Transilvania University of Braşov, Romania

Study program: Advanced Systems in Automation an 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	SAATI0101	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	SAATI0102	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	SAATI0103	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	SAATI0104	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	SAATI0105	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	SAATI0207	Romanian	5	2	-	2	-

Course description (Syllabus): Introduction to Software Systems Architecture; Monolithic architecture and Event-Driven Architecture (EDA); Microservices Architecture; Service-Oriented Architecture (SOA); Application rationalization and transformation of IT into the cloud.

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Multi-agent Systems	SAATI0206	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	SAATI0209	Romanian	5	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
Project Management	SAATI0210	Romanian	5	2	-	1	1

Course description (Syllabus): Project structure and management; Project management context - project life cycle; Organizational systems; Key skills of general management; Standards and regulations, Internationalization, Cultural influences; Project processes; Integration Management, Scope Management, Time Management, Cost Management, Quality Management, Human Resources Management, Communication Management, Risk Management; Software Project Management.

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	SAATI0211	Romanian	5	2	-	1	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.

2nd Year

Course title	Code	Language of instruction	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Natural Language Processing	SAATI0301	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	SAATI0302	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	SAATI0303	Romanian	5	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
Variable Structure Systems	SAATI0304	Romanian	5	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
Modelling and Identification of Distributed Parameters Processes	SAATI0305	Romanian	5	2	-	1	1

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)	SAATI0106	Romanian	8	-	-	-	10
Research 2 (partially assisted research activities)	SAATI0212	Romanian	8	-	-	-	10
Research 3 (partially assisted research activities)	SAATI0306	Romanian	8	-	-	-	10
Research 4 (partially assisted research activities)	SAATI0407	Romanian	10	-	-	-	12
Practical Training for Dissertation Project	SAATI0408	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.