methods.
- Satellite communications.
- Cellular networks.

- Mobile IP and WAP.
- Wireless LANs.
- ZigBee networks.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Modelling and Identification of Distributed Parameters Processes	MIPPD	Romanian	4	1	-	2	-

Course description (Syllabus):

- Analytical modelling of some distributed parameters processes.
- Software analysis methods for the distributed parameters processes.
- Observability and control through boundary conditions.
- Wireless methods for measurement and system identification of distributed parameters processes.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Research 1 (partially assisted research activities)	PC1	Romanian	8	-	-	-	10
Research 2 (partially assisted research activities)	PC2	Romanian	8	-	-	-	10
Research 3 (partially assisted research activities)	PC3	Romanian	8	-	-	-	10
Research 4 (partially assisted research activities)	PC4	Romanian	10	-	-	-	12
Practical Training for Dissertation Project	PELD	Romanian	10	-	-	-	12

Course description (Syllabus):

Practice and research activities ar consistent with the subject of the Master Degree (dissertation) project.

Topics focus on:

- study of digital computing systems and programming environments, including hardware structure and software development packages;
- development and implementation of algorithms and automated management structures based on microcontrollers, DSPs, programmable logic controllers;
- design and management of software applications, including web applications and databases and debugging source code;
- the use of dedicated software packages specific to industrial automation;
- study of processes subject to automation, static and dynamic characteristics and parameters;
- the study of algorithms used in general-purpose automated installation and performance analysis;
- the use of automation equipment, analyzing the particularities of implementation and numerical aspects of the implementation;
- the study and use of systems and control algorithms industrial robots and flexible manufacturing lines;
- study adjustable electrical drives used in industrial automation systems;
- making software and/or hardware specific issues where operating unit of practice, including user interface design;
- interpretation of experimental results and draw conclusions from testing automation equipment.